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ECONOMICS, ECOLOGY AND THE ENVIRONMENT

Working Paper No. 101

**Knowledge and Willingness to Pay for the
Conservation of Wildlife Species: Experimental
Results Evaluating Australian Tropical Species**

by

Clem Tisdell and Clevo Wilson

May 2004



THE UNIVERSITY OF QUEENSLAND

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Knowledge and Willingness to Pay for the Conservation of Wildlife Species: Experimental Results Evaluating Australian Tropical Species

Abstract

The nature of an experiment involving 204 residents is outlined and the results are reported and analysed. Two consecutive surveys of the respondents provide data about their stated knowledge of 23 wildlife species present in tropical Australia, most of which exclusively occur there. In addition, these surveys provide data about the willingness of respondents to pay for the conservation of those species belonging to three taxa; reptiles, mammals, and birds. Thus it is possible to compare the respondents' stated knowledge of the species with their willingness to pay for their conservation, and to draw relevant inferences from this. From the initial survey and these associations, interesting relationships can be observed between those variables (knowledge and willingness to pay). The second survey was completed after the respondents' knowledge of the species was experimentally increased and became more balanced. This is shown to result in increased dispersion (greater discrimination) in willingness to contribute to conservation of the different species in the set of wildlife species considered. Both theoretical and policy conclusions are drawn from the results.

Knowledge and Willingness to Pay for the Conservation of Wildlife Species: Experimental Results Evaluating Australian Tropical Species

1. Introduction

The degree of knowledge that individuals have of different wildlife species influences their economic valuation of the different species and their willingness to pay for their conservation. Variations in such knowledge are capable of altering, both stated and revealed preferences, and therefore, have important implications for techniques used for economic valuation and policies derived from such methods. However, there have been few empirical studies of the relationship between the knowledge individuals have of different wildlife species and their willingness to pay for their conservation. The main exception is the experimental research by Samples et al. (1986). More recently Spash (2002), drawing on the theories of Ajzen et al. (1996) and Ajzen and Driver (1992), emphasises how the provision of information can be preference-forming due to interaction effects.

The purpose of this paper is to report on and interpret the results of an experimental survey involving a sample of 204 Brisbane (Australia) residents. It examines the relationship between their stated knowledge of various Australian tropical wildlife species and their stated willingness to pay for their conservation. It considers the initial relationship and the subsequent relationship once the respondents' knowledge of all the species has been experimentally increased.

First, the nature of the experiment is described and then measures of the respondents' stated knowledge of the species are given. Variations in the respondents' knowledge as a result of the experiment are specified. The respondents' stated knowledge of each of the species is then related to their stated willingness to pay for its conservation. The effects of a reduction of uncertainty about the species on the willingness to pay of respondents for the conservation of each of the different species are given particular attention. It is, however, recognised that factors other than knowledge of species, such as the abundance of a species, influence willingness to pay for their conservation. That raises doubts about whether the willingness to pay for the conservation of a particular species is a reliable indicator of its total economic value. The policy relevance of this, and other findings, are discussed before concluding.

2. The Nature of the Experimental Survey

An experimental survey was conducted in 2002 of 204 residents of Brisbane drawn from different suburbs with varying socio-economic characteristics. Potential respondents were mostly contacted by letter drops and the sample was adjusted so that it had a similar age composition to that of the residents of Brisbane and a similar gender composition. While care was taken to select a representative group of Brisbane adults (persons of 18 years of age and older), it should be noted that predictions of population parameters is not the prime objective of this research.

The sample of respondents came in groups of 40-50 to a central place, mainly The University of Queensland. These meetings were arranged at different times of the day and on both weekdays and at weekends to ensure full participation by those selected to participate.

Each group at the initial meeting completed Survey I, a written questionnaire, which was designed to provide information about the knowledge of each of the respondents about each of a set of Australian wildlife species present in tropical Australia. The survey also collected information on how much financial support each of the participants would be willing to give for the conservation of each of these species. Other relevant information was also obtained. The completed survey forms were then collected.

In the second part of the meeting, participants attended an informative and illustrated lecture by Dr. Steven Van Dyck, Curator of Birds and Mammals at the Queensland Museum. His lecture mostly concentrated on the mahogany glider. This tropical gliding possum had not been officially sighted for several decades and he had 'rediscovered' it. Following this lecture, participants were given a second survey form (Survey II) and asked to complete this after reading a booklet containing coloured photographs of wildlife species mentioned in the surveys and descriptions of each of them. They were asked to take home this survey form and the booklet. They were requested to complete the second survey form after reading the booklet and to return the completed survey form in the self-addressed pre-paid postage envelope provided.

After some follow-up, all participants completed and returned the forms for Survey II. Survey II also collected additional information (not reported here) on respondents' knowledge and views about other aspects of Australian tropical wildlife.

