HUMAN DIMENSIONS OF WILDLIFE
2016, VOL. 21, NO. 1, 86–94
http://dx.doi.org/10.1080/10871209.2015.1094710

Routledge
Taylor & Francis Group

RESEARCH NOTE

Assessment of Public Knowledge and Willingness to Pay for Recovery of an Endangered Songbird, the Golden-Cheeked Warbler

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ABSTRACT

Ecological economics assigns value to resources. Valuation can be difficult when the resource is a species, particularly one that does not directly impact humans. The endangered golden-cheeked warbler (*Setophaga chrysoparia*) is a songbird that breeds exclusively in central Texas. Using a door-to-door survey design, we investigated knowledge and willingness to pay for golden-cheeked warbler recovery actions in Austin, Texas, a city attempting to balance human population growth with conservation of several endangered species. Approximately half of respondents had knowledge of this species; of those 80% knew it was endangered. Seventy-four percent of respondents believed the species held value, and most regarded that value as existence-based. The mean willingness to pay was $21.47 per person annually over a 5-year period, including individuals not willing to pay. Our study indicated the public values the warbler, and is willing to provide monetary support for recovery and conservation efforts.

KEYWORDS

Conservation; development; endangered species; public; value

Introduction

Gauging contingent valuation for environmental issues, such as endangered species recovery actions, is an important component of environmental management, as public opinion has the potential to influence societal change, policies, and decision-making (Czech, Krausman, & Borkhataria, 1998). Public support can be critical to recovery success of threatened and endangered species, particularly when the species occurs largely on private property (Brook, Zint, & De Young, 2003; Hatch et al., 2002; Kellert, 1985). Endangered species can benefit from public support through favorable attitudes that help influence decision-making processes (e.g., proactive land-use planning; Broberg, 2003), landowner-instituted habitat conservation (e.g., Safe Harbor agreements; Toombs, 2005), and monetary, property, and volunteer contributions to conservation or research (Alberts & Grant, 2003; Chase, Schusler, & Decker, 2000).

Ecological economics is a growing field that incorporates environmental and social impacts with project design and economic growth (Leefers & Castillo, 1998). In the face of resource depletion as a means of economic growth, neoclassical economics offers the solution that growth can be supported as long as technologies continue to

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advance and substitutes or alternatives are available for capital resources (Solow, 1974). Ecological economics, however, recognizes the need to address environmental loss and degradation on local and global scales wherein resources are finite (Ingebrigsten & Jakobsen, 2012). Ecological and social impacts from loss or degradation of natural resources can be difficult to quantify. Total economic values can be derived from direct, indirect, or non-use values. Direct values include commercial or recreational goods consumed by the public whereas indirect values are associated with biological or environmental services. Non-use values are more difficult to quantify as they are abstract and largely based on simply existing. Examples of non-use value include intrinsic/existence value, aesthetic value, and bequest value (Perman, Ma, McGilvray, & Common, 2003).

Although difficult to estimate, non-use values are important for conservation purposes. This is a common issue when endangered species have no direct public use value and the public is not aware of their existence. In these instances, contingent valuation methods can be used to assign an economic value to a species (Martin-Lopez, Montes, & Benayas, 2007) via willingness to pay surveys (Solomon, Corey-Luse, & Halvorsen, 2004; Zander, Ainsworth, Meyerhoff, & Garnett, 2014). These surveys assign a monetary value for cost–benefit analyses of land use or management actions, and identify potential funding sources for recovery actions (Diffendorfer et al., 2014; Zander et al., 2014).

The golden-cheeked warbler (*Setophaga chrysoparia*) is an endangered species that winters in southern Mexico and Central America and migrates to central Texas during their breeding season (Rappole, King, & Leimgruber, 2000). This species is a habitat specialist that requires forests with a mix of mature ashe juniper (*Juniperus ashei*) and hardwood trees such as oaks and elms (Ladd & Gass, 1999). Reasons for their endangered status are primarily habitat loss and fragmentation in wintering and breeding ranges (U.S. Fish and Wildlife Service [USFWS] 1992). Current recovery efforts are outlined in the USFWS recovery plan, and include habitat protection and population monitoring to achieve sustainable populations with sufficient genetic flow throughout eight regions across central Texas (USFWS, 1992). Additionally, the recovery plan recognizes the importance of public support by stating that this plan will most likely succeed "through enhanced public relations/public education, incentives, assistance, and cooperative arrangements" (USFWS, 1992). Because of the golden-cheeked warbler's endangered status, land development in these areas is restricted. As a result, public attitudes toward this species may reflect negative support for recovery efforts. Alternately, the presence of golden-cheeked warblers and other endangered species (e.g., black-capped vireos [*Vireo atricapilla*]) has resulted in the creation of the Balcones Canyonlands Preserve network, which has created over 11,300 ha of green space in the greater Austin area. This green space benefit may reflect positively in public attitudes toward the species.

