Threatened Bird Valuation in Australia

Kerstin K. Zander1*, Gillian B. Ainsworth2, Jürgen Meyerhoff3, Stephen T. Garnett2

1 The Northern Institute, Charles Darwin University, Darwin NT, Australia, 2 Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin NT, Australia, 3 Institute for Landscape Architecture and Environmental Planning, Technische Universität Berlin, Berlin, Germany

Abstract

Threatened species programs need a social license to justify public funding. A contingent valuation survey of a broadly representative sample of the Australian public found that almost two thirds (63%) supported funding of threatened bird conservation. These included 45% of a sample of 645 respondents willing to pay into a fund for threatened bird conservation, 3% who already supported bird conservation in another form, and 15% who could not afford to pay into a conservation fund but who nevertheless thought that humans have a moral obligation to protect threatened birds. Only 6% explicitly opposed such payments. Respondents were willing to pay about AUD 11 annually into a conservation fund (median value), including those who would pay nothing. Highest values were offered by young or middle aged men, and those with knowledge of birds and those with an emotional response to encountering an endangered bird. However, the prospect of a bird going extinct alarmed almost everybody, even most of those inclined to put the interests of people ahead of birds and those who regard the way threatened species sometimes hold up development. The results suggest that funding for threatened birds has widespread popular support among the Australian population. Conservatively they would be willing to pay about AUD 14 million per year, and realistically about AUD 70 million, which is substantially more than the AUD 10 million currently thought to be required to prevent Australian bird extinctions.

Citation: Zander KK, Ainsworth GB, Meyerhoff J, Garnett ST (2014) Threatened Bird Valuation in Australia. PLoS ONE 9(6): e100411. doi:10.1371/journal.pone.0100411

Introduction

Wild birds have been the subject of economic valuation studies for decades [1,2]. Direct economic values to humans [3] include being hunted for food or sport [4,5], pest control [6] or as objects of tourism [7,8]. However, birds also play less tangible roles that increase the well-being of those who encounter them [9]. Like many ecosystem services [10,11], birds provide utility to humans in ways that are not traded in the market and so their value cannot be obtained from observations of market transactions. Put another way, many people would feel poorer should wild birds no longer enrich their daily lives but there is no market from which their presence can be purchased. Thus quantifying the economic value of wild birds, including values not directly related to use, requires non-market valuation techniques.

Stated preference methods, of which contingent valuation (CV) is one, allow for the estimation of non-market goods for which there is no corroborating market behaviour that would provide reliable measurements [12]. Stated preference methods have been used to value non-market environmental goods for more than 50 years [13], with few alternative methods [14]. The core of a survey-based CV is the creation of a hypothetical market where respondents are asked to state directly their willingness-to-pay (WTP) for the good in question based on information provided to them. Studies using CV have provided a range of meaningful quantitative estimates of the anthropocentric benefits derived from threatened species conservation [15]. Most WTP bird studies have evaluated single, often threatened, bird species [16–20], some considered a category of birds (e.g. migratory birds) [21], some investigated multiple threatened and non-threatened species of which one assessed category was birds [22–24] and some studies investigated particular qualities of birds (e.g. rarity) [25]. Some of the values identified in these studies have been substantial. A meta-analysis of 12 studies found a mean WTP of USD44 per threatened species per year [24]. More recently a CV study found an average WTP for the nationally threatened corncrake (Crex crex) of between €7 and €11 among Irish farmers [20].

In Australia 211 bird taxa have been assessed as threatened or Near Threatened using the IUCN Red List criteria [26]. Although investment in conservation of these species has already been substantial [27], preventing their extinction will still cost millions of dollars to pay for actions ranging from direct interventions for individual species through to opportunity costs incurred by retaining habitat that might otherwise be developed [28,29]. Against this are the benefits from birds received by the Australian public who, for the most part, pay for conservation through their taxes. Comparing the costs and benefits (the value) of threatened bird conservation can lead to optimal conservation investment.

In this study we provide a monetary estimate of some of the benefits bird conservation would bring to Australians. Using the CV method, we compared the stated WTP across respondents from different socioeconomic backgrounds, with different attitudes and beliefs about birds and bird conservation, and with different levels of knowledge about birds. We know of no other study in which the diversity of perceptions about birds and the value of all
threatened birds, rather than a narrow selection of species, has been estimated for a whole country.