In the booklet, we endeavoured to provide non-emotive and a balanced amount of information about each of the wildlife species considered in the survey. The aim was to provide information without influencing the preferences of the respondents. We recognise, however, that this ideal is difficult, or even virtually impossible, to achieve. The provision of information is not, as a rule, merely informative but is liable to alter preferences (Spash, 2002). We were unable to control the information in the lecture given by Dr. Van Dyck and its presentation. This lecture primarily focused on the mahogany glider and was presented in an entertaining manner that undoubtedly increased the empathy of the audience for the mahogany glider. As will be evident later, there was a major rise in the willingness of survey participants to pay for the conservation of the mahogany glider in Survey II compared to Survey I, and in their stated amount of knowledge of it. It, therefore, became an outlier in Survey II in the set of tropical species considered. Nevertheless, the stated level of knowledge of respondents about the set of species considered increased and became more balanced and even in Survey II compared to Survey I. This is apparent from the analysis presented in the next section.

3. Stated Degrees of Knowledge of the Wildlife Species Considered

The wildlife species considered by respondents are listed in Table 1. They consist of species from three taxa; birds, mammals and reptiles. Both in the initial survey, (Survey I), and in the subsequent survey, (Survey II), participants were asked to self-rank their perceived knowledge of each these species as ‘very good’, ‘good’, ‘poor’, or ‘non-existent’.

Table 1:
**List of Australian wildlife species covered in surveys of knowledge
and comparative economic valuation of respondents**

Common name	Scientific name	Abbreviation
Reptiles		
Saltwater crocodile	<i>Crocodylus porosus</i>	Sc
Freshwater crocodile	<i>Crocodylus johnstoni</i>	Fc
Hawksbill turtle	<i>Eretmochelys imbricata</i>	Ht
Taipan snake	<i>Oxyuranus scutellatus</i>	Ts
Northern long-necked turtle	<i>Chelodina rugosa</i>	Lt
Mammals		
Lumholtz's tree kangaroo	<i>Dendrolagus lumholtzi</i>	Tk
Red kangaroo	<i>Macropus rufus</i>	Rk
Koala	<i>Phascolarctos cinereus</i>	K
Mahogany glider	<i>Petaurus gracilis</i>	Mg
Northern bettong	<i>Bettongia tropica</i>	Nb
Northern quoll	<i>Dasyurus hallucatus</i>	Nq
Dugong	<i>Dugong dugon</i>	D
Northern hairy-nosed wombat	<i>Lasiorhinus krefftii</i>	Nw
Eastern pebble-mound mouse	<i>Pseudomys patrius</i>	Em
Birds		
Southern cassowary	<i>Casuarius casuarius</i>	Scw
Brolga	<i>Grus rubicundas</i>	B
Golden-shouldered parrot	<i>Psephotus chrysopterygius</i>	Gp
Palm cockatoo	<i>Probosciger aterrimus</i>	Pc
Eclectus parrot	<i>Eclectus roratus</i>	Ep
Gouldian finch	<i>Erythura gouldiae</i>	Gf
Red-tailed black cockatoo	<i>Calyptorhynchus banksii</i>	Bc
Golden bowerbird	<i>Prionodura newtoniana</i>	Gb
Australian magpie	<i>Gymnorhina tibicen</i>	Am
Kookaburra	<i>Dacelo novaeguineae</i>	Kb

A weighted index of the average degree of knowledge of participants of each of the species was obtained by assigning a weight of 3 to 'very good', 2 to 'good', 1 to 'poor' and zero to 'non-existent'. There is a degree of arbitrariness in this assignment as there would also be so in the participants' self-assessment of their degree of knowledge. However, these knowledge measures do allow some progress to be made with the analysis. A related article (Tisdell, forthcoming) using somewhat different weights, arrived at conclusions that are compatible with those reported here.

Figure 1 shows the relationship between the initial level of the indices of self-stated knowledge, k_1 , of the species and the subsequent indices, k_2 , obtained in Survey II. We observe that the largest increases in the indices occurred for wildlife species that were initially more poorly known than the others. While all of these initially poorly known species, except the mahogany glider, remained less well known than species that were initially better known, differences in the degree of knowledge of the species were substantially reduced in Survey II compared to Survey I. Knowledge of the various species was more balanced.

