PETITION TO LIST THE HUACHUCA TIGER SALAMANDER *Ambystoma tigrinum stebbinsi* AS A FEDERALLY ENDANGERED SPECIES

Mr. Bruce Babbitt
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Kieran Suckling, the Greater Gila Biodiversity Project, the Southwest Center For Biological Diversity, and the Biodiversity Legal Foundation, hereby formally petition to list the Huachuca Tiger Salamander (*Ambystoma tigrinum stebbinsi*) as endangered pursuant to the Endangered Species Act, 16 U.S.C. 1531 et seg. (hereafter referred to as "ESA"). This petition is filed under 5 U.S.C. 553(e) and 50 CFR 424.14 (1990), which grants interested parties the right to petition for issue of a rule from the Assistant Secretary of the Interior.

Petitioners also request that Critical Habitat be designated concurrent with the listing, pursuant to 50 CFR 424.12, and pursuant to the Administrative Procedures Act (5 U.S.C. 553).

Petitioners understand that this petition action sets in motion a specific process placing definite response requirements on the U.S. Fish and Wildlife Service and very specific time constraints upon those responses.

Petitioners

Kieran Suckling is a Doctoral Candidate, endangered species field researcher, and conservationist. He serves as the Director of the Greater Gila Biodiversity Project and has extensively studied the status and natural history of the Huachuca Tiger Salamander.

The Greater Gila Biodiversity Project is a non-profit public interest organization created to protect imperiled species and habitats within the Greater Gila Ecosystem of southwest New Mexico and eastern Arizona. Through public education, Endangered Species Act petitions, appeals and litigation, it seeks to restore and protect the integrity of the Greater Gila Ecosystem.

The Southwest Center For Biological Diversity is a non-profit public interest organization dedicated to protecting the diverse life forms of the American Southwest and northern Mexico.

The Biodiversity Legal Foundation is a non-profit public interest organization dedicated to the preservation of all native wild plants and animals, communities of species, and naturally functioning ecosystems in this country. Through visionary educational, administrative, and legal actions, the BLF endeavors to encourage improved public attitudes and policies for all living things.

ABSTRACT

The Huachuca Tiger Salamander is currently confined to 15 locations in the San Raphael Valley of southeastern Arizona. At least 3 populations have been extirpated and 3 others are very unstable. Of the 4 populations closely monitored between 1979 and 1988, 1 was extirpated and 1 was unstable. Although the historic range and habitat are not known, it appears *A.t. stebbinsi* is a cienega dweller. The Southwest's cienegas are among the most endangered habitats in North America. The introduction of exotic fishes, frogs and diseases are the most immanent threats to the remaining Huachuca Tiger Salamander populations. Hybridization with exotic salamanders is also a potential threat. The plight of the Huachuca Tiger Salamander is well summarized by Collins *et al.* (1988):

> "...the small number and restricted geographic range of [San Rafael Valley] populations increases their likelihood of extinction. These facts coupled with our information concerning life history, incidence of disease,and potential negative effects of exotic animals in [San Rafael Valley], argue that conservation efforts and careful management of *A.t. stebbinsi* is needed."

In 1982, the Huachuca tiger salamander was listed as Endangered by the Arizona Game and Fish Commission and as a Category 2 Candidate for protection under the ESA. It has been listed as a Sensitive species on the Coronado National Forest since 1988.

TAXONOMY

<u>Scientific Name</u>: Tiger salamanders (*Ambystoma tigrinum* spp.) range across the entire United States (excluding New England and the Appalachians) into southern Canada and the northern Mexican Plateau (Gehlbach 1967). The taxonomic status of the species has long been a subject of debate.

Based on geographic variance in coloration patterns of adult metamorphosed specimens, Dunn (1940) initially described 7 subspecies. Two were later classified as full species: *A. californiense* Gray (Bishop 1947) and *A. velasci* Duges (Smith and Taylor 1948). An additional subspecies, *A.t. stebbinsi*, was described in 1954 (Lowe 1954). In 1955, 3 Arizona subspecies were recognized: *A.t. utahense* Lowe, *A.t. nebulosum Hallowell* and *A.t. stebbinsi* Lowe (Lowe 1955). Gehlbach (1965) later suggested *utahense* and *stebbinsi* were variants of *nebulosum*, and, in agreement with Dunn's original study, used coloration of adult metamorphosed specimens, larval gill raker counts, and incidence of neoteny to delineate 7 subspecies: *californiense, diaboli* Dunn, *mavortium* Baird, *melanostictum* Baird, *nebulosum* Hallowell, *tigrinum,* and *velasci* (Gehlbach 1967). *A.t. nebulosum* was the only subspecies thought to occur in Arizona. Pierce and Mitton (1980), however, argued that Gehlbach's characteristics might be poor indicators of actual genetic divergence. Citing 3 morphological characteristics, 2 breeding habitat characteristics, and 4 life history characteristics, Collins *et al.* (1980) called for further research into possible specific differences between Gehlbach's 7 subspecies.

