FINAL REPORT:

A status survey of three species of endangered/sensitive amphibians in Arizona

by

James P. Collins
Department of Zoology
Arizona State University
Tempe, AZ 85287-1501

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DISCLAIMER

INTRODUCTION

The proposed project was a survey of aquatic habitats on the Kaibab Plateau and "Arizona strip," the central and eastern mountains, and San Rafael Valley to assess the status of three taxa of threatened/sensitive amphibians: *Scaphiopus intermontanus, Hyla eximia (wrightorum)*, and *Ambystoma tigrinum stebbinsi*. Sampling was done via several methods including seines, dip nets, and listening for calling male frogs to record presence or absence of amphibians associated with aquatic habitats (see specific sections for sampling techniques used for each species). Objective of the project was the following: 1) prepare maps of each area reporting habitats sampled and recording presence of all breeding populations of each species; 2) prepare lists of the exact location of habitats sampled with presence or absence of breeding populations indicated; 3) deposit voucher specimens for each habitat in the collection of Lower Vertebrates at ASU. This report is organized in three sections, each devoted to one of the three species.

Ambystoma tigrinum stebbinsi

The status of *Ambystoma tigrinum stebbinsi* was last assessed thoroughly in 1985 (Collins et al. 1988). My conclusion based on that survey was as follows: "Populations of SRV salamanders [*A.t. stebbinsi* in the San Rafael Valley] are threatened by introduction of exotic fishes and disease. Salamanders were largely eliminated from four habitats after introduction of sunfish and/or catfish. An unknown fatal disease killed all aquatic morphs in two other habitats. An additional threat includes possible hybridization and introgression of SRV populations resulting from introduction of exotic salamanders." (Collins et al. 1988). In 1985, therefore, 6 of 17 known habitats of this distinctive race (Jones et al. 1988) were threatened.

In this current study, 38 habitats in the SRV were sampled for the presence of *A. t. stebbinsi*. During each visit to a locality sampling consisted of seining the perimeter of a habitat for adult and/or larval salamanders, and dipnetting and examining submerged rocks and vegetation for embryos (in habitats shallow enough to permit it, seining was also performed across the deepest part of the habitat). *A.t. stebbinsi* were collected in 15 of the 38 habitats sampled (Fig. 1, Table 1); voucher specimens are stored in the collections of lower vertebrates at Arizona State University (Table 4). One locality (FS 799 Tank) that had salamanders in 1985 had no salamanders during this survey, but did have bullfrogs (*Rana catesbeiana*) and mosquitofish (*Gambusia affinis*). Another location that historically had salamanders (FS 58 Tank, Jones et al. 1988) had no salamanders during this survey, but did have yellow bullhead catfish (*Ictaluris natalis*). More so than in 1985, populations of *stebbinsi* are concentrated in the southeastern part of SRV (Fig. 1, see also Collins et al. 1988)). Introduced species of fish [yellow bullhead catfish, mosquitofish, and bluegill sunfish (*Lepomis macrochirus*)] and bullfrogs (*R. catesbeiana*) are prevalent throughout the SRV (Table 1); bullfrogs are established in more aquatic habitats in SRV than they were in 1985. Laboratory studies (Collins, unpublished) indicate that salamanders, bullheads, mosquitofish, and sunfish eat *stebbinsi* eggs, hatchlings, and small larvae, but bullfrog tadpoles do not eat viable *stebbinsi* ova or hatchlings.

Notably, visual inspection of salamanders in the field revealed no evidence of disease during either year of this survey, a contrast with previous studies (Collins et al. 1988, Pfennig et al. 1991). There was also virtually no recruitment in either year of this study, as evidenced by the lack of surviving larvae in habitats in which eggs were laid. The lack of recruitment appears to be a result of predation by overwintering adult and larval salamanders on eggs and probably hatchlings of each new year class. In previous years, salamander eggs were removed from the stomachs of metamorphosed adult *stebbinsi* in the field via gastric lavage (T. Jones, pers. comm.). As already noted, the effectiveness of *stebbinsi* as predators of conspecifics was confirmed during this study with laboratory experiments. Finally, predation on conspecifics by *stebbinsi* is not necessarily surprising given the high frequency of cannibalism among the closely related races *A.t. nebulosum* and *A.t. mavortium* (Jones et al. 1988, 1995; Collins et al. 1993). What was noteworthy, however, was the fact that during this study experiments with *stebbinsi* from the SRV and *nebulosum* from the Mogollon Rim resulted in the production of cannibalistic morphs from among *nebulosum* eggs collected from the Mogollon Rim but not from among *stebbinsi* eggs collected in the SRV. This suggests *stebbinsi* lacks the genetic propensity to produce this phenotype. My plan is to confirm and extend this result in 1995 using additional populations from the SRV. If confirmed, inability to produce cannibals would represent another significant difference between *stebbinsi* and the closely related races *A.t. nebulosum* and *A.t. mavortium*, adding to the distinctiveness of the SRV populations of salamanders [Note: In experiments performed in 1995, cannibalistic morphs were produced from among *stebbinsi* eggs from the SRV].

