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Research Note

Assessment of Public Knowledge and Support for Recovery of the Endangered Houston Toad (*Bufo houstonensis*) in Bastrop, Texas

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*Community support is critical to recovery success of endangered species. Education can cultivate positive attitudes and actions toward species recovery. The federally endangered Houston toad (*Bufo houstonensis*) is endemic to east-central Texas and the largest population is currently located near the City of Bastrop in Bastrop County. This study quantified the level of knowledge about the Houston toad for residents of the City of Bastrop, explored reasons behind expressed opinions of residents, and determined current and future education outlets. Nearly two thirds of respondents had heard of the Houston toad. Of the 83 surveyed residents who had heard of the species, 94% knew the Houston toad was endangered. Most respondents believed the Houston toad was an important part of the Lost Pines ecosystem and cared if it goes extinct. Survey responses did not vary by sex or age. This article will hopefully guide future education and collaborative recovery initiatives.*

Keywords endangered species, Houston toad, public, recovery, support

Introduction

Community support is important for recovery success of threatened and endangered species, particularly when the species occurs largely on private property (Hatch et al., 2002). Endangered species can benefit from community support through landowner-instituted habitat conservation initiatives (e.g., Safe Harbor agreements; Toombs, 2005), monetary, property and volunteer contributions to conservation or research (Alberts & Grant, 2003; Chase, Schusler, & Decker, 2000), and favorable attitudes that help influence decision-making processes (e.g., proactive land-use planning; Broberg, 2003). Alternately, endangered species can be harmed by intentional or unintentional direct mortality and habitat destruction or degradation (Doremus & Pagel, 2001).

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Education can cultivate positive attitudes and actions toward endangered species recovery (Bjorkland & Pringle, 2001; Caro, Pelkey, & Grigione, 1994). Education positively influenced conservation and recovery initiatives for a wide range of species, from Kirtland's warbler (*Dendroica kirtlandii*; Solomon, 1998) to the Florida manatee (*Trichechus manatus latirostris*; Aipanjiguly, Jacobson, & Flamm, 2003). Negative attitudes toward species listed under the Endangered Species Act are usually harmful to species recovery (e.g., Lueck & Michael, 2003).

The federally endangered Houston toad (*Bufo* [*Anaxyrus*] *houstonensis*; Gottschalk, 1970) is endemic to east-central Texas. Texas is over 94% privately owned (Texas Center for Policy Studies, 2000), and the persistence of this species across its range depends heavily on spatially and quantitatively sufficient suitable habitat located on private property. Since the 1970s Bastrop County has housed the majority of Houston toads, and currently it is the only county retaining fairly robust populations (Brown, 1971; McHenry, 2010). The current extinction vulnerability for this species is high. Most of the Bastrop County toad populations are found within 15 km of the city of Bastrop, including Bastrop State Park, which is located adjacent to the city.

Political conflicts involving the City of Bastrop residents, state and federal wildlife agencies, and the endangered Houston toad date back to 1970 when the toad was first listed as federally endangered (Peterson, Allison, Peterson, Peterson, & Lopez, 2004). These conflicts spawned negative attitudes toward the Houston toad from residents and landowners in and around the City of Bastrop (Brown & Mesrobian, 2005). Beginning in 2000, however, the U.S. Fish & Wildlife Service took a more proactive, cooperation-based approach to Houston toad recovery in Bastrop County. This approach culminated in a landowner and developer-inclusive Habitat Conservation Plan for Houston toad habitat (KES Consulting, Loomis Austin, & Forstner, 2007). Residents living in designated critical habitat for the species are involved at the regulation level of the Habitat Conservation Plan and therefore should be familiar with the federal status of the Houston toad. The human population in the city of Bastrop, however, is increasing rapidly and newer residents may have limited or no knowledge of the Houston toad.

The U.S. Fish and Wildlife Service (USFWS) conservation efforts have been primarily focused on rural landowners in Bastrop County, through the implementation of habitat conservation plans and safe harbor agreements. Conservation initiatives, however, involving the urban and suburban sectors, are becoming increasingly important. These sectors are located adjacent to or within designated critical habitat, are growing rapidly, and are contributing to habitat loss and fragmentation. It is important to gauge the knowledge and opinions about the Houston toad in these sectors as a precursor to future collaborative efforts. In this article, we quantified the level of knowledge about the Houston toad for residents of the City of Bastrop and determined current and future education outlets.

Methods

We used a door-to-door survey that was designed to be completed within one minute. To minimize sampling bias surveyors did not answer any questions regarding specific information about the Houston toad until participants completed the survey. Survey teams consisted of one male and one female per team to minimize sex-based bias. When requesting participation, surveyors introduced themselves as Texas State University graduate students requesting participation on a research study. Only subjects 18 or older were asked to participate in the survey. To sample a range of population demographics we selected sectors that varied in establishment period, housing costs, and surrounding landscape. The