The most current research (Collins 1988, Collins *et al.* 1988, Jones 1988, Jones *et al.* 1988) recognizes *A.t. stebbinsi* as one of eight subspecies of *Ambystoma tigrinum* Green. It is geographically, genetically, and morphologically distinct from the other seven subspecies.

Collins (1988) suggests that specific designation might yet be warranted.

<u>Common Name</u>: Huachuca Tiger Salamander, Sonoran Tiger Salamander.

DESCRIPTION

A.t. stebbinsi may occur in as many as six morphs, although only three have been observed. Individual color patterns, moreover, vary both ontogenetically and in relation to specific habitats. For these reasons it is difficult to describe a "normal" Huachuca Tiger Salamander. Most mature, metamorphosed individuals have narrow to broad vertical bars or large blotches, yellow to olive in color, on the dorsum and especially sides of the body (Collins 1988) (see Figure 1).

DISTRIBUTION

A.t. stebbinsi has been known to occur only in 17 locations, all in the San Rafael Valley and the immediately adjacent foothills of the Patagonia and Huachuca mountains north of the Mexican border (Collins *et al.* 1988, Jones *et al.* 1988) (see Figure 2). Its recent discovery precludes exact knowledge of its historic range, but it is likely that human induced habitat degradation, and possibly, long term climactic changes, have reduced its geographic range (Jones *et al.* 1988).

NATURAL HISTORY

<u>Phylogeny</u>: Electrophoretic and morphologic analysis suggest *A.t. stebbinsi* is phylogenetically most closely related to *A.t. mavortium*. Mitochondrial DNA analysis suggests *A.t. stebbinsi* is a mitochondrial clone derived from *A.t. nebulosum*. Collins (1988) believes *A.t. stebbinsi* arose from hybridization between *A.t. mavortium* and *A.t. nebulosum*. Jones *et al.* (1988) argue that this hybridization is a natural form of speciation, rather than the result of deliberate or accidental introduction of *A.t. nebulosum* and/or *A.t. mavortium* into the San Rafael Valley by humans.

A.t. stebbinsi has the lowest mean heterozygosity (genetic diversity) of any known salamander indicating it evolved through one or more genetic bottlenecks (Jones *et al.* 1988). There is no evidence that other tiger salamanders have been introduced within its range or that interbreeding is taking place.

Ontogeny: *Ambystoma tigrinum* has the most complicated salamander morphic and life history known (Collins *et al.* 1988).

A.t. stebbinsi breeds as early as mid-February, and as late as early May (Collins *et al.* 1988). Most eggs are laid between mid-March and late April. Hatching occurs within several weeks. Larval development is rapid. Larvae >40 mm SVL (snout-vent length) are often abundant by late spring.

Upon reaching approximately 30 mm SVL, *A.t. stebbinsi* may continue developing into a typical larva, or a cannibalistic larval morph. This dimorphism is unknown in any other *A. tigrinum* subspecies.

By mid-July, larvae have usually reached 60 mm SLV. In late July to early September, when about 70 mm SVL, *A.t. stebbinsi* (and all *A. tigrinum* except *californiense*) is again dimorphic: either of the previous forms may metamorphose, often leaving the water and returning to breed, or continue to grow, maturing and breeding as a larval-like form, or paedomorph. A single population then, may have as many as two juvenile morphs (typical or cannibal) and four adult morphs (typical branchiate, cannibal branchiate, typical metamorphosed, and cannibal metamorphosed). The relative frequency of each morph varies within populations of each subspecies (Collins 1981, Rose and Armentrout 1976). Most mature members of *A.t. stebbinsi* populations are typical, branchiate morphs and, to a lesser extent, typical metamorphosed morphs. Only 17 to 40% of larvae metamorphose annually. Between 1979 and 1985, Collins *et al.* (1988) collected more than 1,200 typical, branchiate morphs, and only 64 typical, metamorphosed morphs. They found no cannibalistic morphs although these morphs can be common in *A.t. stebbinsi*'s closest relatives: *A.t. nebulosum* and *A.t. mavortium*.