In summary, the Huachuca tiger salamander, *Ambystoma tigrinum stebbinsi*, is an isolated race known currently from 15 localities in and around the SRV. Recent genetic (Jones et al. 1995) and morphological analyses (Jones et al. 1988) highlight distinctive features of the biology of these salamanders.

Color pattern and allozymic data suggest *A.t. stebbinsi* shares a common ancestor with *A.t. mavortium*, while the *A.t. stebbinsi* mitochondrial DNA haplotype is derived from an *A.t. nebulosum* haplotype. SRV populations lack the cannibalistic morph characteristic of other intermountain and Great Plains races of tiger salamanders, and laboratory experiments suggest *A.t. stebbinsi* populations lack the genetic propensity to produce this phenotype. Recent field studies reinforce and extend earlier results: largest populations are in the southeastern SRV, exotic species of fish (and possibly bullfrogs) negatively affect salamanders, and larval and adult salamanders are significant predators of eggs (and probably hatchling salamanders), perhaps because of the absence of significant structural complexity in the stock tanks that continue to be the primary breeding sites of these salamanders.

Our data suggest that *A.t. stebbinsi* originated through hybridization between *A.t. mavortium* and *A.t. nebulosum* (Jones et al. 1988, 1995). Salamanders in the SRV have a number of distinctive biological features and conservation agencies must recognize that hybrids are not necessarily evolutionary "mistakes;" rather, under some conditions hybrids might play a significant role in the production of natural biodiversity (Bullini 1994).

Hyla eximia

Mountain treefrogs, *Hyla eximia*, are generally regarded as being distributed across the central part of Arizona from the San Francisco Mountains along the Mogollon Rim to the Arizona-New Mexico border, and in the Huachuca Mountains (Renaud 1977, Stebbins 1985). Sampling for Mountain treefrogs was conducted during and immediately after the summer monsoon season, when adult frogs return to aquatic habitats to breed and tadpoles are present. Sampling consisted of walking the bank of each habitat to check for the presence of adult frogs, listening for calling males, dipnetting around the perimeter of the habitat for tadpoles and examining aquatic vegetation for embryos. We recorded Mountain treefrogs in 17 of 96 localities sampled, extending from Williams to Springerville (Fig. 2, Table 2); voucher specimens are stored in the collections of lower vertebrates at Arizona State University (Table 4). By far, the greatest concentration of populations were in the Mogollon Rim region from just north of Payson to near Heber. [Although the Huachuca Mountains were not included in this *H. eximia* survey, in the course of studying *A.t. stebbinsi* in the SRV, Peterson Ranch Tanks, a historical locality for *H. eximia* in the Huachucas, were sampled. No Mountain treefrogs were collected, but bullfrogs were collected at this site (Table 1)].

Habitats with *H. eximia* varied in permanence, ranging from flooded meadows that dried within several weeks to earthen stock tanks with water all year. No *H. eximia* larvae were found in habitats with exotic fish (*Lepomis sp., Pimephales sp.*), bullfrogs (*Rana catesbeiana*), or crayfish, which were generally restricted to permanent aquatic habitats (Table 1). Likewise, invertebrate predators of mountain treefrogs, including dragonflies and water beetle larvae, also appear to be restricted to aquatic habitats of at least moderate duration (Collins, personal observation). Mountain treefrog larvae were more likely to inhabit, and be present in higher densities, in temporary aquatic habitats, occurring infrequently in artificial habitats, like many stock tanks, which often hold water for long periods of time.

In summary, mountain treefrogs breed in montane, aquatic habitats, commonly on the Mogollon Rim. Preferred habitats appear to be temporary, shallow ponds filled during summer monsoon rains. Earthen stock tanks have been constructed within many of these temporary aquatic habitats to provide a permanent water source for livestock or wildlife. Our results support the hypothesis that altering these habitats to increase their capacity to hold water for long periods permits colonization by predators of mountain treefrogs and decreases their suitability for *H. eximia* larvae. Many predators of *H. eximia* cannot survive in shallow ponds because these habitats dry during summer and/or freeze completely in winter. Constructing an earthen stock tank within an otherwise temporary aquatic habitat can provide permanent water that serves as a refuge for predators that may even invade ephemeral portions of the habitat following snowmelt or summer rains (Collins, personal observation). This feature of the biology of *H. eximia* significantly limits its effective range in Arizona and highlights the importance of protecting from unnecessary alteration the natural marshes, lakes, and ponds favored by this species.