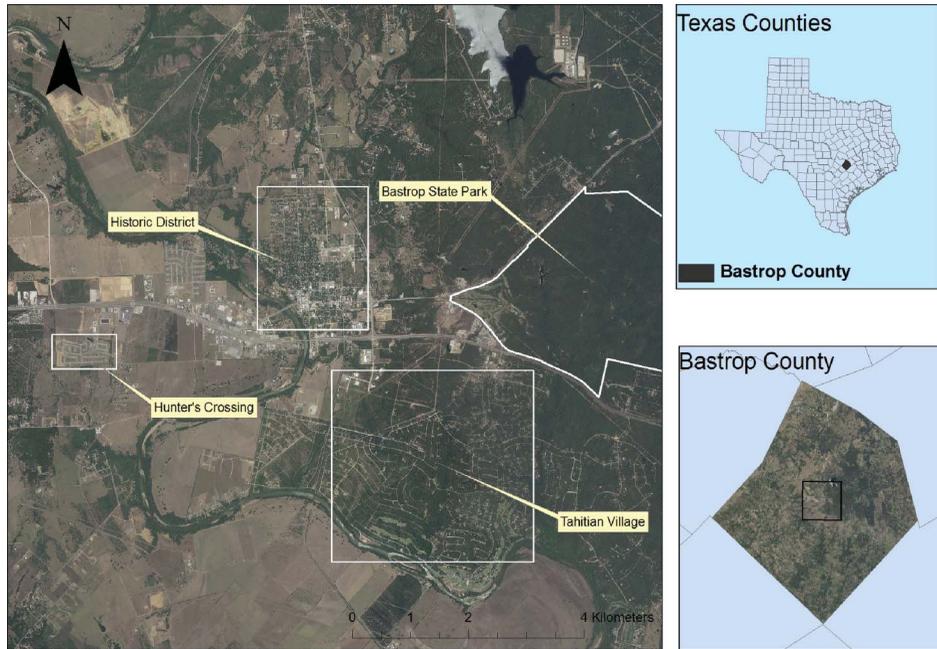


Figure 1. Location of Bastrop State Park and sectors within the City of Bastrop, Bastrop County, Texas, that were surveyed in 2011 to assess knowledge and support of the endangered Houston toad (*Bufo [Anaxyrus] houstonensis*) (color figure available online).

surveyed sectors included the historic district, founded in 1832, Hunters Crossing, developed in 2008, and Tahitian Village, located within the critical habitat boundaries defined by the Houston toad recovery plan (USFWS, 1984; Figure 1).

The survey contained four demographic questions (i.e., sex, age, occupation, county residency). Respondents were asked if they have ever heard of the toad. If the respondent had not heard of the Houston toad, the survey was finished and handed in, however if the respondent had heard of the toad we asked them to further answer three questions involving where they had heard of the toad and to what extent was their knowledge of this species. The final three questions asked for the respondents opinions related to the environmental impact they believe the species has on themselves personally and on the environment.

Results

We visited 193 homes across the three sectors, which resulted in 132 completed surveys (46, 40, and 46 in the Historic District, Hunters Crossing, and Tahitian Village, respectively). The age distribution was: >60 [24%], 51–60 [19%], 41–50 [18%], 31–40 [22%], 18–30 [16%]. Sex was distributed as 45% male and 55% female.

We found that 63% (83 individuals) of the survey respondents had heard of the Houston toad. Among the three sectors, 70%, 63%, and 55% of surveyed respondents in Tahitian Village, Historic District, and Hunters Crossing, respectively, had heard of the Houston toad, however the differences between sectors were not significant ($p = .392$). Of the 83 respondents who had heard of the Houston toad, 94% knew the Houston toad was an endangered species, and 63% knew the Lost Pines region contained the largest Houston

Table 1

Results from Fisher's exact tests (p -values) used to determine if knowledge and opinions about the endangered Houston toad (*Bufo houstonensis*) differed between sexes and among age classes for residents of Bastrop Texas based on a door-to-door survey conducted in 2011

Survey question	Sex	Age classes
Have heard of the Houston toad	0.465	0.061
Knew the Houston toad was endangered	0.388	0.344
Thought the Houston toad benefited them personally	0.402	0.008
Thought the Houston toad benefited the ecosystem	1.000	0.418
Would care if the Houston toad went extinct	0.792	0.086

toad population. Furthermore, 50% of the respondents thought the Houston toad benefits them personally, 84% thought the Houston toad population benefits the ecosystem, and 81% cared if The Houston toads went extinct. When survey responses were compared based on sex, no significant differences were observed. For age class comparisons, responses to all questions but one were not significant. When asked, do you think the Houston toad benefits "you" in any way, a significant difference was found ($p = .008$) (Table 1). All 12 respondents from the 18–30 age class replied "no" for this question.

Discussion

Recovery success in urbanized regions often depends on management programs that benefit target species and simultaneously are socially acceptable (Phillips et al., 1998). Education increases public awareness and can assist in placing value on an object, and values provide the basis for attitudes (Tarrant et al., 1997). In our study, over half of the survey respondents had some knowledge of the Houston toad. Knowledge was not correlated with sector location; however, residents living outside critical habitat are still gaining knowledge on this endangered species. Attitudes toward the Houston toad were generally favorable among all three sectors. Our results further indicated the majority of survey respondents believe there is an ecosystem-level value in the toads' existence, but relatively few made the connection between having value to the ecosystem and value to people. To further educate the public (especially younger residents) and promote community support for Houston toad recovery we recommend increasing education at the K–12 level through informative presentations, and increasing education to the general public. Further education efforts should not only provide information about the Houston toad, but also include general information on the role of amphibians in ecosystems and how ecosystem health benefits human populations.

On September 4, 2011 a catastrophic wildfire began in the Lost Pines ecoregion of Bastrop County. Bastrop State Park and Tahitian Village were within the boundary of this 13,800 ha wildfire. Overstory tree mortality was nearly 100%, and understory vegetation was completely removed throughout much of this area. The dead and dying trees are currently being removed, leaving behind currently unsuitable Houston toad habitat patches. The aftermath of the catastrophic wildfire has left Bastrop County with the need for immediate and active restoration of the plant community in order to restore the integrity of the Lost Pines ecoregion. Restoration actions, along with some of the necessary expenses, will require landowner support and involvement. It will be necessary to educate these

landowners on best management practices for the Houston toad. The USFWS has compiled this information (2011), and we recommend that it be widely distributed among landowners in Houston toad habitat.

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