Branchiate morphs begin to mature by early autumn. They are >100 mm SVL from late autumn through the winter and are ready to breed.

Dispersal: *A.t. stebbinsi* has not been found in fishless stocktanks in Sonora ca 15-20 km south of occupied stocktanks in the United States. Jones *et al.* (1988) and Collins *et al.* (1988) note that salamanders have been moved between stocktanks north of the border by humans. While unaided dispersal may take place between tanks in close proximity, dispersal across larger distances is probably effected by human intervention.

Habitat: The San Rafael Valley is a Plains grassland-Madrean evergreen woodland extending from southeast Arizona into northeast Sonora (Brown 1982). All known Huachuca Tiger Salamander sites are artificial stock tanks within or adjacent to the valley, though the type locality was spring-fed and another tank is an impounded cienega. The salamander's native habitat is not precisely known, but would appear to be mid-elevation cienegas (Warren *et al.* 1991).

THREATS TO THE SPECIES

The Huachuca Tiger Salamander is currently confined to 15 locations in the San Raphael Valley of southeastern Arizona (see Appendix A). At least 3 populations have been extirpated and 3 others are very unstable. Four localities were closely monitored between 1979 and 1988 (Collins 1988). *A.t. stebbinsi* was extirpated from one and was highly unstable at another during this time.

Habitat Loss: Southeastern Arizona, including the San Rafael Valley, once supported large numbers of extensive cienegas. Hendrickson and Minckley (1985) have documented their near total disappearance- that entire study is incorporated here by reference. It is likely that *A.t. stebbinsi* occupied a greater portion of the San Rafael Valley and perhaps other areas as well, when cienegas were more common. Overgrazing, pumping, diverting, and impounding have been the principal causes of wetland destruction in southeast Arizona.

Disease: During July and August of 1985, all branchiate salamanders in Huachuca, Parker Canyon #1, and Inez tanks were killed by an unknown disease. Laboratory and field studies found the disease to be 100% fatal within a few days of the symptoms appearing (Collins *et al.* 1988). Symptoms- lethargy, loss of appetite, and red, blood infused epidermis -resembled *Aeromonas* (red leg) infection (Fowler 1978). Being dominated by larvae and branchiates (ie. aquatic morphs) *A.t. stebbinsi* populations are particularly threatened by such aquatic diseases.

Though the origin of the disease is also unknown, Collins *et al.* (1988), suggest that it may have been introduced by Bullfrogs (*Rana catesbeiana*) since frog populations in the three heavily diseased tanks were large and apparently unaffected. Bullfrogs disperse readily. If they are indeed disease vectors, they can quickly spread disease among many amphibian populations.

Predation: Very few salamanders can coexist with fish. *A.t. stebbinsi* does not occur in the four San Rafael Valley suitable habitats which support native fish (Heron Spring, Sheehy Spring, Sharp Spring, Santa Cruz River and tributaries). Introduced exotics, "especially centrarchids and ictalurids, invariably eliminate [Huachuca tiger] salamanders" (Collins *et al.* 1988). Eggs, larvae, and all but the largest adults are susceptible to catfish predation.

The introduction of Bullfrogs (*Rana catesbeiana*) into the San Rafael Valley during the last decade has been correlated with a decline in native frogs but their impact on *A.t. stebbinsi* is as yet unknown (Collins *et al.* 1988). Bullfrogs are known to be voracious predators of small fish, reptiles, and amphibians (Hammerson 1982, Hayes and Jennings 1986, Schwalbe and Rosen 1988, Smith 1977). Bullfrog larvae are likely to eat salamander eggs and adults are likely to eat salamander larvae.

Collection: The Huachuca Tiger Salamander occurs in such low numbers and at such few locations that any level of collection could pose a serious threat to its continued existence. Collection does not appear to currently be a problem.

Genetic homogeneity: *A.t. stebbinsi* has the lowest mean heterozygosity of any known salamander indicating it went through one or more population bottlenecks (Jones *et al.* 1988).