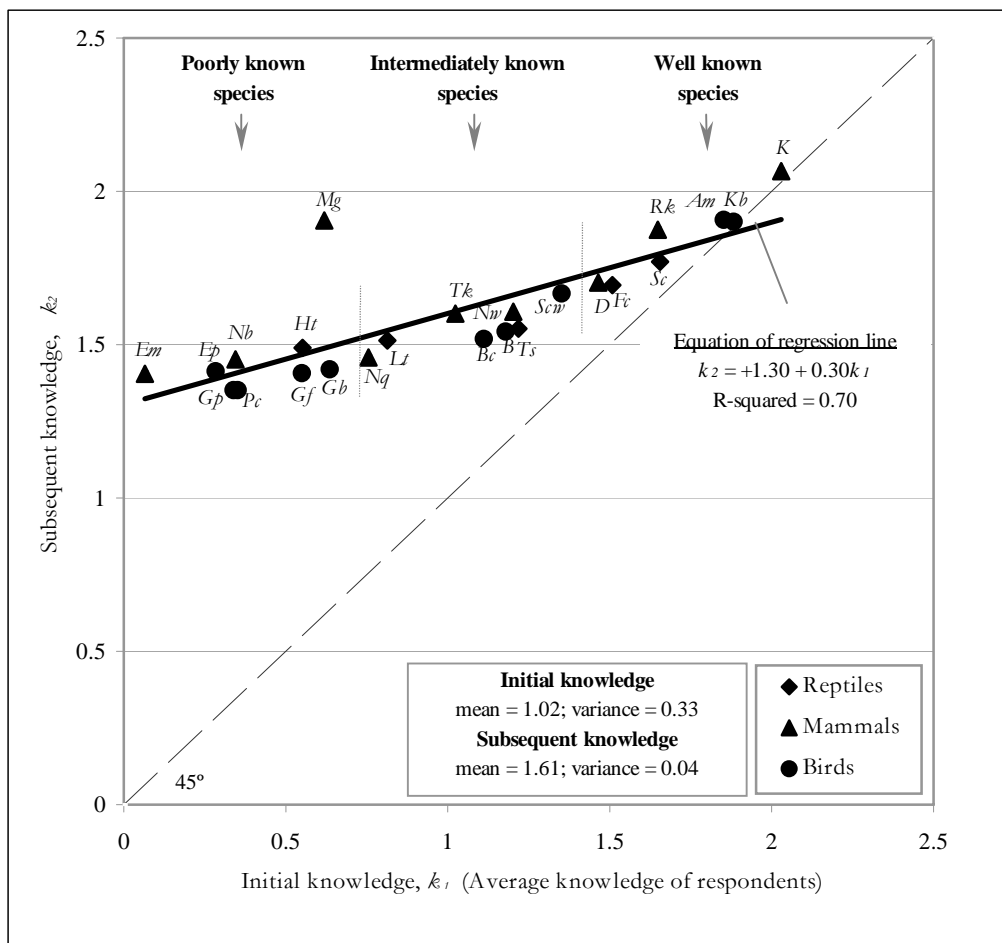


Figure 1: Initial knowledge indices (Survey I) versus subsequent knowledge indices (Survey II) for bird, reptile and mammal species in surveys

The degree of increase in the stated knowledge of the mahogany glider in Survey II stands out noticeably from the other increases. This is primarily a result of the presentation by Dr. Van Dyck mentioned above.

The rise in the average degree of knowledge of the species surveyed and reduction in the degree of uncertainty about them is evident from Table 2. The mean value of the knowledge indicator rises for each of the taxa. The degree of knowledge of the species becomes more even in Survey II than in Survey I as indicated by a substantial fall in the variance of knowledge of them as well as a considerable reduction in all the coefficients of variation.

Table 2:
Mean values of knowledge indices and their dispersion between species

Survey I					Survey II				
Taxa	k_1	σ^2	σ	C.V.	Taxa	k_2	σ^2	σ	C.V.
Reptiles	1.15	0.21	0.46	40.31%	Reptiles	1.60	0.01	0.12	7.63%
Mammals	1.02	0.41	0.64	62.60%	Mammals	1.67	0.05	0.23	13.77%
Birds	0.95	0.37	0.61	64.03%	Birds	1.55	0.04	0.21	13.62%
All the above	1.02	0.33	0.57	56.40%	All the above	1.61	0.04	0.20	12.72%

k = mean of knowledge index
 σ^2 = variance
 σ = standard deviation
C.V. = standard deviation/mean; the coefficient of variation.

4. Stated Degree of Knowledge of the Species Related to the Willingness to Pay for their Conservation

In both Survey I and Survey II, respondents were asked the following question:

“Suppose that you are given AUS\$1,000, but you can only use it to donate funds to support the conservation of the reptiles in Australia listed below. Suppose that a reliable organization were to carry out the conservation work and your money would supplement other funds for this purpose. What percentage of your \$1,000 would you contribute for the conservation of each of the reptiles listed below? Your total should add up to 100%.”

Reptiles	(%)
Saltwater crocodiles	
Freshwater crocodiles	
Hawksbill Sea Turtles (a marine species with a beautiful shell)	
Northern Long-necked (Freshwater) Turtles	
Taipan Snakes	
	100

They were also asked the same type of question in relation to the birds and mammals listed in Table 1. This enables us to consider whether there might be any systematic relationships between the willingness of respondents to pay for the conservation of species and their stated knowledge of these species. In interpreting the results, it is necessary to bear in mind that

factors other than knowledge may influence the respondents' allocation of funds for the conservation of the various species.