Methods

Willfulness-to-pay determinants

Many studies that have evaluated the value of threatened species and peoples’ WTP for their conservation, have investigated and found variation in WTP across respondents. Most studies test for age, education, gender and income effects on the WTP, respondents’ location (e.g. urban vs. rural) and the distance of the respondent to the species in question, respondents’ knowledge of the species and their attitudes towards environmental issues and conservation more generally. The choice of factors thought likely to influence the WTP for threatened bird conservation in Australia, and so tested in this research, arose partly from literature review and partly from qualitative interviews prior to the survey. Apart from commonly used economic and demographic determinants such as income, gender and age, we were particularly interested in the impact of respondents’ knowledge about bird identification and their attitudes towards threatened birds on their WTP. Table 1 outlines the variables that we test in this study and the expected impact on peoples’ WTP for threatened bird conservation in Australia.

We expected that people with high incomes would be more likely to pay as well as to pay more for threatened bird conservation in Australia, as found for other threatened wildlife (e.g. for the conservation of black-faced spoonbills (*Platalea minor*) ([19]), for peregrine falcons (*Falco peregrinus*) and shortnose sturgeon (*Acipenser brevisrostrum*) ([17]). Age has been found to be a consistent predictor which is negatively related to WTP for environmental amenities in general ([30]) and, for example, for the recovery of the guillemot (*Uria aalge*) population in Spain ([31]) specifically. Being female is often positively associated with higher WTP for environmental amenities ([30]; and, for example, for biodiversity protection in Germany ([32] and the conservation of Mediterranean monk seals (*Monachus monachus*) ([33])), and so we hypothesis that women have a higher WTP for wild birds than men.

| Determinant | Expected impact on WTP |
|-------------|------------------------|
| Income      | +                      |
| Being female| +                      |
| Age         | –                      |
| Interest in birds in general | + |  |
| Attitudes towards threatened birds | + |  |
| Aesthetic value | + |  |
| Humanistic value | + |  |
| Spiritual value | + |  |
| Scientific value | + |  |
| Experiential value | + |  |
| Existence value | + |  |
| Utilitarian value | – |  |
| Knowledge of birds, measured by peoples’ self-rated ability to identify common birds | + |  |

Table 1. Potential willingness-to-pay (WTP) determinants and their expected impact (positive [+]/negative [−]).

The attitudinal questions in our survey are based on the categorization of attitudes to wildlife developed by Kellert ([34]). For each of Kellert’s eight categories of wildlife value, we posed one statement question to each respondent. Research on environmental attitudes and WTP often find a positive relationship between the two ([17,23,35]).

Finally we integrated a knowledge variable as an indicator for peoples’ WTP. This variable is a measure of respondents’ self-rated ability to identify common birds. The possible answers were: cannot identify any, can identify some, can identify most and can identify all common birds. The expectation was that those people who have good or expert knowledge about birds, i.e. those who said they can identify most or all common birds, would be willing to pay more for the conservation of threatened species than those with less knowledge. Apart from examples in wildlife valuation where this was evident ([16,18,36]), this phenomenon was also found for the conservation of threatened livestock breeds ([37]).

The sample

The survey was delivered online between 16th and 21st of February 2011. We opted for a cost-efficient online survey because other valuation studies have shown that WTP values do not vary significantly across different survey modes ([38–40]). The survey was commissioned by a survey company, MyOpinions Pty Ltd, and respondents were paid AUD 3 on completion (at the time of the survey the AUD equalled the USD). The survey was voluntary and anonymous, and ethics approval was obtained from Charles Darwin University Human Research Ethics Committee (H11059). MyOpinions Pty Ltd is accredited to ISO 20252 and ISO 26362, adheres to the “research only” policy governed by industry bodies including the European Society for Opinion and Marketing Research, the Australian Market and Social Research Society and the Association of Market and Social Research Organisations and has an active panel of 300,000 verified respondents drawn from the general public (1.2% of Australian population) who registered (without having received any payment) with the company after recruitment via television, radio, newspaper, and online. Approximately half of the MyOpinions panel has been recruited from offline sources. The sample was selected using a quota random sampling whereby quotas were set to match the national population for gender, age and geographic location. The survey company randomly selected 5,800 members within these quotas and invited them to participate. Of these, 1,229 people agreed to undertake the survey before the topic was revealed. From these, 70 people dropped out before they started the survey. From the remaining 1,159 people, nearly 56% (645 people) completed the survey. The overall response rate of 11% (645/5,800) is consistent with other online surveys ([41]) where the invited sample tends to be very large to start with to ensure that all survey categories reach their quota quickly.