One such bottleneck drastically reduces genetic diversity, multiple bottlenecks could reduce it further (Motro and Thomson 1982). Increased heterozygosity generally correlates positively with population stability and high individual vigor and fitness (Mitton and Grant 1984). Low heterozygosity may leave *A.t. stebbinsi* highly susceptible to disease and infection:

> "This susceptibility, as seen in contemporary stocktanks, could easily cause severe reductions in numbers of salamanders and retard any expected increase in gene diversity" (Collins *et al.* 1988).

It is not clear, however, whether population reductions and loss of genetic diversity is the original cause, or the result, of increased susceptibility to disease.

Hybridization: Exotic salamanders are used as bait by fishermen in Arizona and the Southwest (Collins *et al.* 1988, Lowe 1955). They have been introduced into native habitats in Arizona by commercial baitdealers, fishermen, and private landowners (Collins 1985). Though it is illegal to introduce or collect salamanders in the San Rafael Valley, the size and remoteness of the valley makes enforcement very difficult. Introduced *A. tigrinum* would be likely to interbreed with *A.t. stebbinsi* as pre- and post-mating isolating mechanisms are week within the *A. tigrinum* species (Brandon 1972, Nelson and Humphrey 1972).

Pollution: Being terrestrial and aquatic in different stages of their development, amphibians are particularly susceptible to a wide array of environmental pollutants. Air and water pollution is suspected in the world-wide decline of amphibians since the 1970s.

Pesticides, herbicides, heavy metals, and other toxicants are known to negatively affect amphibians (Logier 1949, Kapland and Overpeck 1964, Mulla *et al.* 1966, Rosato and Ferguson 1968, Tuck and Crabtree 1970, Weis 1975, Hall and Swineford 1980, Monhanty-Hejmadi and Dutta 1981, Steele *et al.* 1991). Larval stages appear to be more sensitive to toxicants than are embryonic and post-metamorphic stages (Mulla *et al.* 1966, Meeks 1968, Lande and Guttman 1973, Hall and Swineford 1980). Sublethal responses such as hyperactivity and prolonged metamorphic development can increase vulnerability to predation (Cooke 1971, Yeung 1978). Toxicity may exacerbate bull frog predation as *R. catesbeiana* appears to be relatively resistant to toxicants (Logier 1949, Newsom 1958, Ferguson 1963, Meeks 1968, Weis 1975).

Acid rain may be an important cause of recent amphibian declines (Pierce 1985, Tome and Pough 1982). Acid rain may exacerbate bull frog predation as *R. catesbeiana* appears to be relatively resistant to lower pH levels (Tome and Pough 1982). More directly, lowered pH levels may cause death (Padhye and Ghate 1988, Pough 1976, Pough and Wilson 1977, Beebee and Griffin 1977), developmental anomalies (Tome and Pough 1982, Pierce *et al.* 1984), lowered fertilization effectiveness because of decreased sperm motility (Schlichter 1981), interference with ion regulatory capabilities (Fromm 1981, Freda and Dunson 1985), and decreased growth rates (Freda and Dunson 1985). Acid rain has been implicated in lowered pH of pools in the northeastern United States causing tiger salamander mortality (Pough 1976, Pough and Wilson 1977). In southeastern Arizona, acid rain may be responsible for the extirpation of the Tarahumara Leopard Frog (*R. tarahumarae*) and declines in other amphibian populations (Schwalbe 1987, Hale and May 1983). Copper sulfate emissions are known to adversely affect amphibian species (Lande and Guttman 1973). Schwalbe suspects that copper smelters in San Manuel and Douglas, Arizona and in Nacozari and Cananea, Sonora are threatening southeast Arizona amphibians. The Douglas and Cananea smelters have been linked to sulfate and heavy metal pollution (Blanchard and Stromberg 1987).

Inadequacy of Existing Regulatory Mechanisms: Collection and introduction of salamanders in the San Rafael Valley is prohibited by Arizona Game and Fish Commission order #R12-4-311. As pointed out by Collins *et al.* (1988), however, the size and remoteness of the valley makes this order very difficult to enforce.

The Huachuca Tiger Salamander is listed as a Sensitive species on the Coronado National Forest. No specific management plan has been developed for the subspecies.

CRITICAL HABITAT DESIGNATION RECOMMENDED

Petitioners strongly recommend the designation of critical for the Huachuca Tiger Salamander coincident with its listing. Critical habitat should be designated in all areas where it is currently located and in key unoccupied areas where restoration is necessary for the conservation of the species.

Please respond to: Kieran Suckling, Box 742, Silver City, NM 88062 phone: (505) 538-0961.