The scatter of observations for the average level of initial knowledge of the species and the average allocation of funds for their conservation are graphed in Figures 2-4 for each of the taxa.

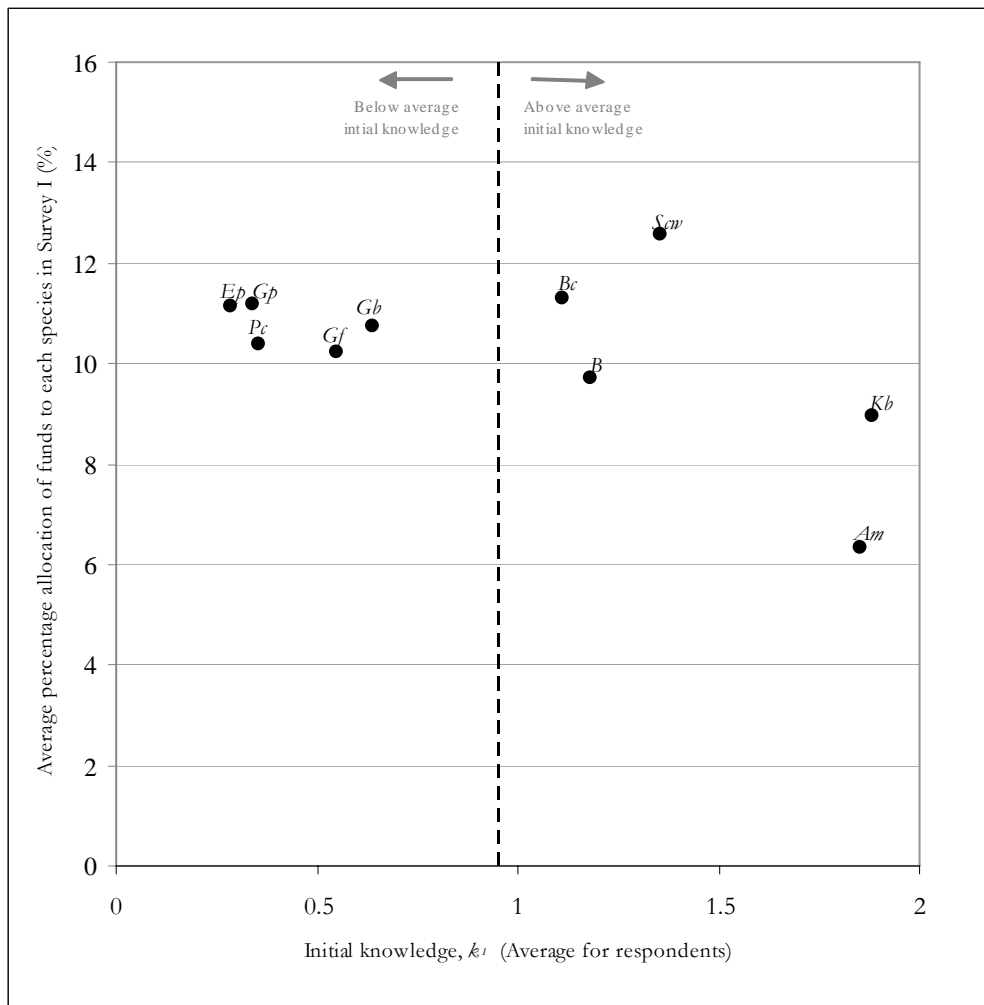


Figure 2: Initial knowledge indices versus percentage allocation of funds to each bird species in Survey I