We conducted this study in Austin, Texas, a city attempting to balance substantial human population growth and development with conservation of the golden-cheeked warbler and other endangered species (Regional Environmental Consultants & USFWS, 1996). Our objectives were to gauge general knowledge of the public concerning the golden-cheeked warbler, and to assess willingness to pay for recovery actions. The willingness to pay portion of the survey assessed contingent valuation of an environment resource that cannot be directly valued using traditional cost–benefit analyses, and determined if public donations

for conservation actions was a viable method for funding additional land acquisition and species recovery actions.

Methods

Surveys were conducted in spring 2013 in Austin, Texas, where there is a high level of both urbanization and conservation efforts for the golden-cheeked warbler. Interstate highway 35 was used as an eastern boundary for the random selection of four neighborhoods within the greater Austin area (Figure 1). Using a geographic information system (GIS), we created a polygon around the city limits, within which four points were randomly generated. The nearest neighborhoods to these points were sampled. One non-randomly selected neighborhood was included near the northwestern boundary of Travis County adjacent to the Balcones Canyonlands Preserve National Wildlife Refuge. The neighborhood was included to ensure residents living close to the refuge, and thus potentially more aware of the species and the associated issues, were represented in the sample. Note that in addition to the refuge, there are numerous city and privately owned Balcones Canyonlands Preserve land tracts throughout Travis County managed primarily for the golden-cheeked warbler (Figure 1).

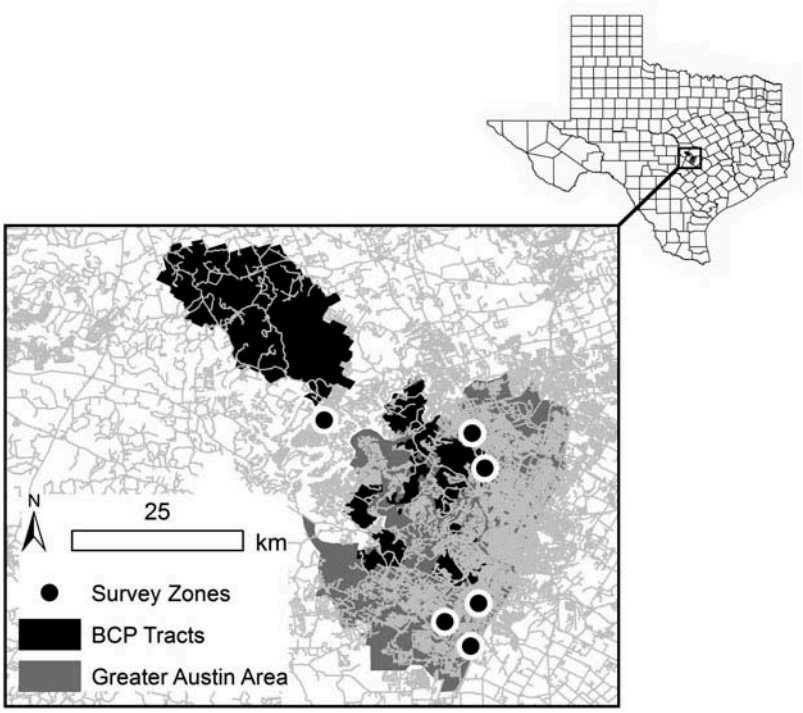

Figure 1. Four randomly selected neighborhoods in the greater Austin area of Texas, and one non-randomly selected neighborhood adjacent to the Balcones Canyonlands Preserve (BCP) National Wildlife Refuge, used to assess public knowledge and willingness to pay for recovery of the endangered golden-cheeked warbler (*Setophaga chrysoparia*). The dark gray area delineates the greater Austin area, with non-refuge BCP tracts in Austin shown in black.

We surveyed between 10 and 30 residents in each neighborhood (M = 17), with one female and one male surveyor gathering data from residents. We obtained basic demographic information, including age, sex, and years of residency in the Austin area. We then asked respondents whether or not they participated in outdoor activities including hunting, fishing, wildlife viewing, or hiking. Participation in these activities could influence whether an individual values wildlife species and would be willing to contribute to wildlife conservation. To assess basic knowledge of the golden-cheeked warbler, we asked respondents if they had ever heard of the golden-cheeked warbler, and if so, if they were aware of its endangered status. Respondents were then allowed to state the biggest threat to the species. We also asked if they believed the species held any kind of value, and if so, what value the species held. Finally, to gauge willingness to pay for recovery actions, we presented respondents with four hypothetical scenarios that correlated recovery actions and results of those actions on the status of the golden-cheeked warbler. Each recovery action scenario included an annual donation over a 5-year period, ranging from $0 to $150, and respondents chose the scenario they would hypothetically be willing to support. The ranges in dollar amounts were selected to represent the cost of recovery corresponding to each scenario (i.e., land acquisition, research and monitoring, and management). We chose a 5-year annual donation period, rather than a one-time donation, so that each donation would represent little financial burden to the respondents, while also providing a series of years of monetary support for conservation. Most willingness to pay surveys consist of simply preserve or not preserve options, which does not allow for valuation of different population-level changes (Christie et al., 2006; Jacobsen, Lundhede, & Thorsen, 2012). We gave respondents a range of choices so that we could evaluate value for recovery beyond persistence (Table 1). We did not ask about household income to avoid discomfort during the face-to-face survey.