Respectfully submitted,

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Dated this day of May, 1993

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APPENDIX A:

Current and historic Huachuca Tiger Salamander Populations (from Collins *et al.* 1988).[1] Numbers correspond to distribution map (see Figure 2).

1. LOWER 13 RESERVOIR: T24S R17E Sec 18 SW NE PRIVATE

2. UPPER 13 RESERVOIR: T24S R17E Sec 7 S center USFS
50 mature, branchiate morphs- 1984 (Collins *et al.* 1988).

3. GRENNAN TANK: T23S R16E Sec 14 S center USFS

4. FS 58 TANK: T23S R7E Sec 6 NE NE USFS
Branchiate and larval salamanders were present in 1979. Yellow Bullheads (*Ameiurus natalis*) were present in 1980, but salamanders were not. In 1984, when catfish were absent, 19 branchiate salamanders and hundreds of sunfish (*Lepomis* sp.) were present.

5. MEADOW VALLEY FLAT TANK #1: T23S R17E Sec 6 SW NE USFS?

6. BOG HOLE TANK: T22S R17E Sec 33 NW SE USFS
Formerly a cienega, bog hole was impounded in 1975 by Arizona Game and Fish as a Mexican Duck refuge. Adult salamanders were present in 1979 and 1980. One larva was present in 1982. *A.t. stebbinsi* is no longer present, neither are the two native fish (Longfin Dace and Gila Topminnow). The loss of these native fauna coincides with the introduction of exotic fishes: *Gambusia affinis*, *Cyprinodon macularius*, *Lepomis* spp., and *Micropterus salmoides*.

7. FS 799 TANK: T22S R17E Sec 36 SW NE USFS

8. KI-HE-KAH RANK TANK: T23S R17E Sec 1 SW SW USFS

9. J.F. JONES RANCH TANK: PRIVATE
A.t. stebbinsi was extirpated from its type locality after the introduction of Largemouth Bass (*Micropterus salmoides*) and Bluegill (*Lepomis macrochirus*) in the 1950s. The tank is popular local fishing spot.

10. JUDY TANK: T23S R18E Sec 35 SE SE USFS
No mature, branchiate morphs were found between 1979-1988.

11. INEZ TANK: T24S R18E Sec 2 SW NW USFS
All branchiate salamanders were killed during July and August of 1985 by an undiagnosed aquatic disease. The tank was recolonized by metamorphosed salamanders. Two metamorphosed morphs (male and female) and on larva were found in 1986. Eggs were present in 1987.

12. BODIE CANYON TANK: T24S R18E Sec 2 NW SE USFS

13. HUACHUCA TANK: T24S R18E Sec 15 NE NW USFS
Salamanders were first found here in 1982. Several hundred larvae and branchiate morphs were present in 1983 and 1984. Only one Yellow Bullhead was found in 1984. In August of 1985, there were several thousand fingerling catfish and three dead branchiate salamanders, though more than 100 salamanders were present the previous month. Periodic surveys up to 1988 have found catfish but no salamanders.

Disease may also have been a factor in the extirpation of the Huachuca Tank population. The August 1985 decline coincided with the spread of a devastating undiagnosed disease in two other tanks.

"Yellow bullheads are highly carnivorous (Minckley 1973), and we do not expect salamanders to successfully recruit at Huachuca Tank as long as the catfish population remains high" (Collins *et al.* 1988).

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[1] Legal descriptions for FS 58, Meadow Valley Flat #1, and School Canyon #1 tanks have been "corrected" to be consistent with narrative descriptions and other studies. Ownership class is based on National Forest map overlays and may not be 100% accurate.

14. PARKER CANYON TANK #1: T24S R18E Sec 19 NE NE USFS

All branchiate salamanders were killed during July and August of 1985 by an undiagnosed aquatic disease. The tank was recolonized by (presumably) metamorphosed salamanders. No salamanders were found in 1986. Eggs were found in 1987. Five branchiate morphs (3 males, 2 females) were found in 1988.

15. HERON SPRINGS TANK: T24S R17E Sec 14 SW NE PRIVATE

16. SCHOOL CANYON TANK #1: T24S R19E Sec 9 NE SE USFS

17. SCHOOL CANYON TANK #2: T24S R19E Sec 17 NE SE PRIVATE

18. CAMPINI MESA TANK #1: T24S R19E Sec 19 SW E USFS

APPENDIX B:

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