Questionnaire

The questionnaire had four sections: 1) questions aiming to elicit respondents’ attitudes towards birds and bird knowledge, 2) the CV question and a follow-up on the motivations for those not willing to pay, and 3) questions on socioeconomic characteristics (income, education, current employment situation and country of birth). For the CV we used a single-bounded dichotomous yes/no choice question on whether respondents were willing to pay for a stated amount (referred to as a bid) that varied between questionnaires ([42,43]). Additional to these bids we offered respondents the opportunity to state their WTP openly, which could be lower or higher than the bid. The number of bids and bid amounts were finalised after a pilot study with 30 respondents.
By using a probit model we estimated the function, so that the deterministic part of utility can be written as:

\[ v(y_j,q) = Z_j \beta + \epsilon(y_j) \]

and the median is given by

\[ \text{median WTP} = \exp\left(\frac{-Z_j}{\beta}\right) \]  \hspace{1cm} (6)

To calculate the mean and median WTP values as well as the 95% confidence intervals (CI), we employed the Stata command ‘wtpcikr’ [47]. The CIs were calculated using the Krinsky-Robb approach [48], i.e., the standard errors are derived via simulation. For the simulation we used 10,000 draws. In addition to a bid-only model, which includes solely the constant and the bid parameters, we also estimated a model investigating whether the hypothesised WTP determinants are statistically significantly related to the responses toward the offered bids, i.e., accepting or declining them (Yes/No-response). This model is called the ‘Covariates model’.

**Results**

In general willingness-to-pay and protest responses

More than half of the respondents (353; 55% of 645) did not want to contribute to a threatened bird fund in general. These people rejected the bid and also did not state an alternative amount that they might be willing to pay. A follow-up question after the CV asking respondents why they did not want to pay (Table 2) was used to separate those people who had zero value for threatened birds (valid ‘no’ responses) and those who opposed the CV question even though they might value threatened birds (protest responses). Most of the non-contributors said that they could not afford to pay (37%) or that they already donate money to another cause (32%). Some (11%) would not donate to any fund in general, while a few said that their taxes already support the protection of threatened birds (6%) or that they support bird conservation in other ways already (6%).

Respondents who have been identified as protesting against the payment vehicle are usually deleted from the sample [49]. However if those who are categorised as protesters actually have a WTP, then assuming a zero WTP for them would underestimate the economic value of the good in question [50]. On the other hand, the economic value could be overestimated if respondents categorised as protesters but having a zero WTP are ascribed some average value. Following Jakobsson and Dragun [51], we treated positive responses to two of the reasons as protest responses and deleted them from the data set. These were the 39 respondents who would not donate to any fund in general and 21 respondents who believed that their taxes already pay for the protection of threatened birds. This reduced the data set from 645 to 585 respondents. A further 17 responses could not be used because people did not answer most of the questionnaire properly. The final dataset contained 568 responses.

**Sample characteristics**

With 61% of the 568 respondents being female, the sample constitutes a slight gender bias. Forty percent of the respondents had an income of up to AUD 40,000 per year, 27% of AUD 41,000-80,000 and 7%>AUD 80,000; the remaining 26% of respondents did not reveal their income category. In accordance with the predetermined sample request, respondents were distributed relatively evenly across all age categories (18–24:10%, 25–34:13%, 35–44:17%, 45–54: 21%, 55–64:17%, 65+ :22%). Also by request, the geographical distribution of respondents matched the demographic variation among Australian states (New South Wales 31%, Victoria 25%, Queensland 20%, Western Australia 10%, South Australia 7%, Tasmania 4%, the Australian Capital Territory 2% and the Northern Territory 1%).
Responses to offered bids

In total, respondents accepted the offered bid in 25% of the CV questions while they rejected it in 75% of the questions (Table 5). The percentage of respondents accepting the bid diminished as its cost increased. Almost half of the respondents (45%) accepted the lowest bid offered (AUD 10) while only four respondents (3%) answered ‘yes’ to the highest bid of AUD 200.