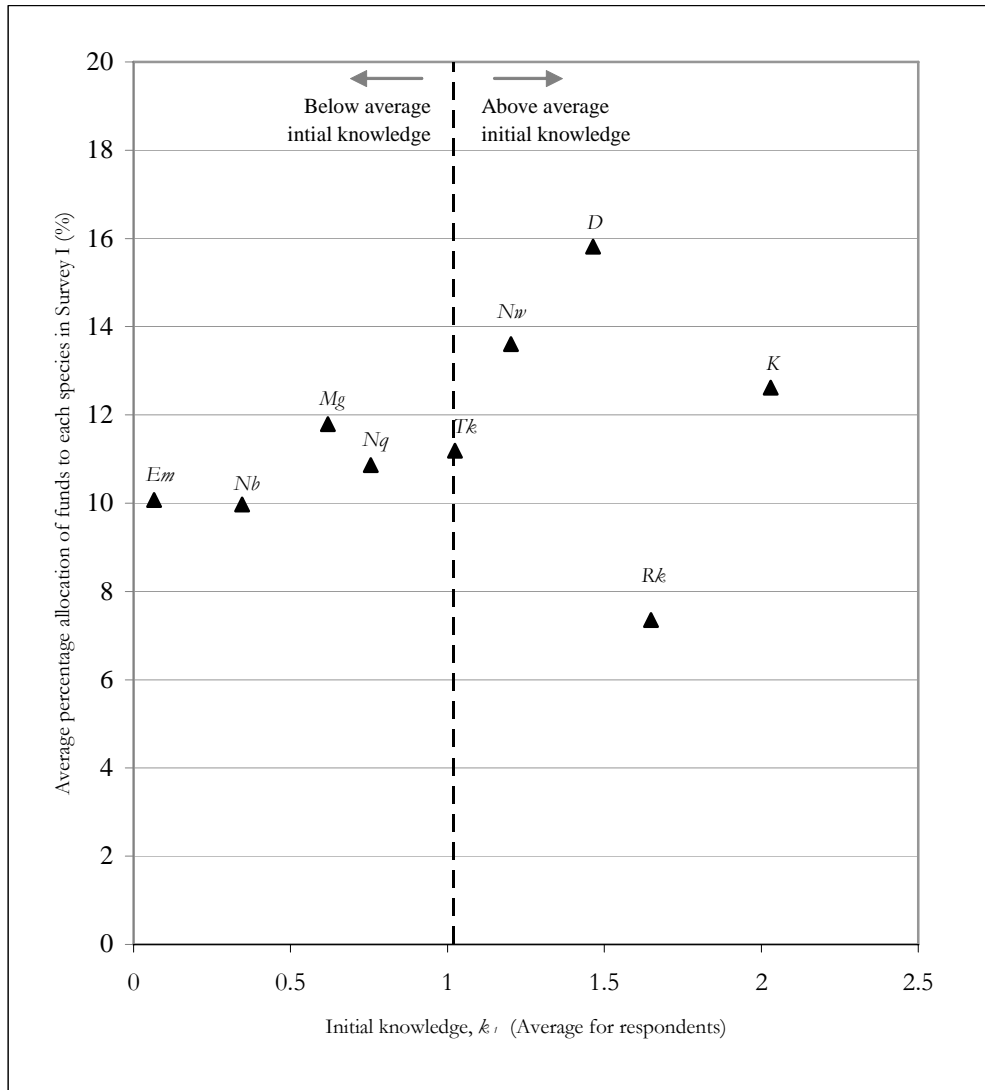


Figure 3: Initial knowledge indices versus percentage allocation of funds to each mammal species in Survey I