Scaphiopus intermontanus

Status of Great Basin Spadefoot toads, *Scaphiopus intermontanus*, in Arizona is poorly known. Sampling for Great Basin Spadefoot toads was conducted by walking the bank of each habitat to check for adults toads and seining the perimeter of each habitat for tadpoles. During this survey Great Basin Spadefoot toads were recorded in only one of 28 localities sampled near Fredonia in the

"Arizona strip" (Fig. 3, Table 3); voucher specimens are stored in the collections of lower vertebrates at Arizona State University (Table 4). A survey of 54 aquatic habitats on the Kaibab Plateau in 1988-89 yielded Great Basin spadefoots in only one habitat (Berna 1990). This species appears to be locally abundant, but restricted in distribution in Arizona. In addition, its distribution appears limited by predators like fish and perhaps salamanders, which can successfully occupy permanent aquatic habitats, like many artificial stocktanks (Table 4). It is also important to note, however, that each summer during this survey were very dry periods in this part of Arizona, thus reducing the likelihood of occurrence of *S. intermontanus*. In wetter years, habitats that were dry during 1993-1994 may provide suitable habitats for *S. intermontanus*.

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FIGURE LEGENDS

Figure 1. San Rafael Valley and surrounding region, AZ. Symbols indicate habitats with and without *Ambystoma tigrinum stebbinsi* during the current survey.

Figure 2. San Francisco Peaks area, Mogollon Rim, White Mountains, and surrounding regions, AZ. Symbols indicate habitats with and without *Hyla eximia* during the current survey.

Figure 3. Fredonia and surrounding regions of the "Arizona strip." Symbols indicate habitats with and without *Scaphiopus intermontanus* during the current survey.

Figure 1.