Attitudes towards threatened birds and their conservation

The highest Likert sample means, over four, were found for the three statements ‘I would regret that humans had caused the bird to become endangered’, ‘I think there’s a moral obligation to protect the bird’ and ‘I would feel upset if the bird became extinct’ (Table 3), indicating a strong dislike of endangered birds becoming extinct across the whole sample, including many who had a zero WTP. Of the 13% who actively rejected payments, 35% still agreed or strongly agreed that they would both ‘not like to see extinction’ and ‘feel a moral obligation to protect the bird’ with 43% regretting that human activities were making it threatened.

To reduce the individual items to underlying latent factors (Table 4) we used factor analysis. Factor analysis is a family of approaches that aim to reduce a number of observed, correlated variables, such as responses to attitudinal questions, by describing linear combinations of the variables that contain most of the information. This information can subsequently be used to reduce the set of variables to a lower number of unobserved latent variables, also called factors [52,53]. Prior to the factor analysis we calculated the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy. With a value of 0.825 it indicates that the data are suitable for a factor analysis. Subsequently, the Varimax rotated results singled out one factor with an Eigenvalue of 2.2 which explains 63.6% of the variance. The Eigenvalue of a factor measures the variance in all the variables which is accounted for by this particular factor. The higher the Eigenvalue the more the factor contributes to the explanation of the variances in the variables [53]. Among the three remaining factors, only one had an Eigenvalue above one. However this value was only slightly above one (1.13) so we did not use it in the subsequent analysis. To calculate an attitudinal factor score for incorporation into the bid function, we used the items with factor loadings above 0.4. We called this score ‘Avicentric’. The higher this score, the more positive the attitude of a respondent towards threatened birds and their protection. The score had a mean value of 16.6 and ranged from a minimum value of 8 to a maximum value of 21.

Willingness-to-pay estimation and aggregation of estimates

The median WTP estimates for threatened birds in Australia were computed as between AUD 11.30 and AUD 11.55, for the bid-only model and the model including covariates, respectively (Table 7). These figures were aggregated for the population of

| Table 2. Stated reasons for not contributing to a threatened bird conservation fund (in %). |
|---------------------------------------------------------------|
| Reason                                        | N | % of those not contributing (N = 353) | % of whole sample (N = 645) | Response type |
| I already donate to a bird conservation fund        | 1 | <1                                      | <1                          | True zero value |
| I already donate to another cause                  | 112 | 32                                     | 17                          | True zero value |
| I cannot afford to donate any money to a bird conservation fund | 131 | 37                                     | 20                          | True zero value |
| I support bird conservation in other ways          | 20 | 6                                       | 3                           | True zero value |
| I would not donate to any fund like this in general | 39 | 11                                      | 6                           | Protest        |
| My taxes already support protection of endangered birds | 21 | 6                                       | 3                           | Protest        |
| No answer                                        | 21 | 6                                       | 3                           | True zero value |
| Other                                           | 8  | 2                                       | 1                           | True zero value |
The most conservative estimate (AUD 13.7–14.0 million) assumed that all those who did not accept the invitation to participate in the survey (89% of those requested) had a zero WTP, even though the subject of the questionnaire was not revealed in the invitation. A more realistic, but still conservative, estimate (AUD 69.6–71.1 million) assumed that all of those who failed to complete the questionnaire after accepting the invitation to participate had a zero WTP (44%; Table 7).