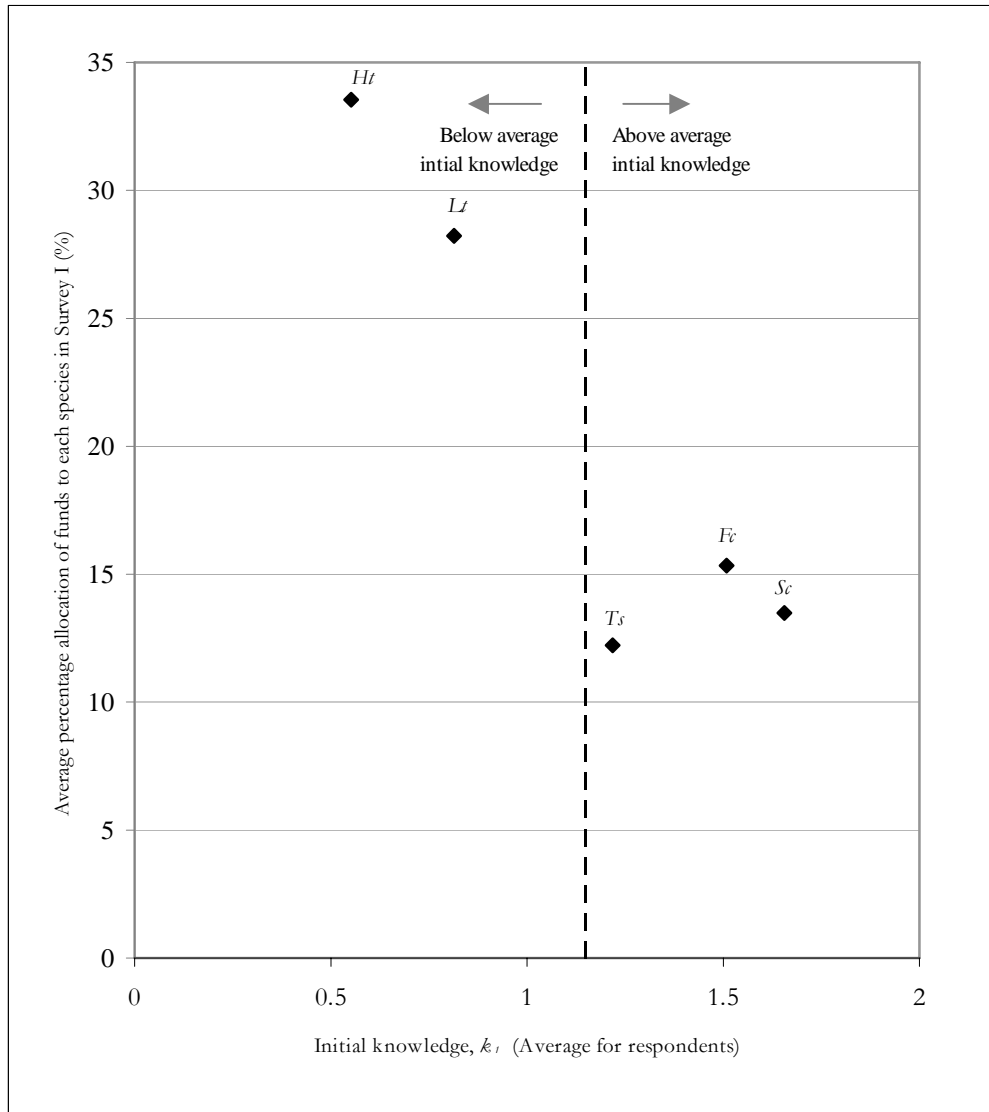


Figure 4: Initial knowledge indices versus percentage allocation of funds to each reptile species in Survey I

In these figures, the vertical broken line divides the set of observations into those which are below the average for the taxa in relation to knowledge of the species and those which are above this average. From Table 3, which provides statistics for observations in each of those sets for each of the taxa, several observations can be made.

Table 3:
Descriptive statistics relating to the scatters in Figures 2-4

% allocation for 'below average' knowledge set					% allocation for 'above average' knowledge set				
Taxa	\bar{y}_1	σ^2	σ	C.V.	Taxa	\bar{y}_2	σ^2	σ	C.V.
Reptiles	30.88	14.15	3.76	12.18%	Reptiles	10.70	1.88	1.37	12.82%
Mammals	10.67	0.71	0.84	7.91%	Mammals	10.40	12.05	3.47	33.39%
Birds	10.75	0.19	0.44	4.07%	Birds	8.47	21.57	4.64	54.82%

\bar{y} = mean percentage allocation

σ^2 = variance

σ = standard deviation

C.V. = standard deviation/mean; the coefficient of variation.

It can be seen that on average the allocation of funds for conservation of the less well known species is greater within each of the taxa than for the better known species. Secondly, the variance and coefficient of variation of stated contributions are much less for the poor knowledge set of birds and of mammals than for the better than average knowledge set.

In the case of reptiles, the situation is slightly different. While the coefficient of variation of contributions is lower for the poor knowledge set of species than for the good knowledge set, the variance shows the opposite relationship. There may be special reasons for this. Snakes and crocodiles may have evoked almost equally negative images in the minds of the respondents. Although the species of turtles were slightly less well known than snakes and crocodiles, turtles appear to evoke a more positive image. This and the small number of species in the set may make it problematic to generalise from the results for the reptile taxa.

Concentrating on the set of birds and set of mammals, consider the reasons why the average allocation of conservation funds to the poorly known species by respondents exceeds that for better known species. It might be because these species are less well known, they are considered to be rare and likely to be more endangered than the better known ones. Therefore, financial support for their survival may be felt to have urgency. This accords with the finding of Fredman (1995) for a group of his respondents that the lower the population of the white-backed woodpecker, the greater the willingness of this group to pay for its survival. Bandara and Tisdell (2004) observed a similar relationship in Sri Lanka for the Asian elephant. An additional factor could be that individuals may be willing to pay more and keep their options open in the case of more poorly known species.

The lower variances and coefficient of variations of contributions to conserve the more poorly known bird and mammal species compared to the better known ones may reflect Laplace's principle of insufficient reason (Laplace, 1951). This principle suggests that when a similar degree of uncertainty exists, probabilities should be treated equal. Because of insufficient reason, there may be a tendency for respondents to treat all poorly known species as equally worthy of support.

It might be also observed from Figures 2 and 3 that in the set of better known species those that achieved the highest allocation of conservation funds are ones widely believed to be endangered in Australia. This is true, for example, of the southern cassowary, the dugong and the northern hairy-nosed wombat. Those with the lowest allocation in this set (the Australian magpie, the kookaburra, and the red kangaroo) are not in danger of extinction in the foreseeable future. It seems that both the perceived utility which individuals expect from the continued existence of the species and the degree of threat to their continuing existence influence the individuals' willingness to pay for the conservation of different wildlife species.

Figure 5 shows, for Survey II, the scatter of respondents' knowledge of species and the average willingness of respondents to allocate funds for their conservation. The spread of knowledge about the species is less than in Survey I and knowledge of all has risen.