We used generalized linear models (GLM) to investigate relationships between demographic variables and the two questions about species value and hypothetical donation level. For the species held value question we used a binomial distribution (i.e., logistic regression; Sokal & Rohlf, 1995), with age, sex, participation in outdoor activities, and knowledge of the species' existence as predictors. We included age and sex as predictors for valuation because they may be related to outdoor recreation participation, which could influence their appreciation, or valuation, of nature. For example, according to a recent Outdoor Participation Report (Outdoor Foundation, 2013), more males participated in outdoor activities than females. However, when broken down into different age classes, females participated more in the 18–24-year-old range. For the hypothetical donation levels question, we used a Gaussian distribution, with years of Austin area residency, awareness of the species, the perceived value of the species, and knowledge of endangerment status as

Table 1. Respondents in Austin, Texas were given a range of donation based choices with hypothetical population level outcomes for the golden-cheeked warbler. The hypothetical scenarios were to span a 5 year period with higher donation levels corresponding to increasingly better population outcomes.

Level 1: $0	Level 2: $25	Level 3: $75	Level 4: $150
Current population declines	Current population levels remain the same	Population reaches the minimum sustainable numbers	Population exceeds minimum sustainable numbers
Species goes extinct	Species remains endangered	Species delisted, but rare	Species delisted, common

predictors. Length of residency might influence the responsibility individuals feel towards maintaining the health of their community and environment. Normality and homoscedasticity tests indicated no data transformations were necessary. Model fit was examined using backwards model selection based on Akaike's Information Criterion (AIC). We then determined if predictors in the most parsimonious models were significantly better than the intercept-only model using log-likelihood ratio tests (Zuur, Ieno, Walker, Saveliev, & Smith, 2009). We considered predictors to be significant at $p \leq .05$.

Results

We received 85 completed surveys (response rate = 40%). Sex-ratio was approximately equal (52% female and 48% male). The age distribution of respondents was 18–30 [14%], 31–40 [29%], 41–50 [14%], 51–60 [14%], and >60 [28%]. Fifty-four percent of residents had heard of the golden-cheeked warbler, and of those individuals, 80% were aware of its status as endangered. Combining those who were aware of species but unaware of the status, a total of 44% of residents were unaware of this endangered species in their area. In response to "what is the biggest threat to this species?," most respondents stated habitat destruction/loss (57%), followed by human presence (23%), pollution/insecticide (9%), predators (e.g., birds of prey, feral cats; 7%), and unknown or other ecological causes (e.g., climate change; 5%).

Seventy-four percent believed the golden-cheeked warbler held value. The model selection indicated the only significant predictor of species-held value was knowledge of existence ($\chi^2_{1,83} = 6.01$, $p = .014$; Figure 2A). Of those who expressed species held value, 60% valued its existence, 28% believed it holds ecological value, and 11% value the species for aesthetics (Figure 2B). For the hypothetical donation scenario, 56% of residents chose \$0, 27% chose \$25, 12% chose \$75, and 5% chose \$150. Overall, slightly less than half of respondents demonstrated some level of willingness to donate. By averaging all donation values, including zero values, the mean willingness to pay was \$21.47 per person annually over a 5-year period. The model selection indicated the only significant predictor of willingness to pay was whether or not an individual believed the species held value ($\chi^2_{1,83} = 3.21$, $p = .035$).

Discussion

A primary challenge of wildlife conservation is gaining support from local communities to facilitate recovery actions (Brewer, 2002). This is especially important for endangered species, where habitat is fragmented by, or adjacent to, those communities (Jones, Brown, Mali, McKinney, & Forstner, 2012). Results here indicated awareness of the species influenced the value of the species. Forty-six percent of respondents had not heard of the golden-cheeked warbler, emphasizing the need for education and outreach to gain public support on environmental and species related issues. By allowing respondents to fill in their own explanation on the value of this species we can gain insight on what might motivate individuals to donate or support species conservation. Of those who answered "yes" to whether this species holds value, 46% wrote comments identical to "all species are valuable." This shows that many of the respondents have a vague sense of why a species is important but may not make the connection to species roles in the environment.