Discussion

Based on data collected in the 1990s, about AUD 5 million per year for the next 80 years could reduce Australian bird extinctions to almost zero and reduce the total number of threatened species by 15% [28]. Even assuming this figure has doubled to about AUD 10 million a year [56], this is still less than one dollar a year for the 11 million Australian adults of working age. Respondents to our survey were willing to pay over ten times that amount, around AUD 11 per year (median value), for threatened bird conservation in Australia, even including the non-contributors. This suggests that, even if we assume that all 89% of those who did not respond to the invitation to participate in the survey would be unwilling to pay, an adequate allocation of public funds to threatened bird conservation would be consistent with the benefits gained by the Australian public.

That more than half of the sample were not prepared to pay may also be deceptive. Three percent said they already supported bird conservation in other ways. Three quarters of the 20% unwilling to pay because they could not afford to (see Table 2), nevertheless agreed that humans have a moral obligation to protect the bird (44%; Table 7).

Table 3. Responses (in %) to a series of statement questions asking: ‘Thinking about how you would feel if you knew you had seen an endangered bird, how much do you agree or disagree with these statements?’

| Statement                                                                 | Strongly disagree (1) | Disagree (2) | Neither Agree nor Disagree (3) | Agree (4) | Strongly agree (5) | Sample Mean |
|--------------------------------------------------------------------------|-----------------------|--------------|-------------------------------|-----------|-------------------|-------------|
| Seeing a new bird fills me with excitement                               | 4                     | 16           | 32                            | 33        | 15                | 3.4         |
| I want to add it to my bird watching list                               | 1                     | 7            | 32                            | 48        | 12                | 3.6         |
| I would regret that humans had caused the bird to become endangered     | <1                    | 2            | 12                            | 47        | 39                | 4.2         |
| I think there’s a moral obligation to protect the bird                   | <1                    | 1            | 17                            | 49        | 33                | 4.1         |
| I feel it’s a nuisance when an endangered bird stops development         | 34                    | 27           | 23                            | 11        | 5                 | 2.3         |
| I think the bird has a right to live only if it’s beautiful or unusual   | 45                    | 28           | 13                            | 8         | 6                 | 2.0         |
| I feel the needs of people come before those of endangered birds        | 26                    | 32           | 32                            | 8         | 2                 | 2.3         |
| I think government is responsible for the bird’s survival, not me        | 17                    | 38           | 35                            | 8         | 2                 | 2.4         |
| I would feel upset if the bird became extinct                           | 2                     | 3            | 15                            | 47        | 33                | 4.1         |
| I would feel privileged or spiritually uplifted                         | 1                     | 4            | 31                            | 43        | 21                | 3.8         |

doi:10.1371/journal.pone.0100411.t003

Table 4. Results of factor analysis extracting four common factors explaining the correlations amongst responses to Likert-type statement questions.

| Statement question                                                                 | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|------------------------------------------------------------------------------------|----------|----------|----------|----------|
| I think there’s a moral obligation to protect the bird                             | 0.75     | −0.16    | 0.19     | −0.02    |
| I would regret that humans had caused the bird to become endangered               | 0.72     | −0.17    | 0.14     | −0.04    |
| I would feel upset if the bird became extinct                                     | 0.58     | −0.08    | 0.22     | 0.19     |
| I would feel privileged or spiritually uplifted                                   | 0.54     | −0.09    | 0.30     | 0.19     |
| I want to learn more about the bird                                              | 0.47     | −0.07    | 0.58     | 0.04     |
| I might tick the bird off my bird watching list                                   | 0.25     | 0.13     | 0.57     | −0.01    |
| I think government is responsible for the bird’s survival, not me                 | 0.15     | −0.43    | 0.14     | 0.05     |
| I think the bird has a right to live only if it’s beautiful or unusual            | −0.14    | 0.59     | 0.05     | 0.01     |
| I feel it’s a nuisance when an endangered bird stops development                 | −0.19    | 0.55     | 0.05     | −0.05    |
| I feel the needs of people come before those of endangered birds                 | −0.34    | 0.44     | −0.06    | −0.03    |
| Eigenvalue                                                                        | 2.19     | 1.13     | 0.87     | 0.08     |

Note: Responses to the first five statements with a loading higher than 0.4 were grouped into one variable which we called ‘Avicentric’.

doi:10.1371/journal.pone.0100411.t004
conserve birds. Of the protest votes, 3% felt that government already covered their responsibility towards birds and just 6% actively rejected payment into a conservation fund. Curiously nearly half of the protest group (47%) said they would still pay for threatened birds in general and the majority (83%) would be upset if a bird went extinct. This survey therefore demonstrates that there is substantial support for the conservation of threatened birds across society. It also shows that threatened birds are valued as a group, not just particular species with which people might have a strong affinity.