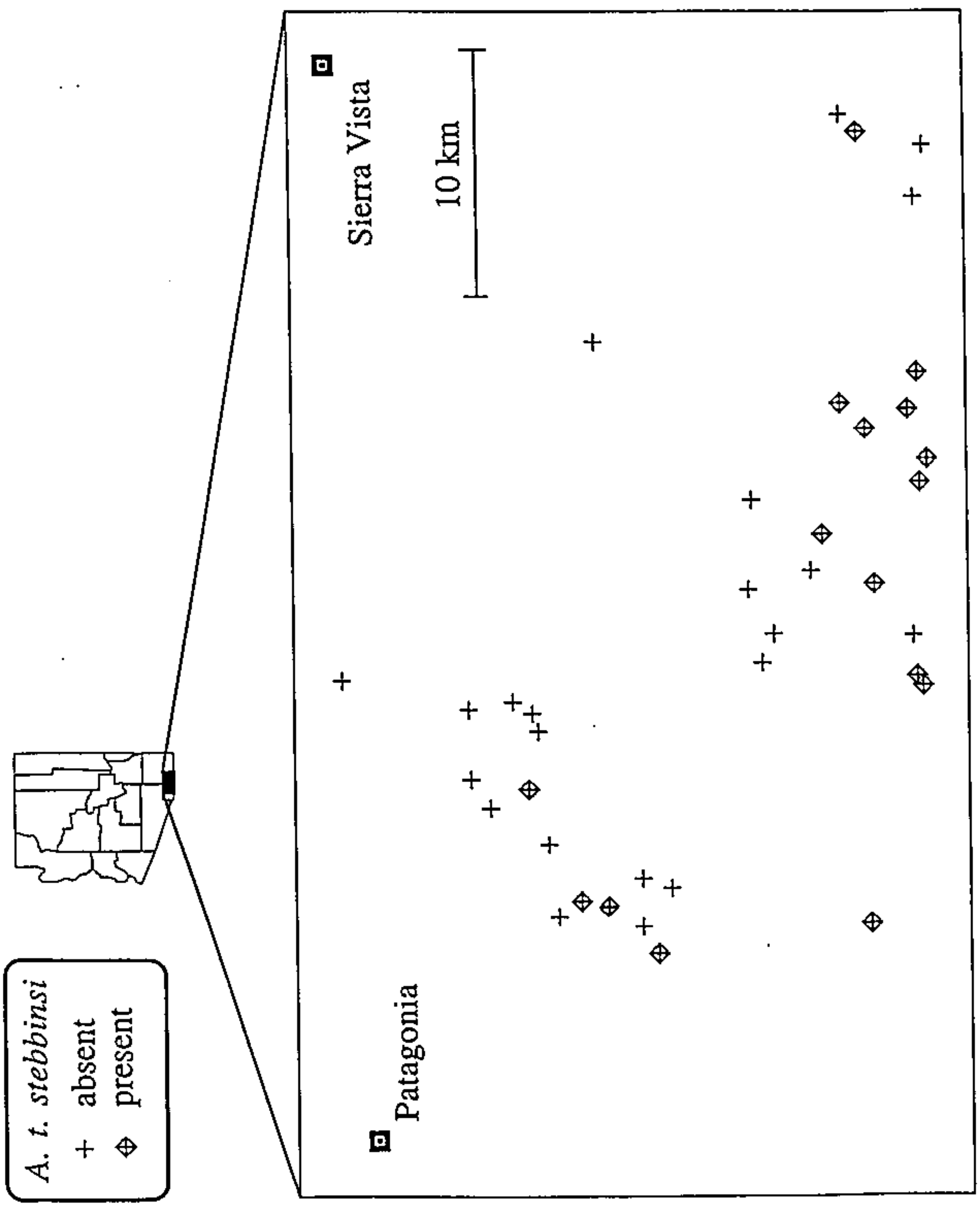

Figure 2.

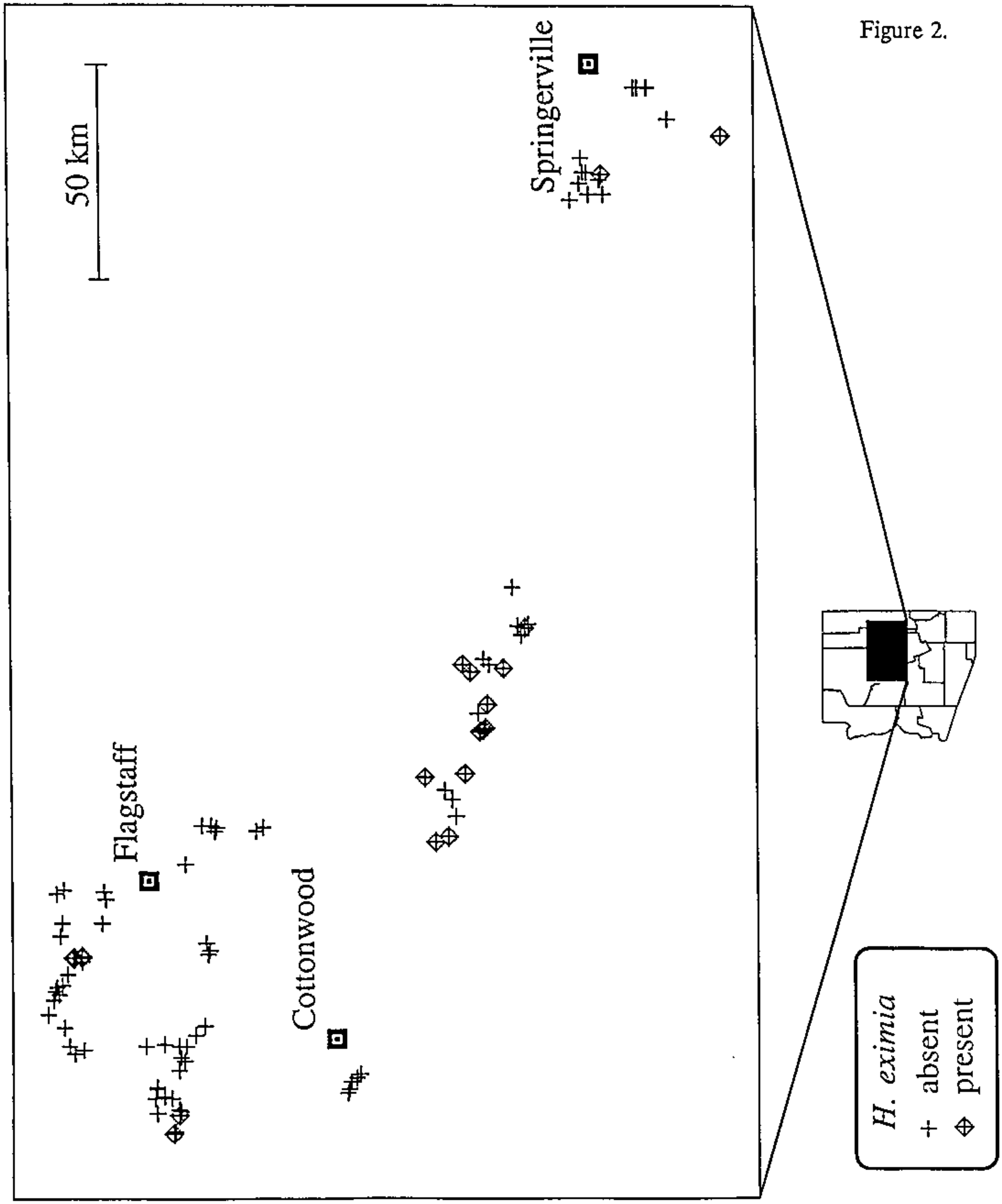
50 km
Springerville
Flagstaff
Cottonwood
H. eximia
+ absent
present

Figure 3.