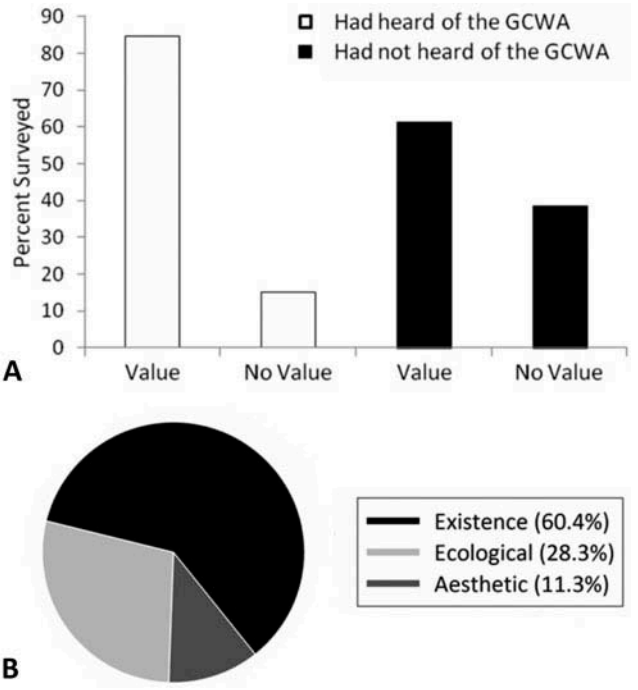

Figure 2. Responses of Austin, Texas residents to door-to-door survey questions asking whether or not they believed the endangered golden-cheeked warbler (*Setophaga chrysoparia*) held value (A), and if yes, what type of value it held (B).

Highlighting the importance of species diversity along with how diversity impacts the environment might better equip the public to influence policy makers. Willingness to donate is likely related to income and a non-donation does not necessarily imply a respondent does not value the species; 38% who acknowledged the species has value were not willing to donate.

Our survey was restricted to neighborhoods within the city limits of Austin, and thus our results might not be representative of urban/suburban communities outside the city limits, or rural communities. Further insights into the broader public opinion could be obtained with similar studies that included other sectors of the population within the golden-cheeked warbler distribution. Because we focused on a single species, our results should not be considered representative of the public's knowledge or opinions regarding willingness-to-pay for conservation of other endangered species in the Austin area (e.g., Barton Springs salamander [*Eurycea sosorum*]). Finally, we attempted to provide a reasonable hypothetical donation scenario to gauge willingness to pay for golden-cheeked warbler recovery actions. Other possible scenarios, such as offering a larger one-time donation instead of smaller annual donations over a 5-year period, would likely result in different total monetary support. Our five year scenario resulted in a mean donation value over 10 times that obtained for Florida manatees (*Trichechus manatus latirostirs*) when asking individuals to name their one-time donation only (i.e., $107.35 per person over five years vs. $10.25 per person; Solomon et al., 2004). Future research is needed to understand

how different donation scenarios influence willingness to pay for endangered species recovery.

As part of the golden-cheeked warbler recovery plan, public awareness of the importance of endangered species falls under actions needed in order to fulfill recovery criteria (USFWS, 1992). Improved public relations are an important task that should be carried out by state, government, and private organizations to facilitate management and encourage volunteer efforts for endangered species recovery. Volunteering for environmental causes has been shown to increase individuals' connectedness to nature, which may lead to changes in behavior that are more environmentally sustainable (Hine, Peacock, & Pretty, 2008). Biological conservation must emphasize the importance of education programs for adults and children to promote the connectedness between human communities and the natural world. In turn, the public could become increasingly willing to provide financial support for species conservation.

Increased financial support for the conservation of the golden-cheeked warbler in the greater Austin area would help support additional acquisition of the 12,314 Balcones Canyonlands Preserve (Regional Environmental Consultants & USFWS, 1996). The Balcones Canyonlands Conservation Plan conservation plan allows incidental take of eight endangered species in the rapidly expanding Austin area, in return for land acquisition and protection from development. Currently, approximately 92% of the land has been acquired (see Figure 1 for locations). Acquisition of additional land tracts would benefit the golden-cheeked warbler and other endangered and non-endangered species by providing and managing additional habitat, and would benefit the community through expansion of the Austin green space network. This could in-turn result in increased tourism revenue (Solomon, 1998; Solomon et al., 2004), as well as increase home values near the green spaces (Asabere & Forrest, 2009; Farmer, Wallace, & Shiroya, 2013). Given the high development pressure in the Austin area (Hill, FitzSimons, & Pearson, 2009), it is a critical time for the preservation of natural areas and the species that depend on them. This article provided one potential way to garner funding for this effort.

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