This strong desire among respondents for wild birds not to go extinct is perhaps surprising given the relatively low rate of membership of bird clubs in Australia. BirdLife Australia has about 25,000 members, supporters and volunteers and around 12,000 Australians participate in BirdLife Australia’s Birds in Backyards citizen science program [57,58] (0.3% of the Australian population) with others interested in birds belonging to natural history and avicultural societies (which collectively are likely to have many more members than BirdLife Australia). This is far lower than, for example, the United Kingdom where the Royal Society for the Protection of Birds has over a million members (1.7% of the population, about one in every 60 people of all ages). In the survey 2.5% were or had been a member of a bird club of any type, although 19% said they sometimes went birdwatching. International comparisons of WTP for threatened birds could provide meaningful comparisons of conservation culture, although the comparison would also need to take account of national differences in the probability of joining a society of any type.

Given that this WTP was elicited from people who had not been primed for the questionnaire, one might expect that it would have been higher had people had greater knowledge than provided in the survey introduction. The result that the stated WTP in this study was higher among those more knowledgeable about birds, and that increasing a person’s knowledge about a species increases

| Table 5. Distribution of responses to the WTP bids (in %); N = number of respondents offered the bid. |
|---------------------------------------------------------------|
| Response | Bid (in AUD) | 10 | 25 | 50 | 100 | 200 | Total |
|----------|-------------|----|----|----|-----|-----|-------|
| Rejected bid |             | 55 | 57 | 78 | 87  | 97  | 75    |
| Accepted bid |             | 45 | 43 | 22 | 13  | 3   | 25    |
| N |             | 101 | 111 | 138 | 100  | 118  | 568 |

| Table 6. Bid-only and covariates model (probit), depended variable = Yes/No response to offered bid. |
|-----------------------------------------------------------------------------------------------|
| Variable | Bid-only model | | | | Covariates model | |
| | Coef. | SE | p-value | Coef. | SE | p-value |
|----------|----------|------|--------|----------|------|--------|
| Constant | 1.296 | 0.06 | 0.001 | 0.54 | 0.58 | 0.356 |
| Bid (log) | -0.534 | 0.24 | 0.001 | -0.60*** | 0.07 | 0.001 |
| Age 25–34 | -0.17 | 0.27 | 0.527 |
| Age 35–44 | -0.34 | 0.26 | 0.193 |
| Age 45–54 | -0.34 | 0.25 | 0.170 |
| Age 55–65 | -0.32 | 0.26 | 0.215 |
| Age >65 | -0.50** | 0.25 | 0.049 |
| Female | -0.27** | 0.14 | 0.049 |
| Medium income | 0.14 | 0.15 | 0.366 |
| High income | 0.10 | 0.26 | 0.700 |
| Can identify some common birds | 0.11 | 0.18 | 0.539 |
| Cannot identify any common birds | -0.41* | 0.22 | 0.0610 |
| Attitudinal score ‘Avicentric’ | 0.08** | 0.03 | 0.0110 |
| Excited to see birds | 0.37*** | 0.15 | 0.0140 |
| Log-likelihood null | -317.19 | | -317.19 | |
| Log-likelihood model | -278.25 | | -254.10 | |
| Pseudo R² | 0.12 | | 0.20 | |
| AIC | 560.50 | | 539.67 |
| BIC | 569.18 | | 604.81 |
| Observations | 568 | | 568 |

*SE = Standard Error.
*** = 1% significance level; ** = 5% significance level; * = 10% significance level.
doi:10.1371/journal.pone.0100411.t005
doi:10.1371/journal.pone.0100411.t006
Table 7. WTP estimates (in AUD) for Australian threatened bird conservation and aggregation of these estimates.