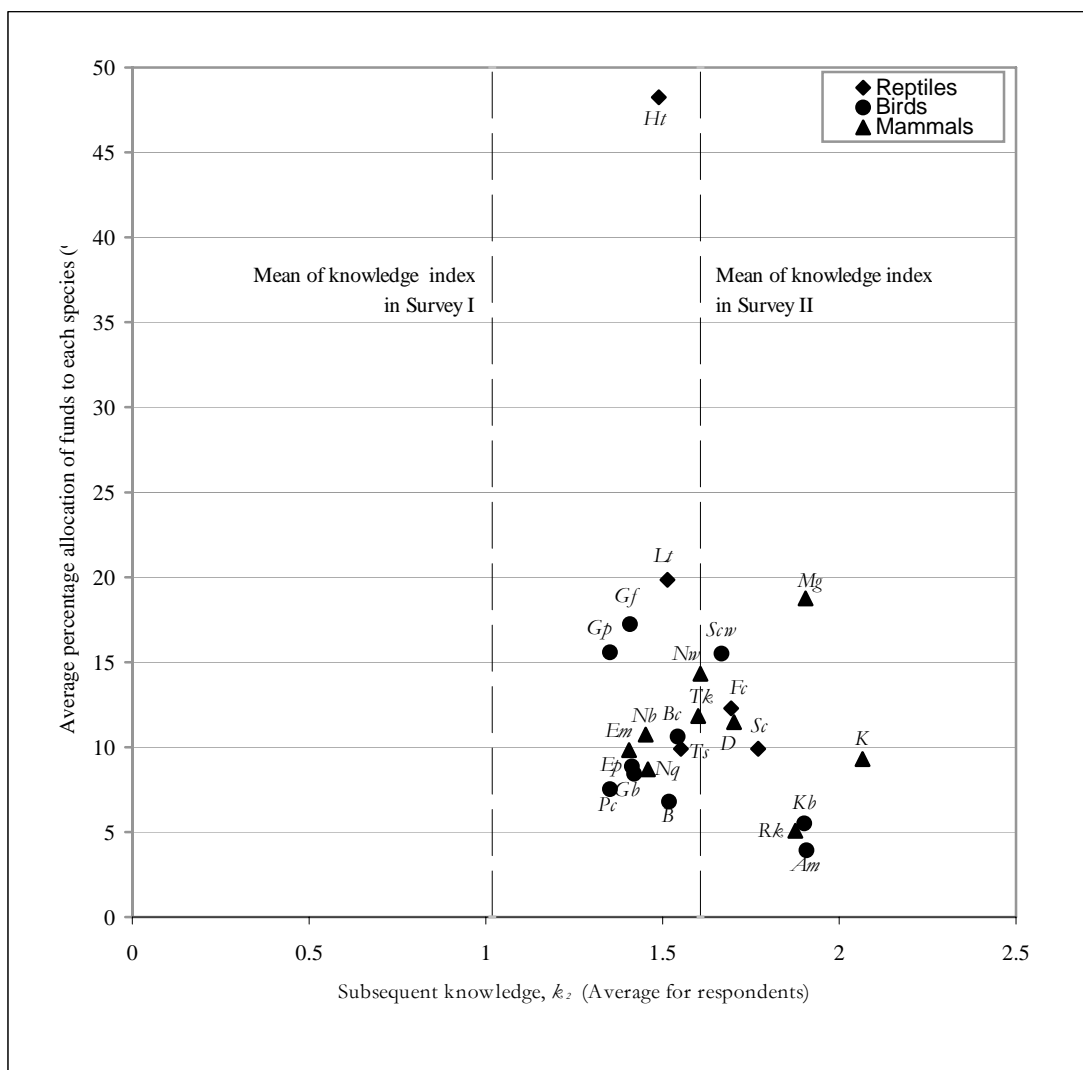


Figure 5: Subsequent knowledge indices (Survey I) versus percentage allocation of funds to each species (Survey II)

Table 4 is useful in interpreting the results. The mean values in this table ought to be 20, 11.11 and 10 percent for reptiles, mammals and birds respectively in both surveys but due to rounding and minor errors, they are slightly higher in Survey I. This does not, however, affect the basic conclusion. The dispersion of willingness to pay for the various species in all of the taxa are substantially higher in Survey II than in Survey I. As a result of increased and more ‘balanced’ knowledge across the board, individuals became more discriminating in their willingness to allocate funds for the conservation of species within each of the taxa.

Table 4:
Statistics of percentage allocation of funds in Survey I and
Survey II for conservation of wildlife species

% allocation (Survey I)					% allocation (Survey II)				
Taxa	\bar{y}_1	σ^2	σ	C.V.	Taxa	\bar{y}_2	σ^2	σ	C.V.
Reptiles	20.56	93.61	9.68	47.05%	Reptiles	20.04	265.26	16.29	81.29%
Mammals	11.48	5.81	2.41	21.01%	Mammals	11.11	14.58	3.82	34.38%
Birds	10.27	2.87	1.69	16.48%	Birds	10.00	21.24	4.61	46.09%

\bar{y} = mean percentage allocation

σ^2 = variance

σ = standard deviation

C.V. = standard deviation/mean; the coefficient of variation.