| Variable                                | Bid-only model | Covariates model |
|-----------------------------------------|----------------|------------------|
| Mean WTP [95% CI]                       | 65.10 [42.27–166.00] | 46.61 [33.46–90.35] |
| Median WTP [95% CI]                     | 11.30 [7.16–15.21]   | 11.55 [7.70–15.23]   |

Aggregation based on median WTP

Conservative scenario: 11% of adult Australians would pay the average median WTP

| Variable                                | 13,673,000 | 13,975,500 |
|-----------------------------------------|------------|------------|

Realistic scenario: 56% of adult Australians would pay the average median WTP

| Variable                                | 69,608,000 | 71,148,000 |
|-----------------------------------------|------------|------------|

*There are about 11 million adult Australians (rounded; [55]).

1) This assumes that all of those people who did not respond to the survey when invited by the survey company (89%) have a zero WTP for threatened bird conservation in Australia.

2) This assumes that all of the 44% who did not complete the survey have a zero WTP and with the other 56% having a WTP corresponding to the sample.

Caution is always required with WTP estimates. In this case the major caution is that, while the survey with the dichotomous choice format had an incentive compatible question format, the payment vehicle is not among those that support consequentiality and thus truth telling [43]. Hence we opted for a voluntary payment into a conservation fund as the payment vehicle, rather than a tax increase, which would be compulsory across the entire population. However, in Australia the link between tax and expenditure by government is nearly always indirect, and suggesting a tax increase may have confounded considerations of the value of birds with views about taxation increases in principle.

We therefore felt that the link between a conservation fund and conservation action was more explicit and self-evidently voluntary. Also, while the choice of payment vehicle may have led to over-estimation of the WTP, the aggregation is based on the more conservative median WTP, which is lower than the mean. Moreover, some respondents stated that they were willing to pay higher amounts than they were requested to pay based on the bids, and some respondents who rejected the offered bid were willing to pay lower amounts, which were on average higher than the estimated median WTP. Overall, we therefore think that the figures presented are sufficiently accurate as an estimate of the Australian population’s valuation of threatened birds that they can be used in conservation policy decisions.

Conclusions

There was strong support for the conservation of threatened birds among the Australian public as demonstrated by their willingness-to-pay for their conservation. Nearly half of the respondents said they were willing to pay into a bird conservation fund or did so already. Many of the remainder said they could not afford to pay rather than they would rather not do so. While support was strongest among those with a passion for birds and those who knew most about them, it was by no means confined to this sector of society. Even many of those who would favour development over birds would still be willing to pay to prevent extinctions. The study is notable for valuing a threatened fauna in its entirety rather than any specific bird. It also suggests that
funding of threatened species conservation has broad backing from the Australian population.

Acknowledgments

We are grateful for advice on the wider questionnaire, of which this was part, from Heather Aslin and Mike Weston, and for comments on the manuscript from Stuart Butchart.

References

1. Bowker JM, Stoll JR (1988) Use of dichotomous choice nonmarket methods to value the whooping crane resource. Am J Agr Econ 70: 327–381.
2. Rubin J, Hellman G, Loomis J (1991) A benefit-cost analysis of the northern spotted owl. Forest Sci 37: 295–30.
3. Wenny DG, Devault TL, Johnson MD, Kelly D, Sbercioglu CH, et al. (2011) The need to quantify ecosystem services provided by birds. Auk 128: 1–14.
4. Gascogne WR, Hoag D, Koontz L, Tangen BA, Shaffer TL, et al. (2011) Valuing ecosystem and economic services across land-use scenarios in the Prairie Pothole Region of the Dakotas, USA. Ecol Econ 70: 1715–1725.
5. Helleflingner JR, Geist V, Wishart W (2013) The role of hunting in North American wildlife conservation. Int J Environ Stud 70: 399–413.
6. Johnson MD, Kellermeier JL, Sherco AM (2010) Pest reduction services by birds in shade and sun coffee in Jamaica. Anim Conserv 13: 435–444.
7. Edwards PE, Parsons GR, Myers KH (2011) The economic value of viewing migratory shorebirds on the Delaware Bay: an application of the single site travel cost model using on-site data. Hum Dimens Wildl 16: 435–444.
8. Sbercioglu CH (2002) Impacts of birdwatching on human and avian communities. Environ Conserv 29: 282–289.
9. Prescott-Allen C, Prescott-Allen R (1986) The First Resource: wild species in the North America economy. New Haven: Yale University Press. 529 p.
10. Daily GC, Geddisavat T, Aniyar S, Arrow K, Daugup, P, et al. (2000) The value of nature and the nature of value. Science 289: 395–396.
11. Millennium Ecosystem Assessment (MA) (2005) Ecosystems and human well-being: the assessment series (four volumes and summary). Washington: Island Press.
12. Mitchell RC, Carson RT (1989) Using survey to value public goods. The contingent valuation method. Washington: Resources for the Future. 404 p.
13. Smith VK (2006) Fifty years of contingent valuation. In: Alberini A, Kahn JR, editors. Handbook on contingent valuation. Cheltenham: Edward Elgar. pp. 7–65.
14. Baker R, Ruting B (2014) Environmental policy analysis: a guide to non-market valuation. Newhaven: Yale University Press. 529 p.
15. Loomis JB, White DN (1996) Economic benefits of rare and endangered species: summary and meta-analysis. Ecol Econ 18: 197–206.
16. Loomis J, Ekstrand E (1998) Alternative approaches for incorporating respondent uncertainty when estimating willingness to pay: the case of the Mexican spotted owl. Ecol Econ 27: 29–41.
17. Kotchen MJ, Reiling SD (2000) Environmental attitudes, motivations, and contingent valuation of nonuse values: a case study involving endangered species. Ecol Econ 32: 93–107.
18. Wilson C, Tisdell C (2005) Knowledge of birds and willingness to support their conservation: a birdwatching example. J Environ Manage 90: 294–292.
19. Olsen SB (2009) Choosing between Internet and mail survey modes for choice experiment surveys considering non-market goods. Ecol Econ 44: 931–940.
20. Lindstrom H, Narud S (2011) Are Internet surveys an alternative to face-to-face interviews in contingent valuation? Ecol Econ 70: 1630–1637.
21. Sax LJ, Gilmartin SK, Bryant AN (2003) Assessing response rates and non-response bias in web and paper surveys. Res High Educ 44: 499–432.
22. Hanemann M (1984) Welfare evaluations in contingent valuation experiments with discrete responses. Am J Agr Econ 66: 332–341.
23. Carson RT, Hanemann WM (2005) Contingent Valuation. In: Maler K-G, Vincent JR, editors. Handbook of Environmental Economics. Amsterdam: North-Holland, pp. 821–936.
24. Likert R (1932) A technique for the measurement of attitudes. Arch Psychol 140: 1–55.
25. Bateman JJ, Carson RT, Day B, Hanemann WM, Hanley N, et al. (2002) Economic valuation with stated preference techniques - a manual. Cheltenham: Edward Elgar. 480 p.
26. Haub TC, McConnell KE (2002) Valuing environmental and natural resources: the econometrics of non-market valuation. Cheltenham: Edward Elgar. 352 p.
27. Jeanty PW (2007) wtpcikr: Constructing Krinsky and Robb confidence interval for mean and median willingness to pay (WTP) using Stata. North American Stata Users' Group Meetings 2007, 8.
28. Kellert S (1986) Social and perceptual factors in the preservation of animal species. In: Norton BG, editor. The preservation of species. Princeton: Princeton University Press. pp. 302–341.
60. Hvenegaard GT (2002) Birder specialization differences in conservation involvement, demographics, and motivations. Hum Dimens Wildl 7: 21–36.
61. Wray-Lake L, Flanagan CA, Osgood DW (2010) Examining trends in adolescent environmental attitudes, beliefs, and behaviors across three decades. Environ Behav 42: 61–85.
62. Balmford A, Beresford J, Gree J, Naieedo R, Walpole M, et al. (2009) A global perspective on trends in nature-based tourism. PLoS Biol 7: e1000144.
63. Zander KK, Sing Tyan P, Jinam C, Tuen AA, Garnett ST (2014) Wild and valuable? Tourists’ preferences for improvements in orang-utan conservation. Conservat Soc 12: 27–42.