5. Discussion and Conclusions

The results indicate that the individual's knowledge of a species, the individual's perceptions of the extent to which a species is believed to be endangered, and the degree to which an individual feels empathy with (or derives utility from or likes) a species' existence, influences the individual's willingness to support financially its conservation. Thus WTP does not seem to reflect only individual's total economic valuation of a species. This statement is true even if the amounts that individuals say they are willing to pay for conserving a species are authentic. It seems that in many cases where these types of WTP questions are asked, individuals are not valuing the species as such but the alternative policies proposed for their conservation. For example, the red kangaroo receives a low allocation of funds in both our Survey I and Survey II. This does not mean that the total economic value of the red kangaroo is less than that say of the northern quoll. The red kangaroo is correctly perceived to be much less endangered and much less in need of conservation effort than the northern quoll. If the red kangaroo should become endangered, it is possible that individuals may put an even higher value on action to save it than the northern quoll.

In the light of the above discussion, the type of factors that may be important in influencing individuals' WTP to support conservation of particular species probably includes those listed in Table 5. Utility or economic value is often not an overriding influence on WTP to support conservation schemes for particular wildlife species.

Table 5:
List of factors that may be important in influencing individuals’
willingness to contribute to schemes to conserve particular species of wildlife

Factor	Comment
1. Judgement of respondent about the effectiveness of the scheme	
2. Perceived degree of threat to the species	This influences the perceived urgency of action
3. The ‘likeability’ of the species influences its utility and valuation	This will be influenced by knowledge of the species
4. Ethical considerations	For example, the right of other species to exist
5. Degree of knowledge of the species	Can affect factors 2 and 3 and possibly 1

Note also that species disliked by the individuals still manage to obtain a significant amount of conservation funding. This is so, for example, for the crocodile species and the taipan snake. For many respondents, the decision to allocate funds to such species is an ethical one (compare Kotchen and Reiling, 2000). Many individuals mentioned that all species have an equal right to exist.

It also emerges from this experimental survey that a strong demand exists for saving wildlife species that individuals have little knowledge of or even have no knowledge of. In fact, on average individuals seem prepared to pay more to conserve poorly known species than those they knew better. This suggests that there is a strong public demand to conserve as yet undiscovered species.

Thus our empirical results support the conjecture of Bishop and Welsh (1992, p. 415) that existence values could exist for obscure or previously unknown wildlife species— our experiment indicates that such values do in fact exist.

On the other hand, these experimental results indicate the need to qualify Randall’s (1986, p. 15) statement that “individuals place no value on resources [such as wildlife species] of whose existence or usefulness they are entirely unaware”. Yet in the absence of any knowledge of the existence of species or their possible existence, individuals will not be in a position to take political action to conserve them. Since for many wildlife species non-use values are the major component of their total economic value (Stevens et al. 1991; Fredman and Boman, 1996; Bandara and Tisdell, forthcoming; Tisdell and Wilson, forthcoming b),

they are to a large extent pure public goods and their provision is subject to market failure. Conserving them, as a rule, will require public or collective action. Observe that in the light of the experimental results the potential existence of unknown species is a source of WTP for their conservation.

The experimental results show that variations in knowledge and experience have a substantial impact on individual's WTP for the conservation of wildlife species. Distortions in these components can 'corrupt' valuations of species by individuals, and result in a form of path dependence. While the provision of 'balanced' information to individual's can help to reduce valuation distortions, balance is a matter of judgement and as pointed out by Spash (2002), interactive influences between the evaluator of values and the evaluated can rarely be eliminated. Thus a phenomenon akin to the Heisenberg uncertainty principle in physics may occur (Heisenberg, 1930).

Furthermore, it may be fanciful to believe that by an interactive process of knowledge provision, one can end up with the 'true' preferences of individuals because preferences do not exist in a vacuum but are to a considerable extent learnt and path dependent. Yet several scholars (e.g. Randall, 1986) believe that 'true' preferences do exist and can in principle be discovered. While it seems possible to increase ones' knowledge about the preferences of individuals for environmental goods, some degree of rational scepticism seems called for about the extent to which 'true' preferences of respondents will be revealed, even assuming that respondents are acting in good faith in answering questions about their WTP.

Despite these problems, the fact that many of Australia's tropical wildlife species are rare and endangered, and that some of these species probably have not yet been 'discovered' seems to strengthen arguments for greater nature conservation efforts in Australia's north. At least this seems to be so on the basis of the WTP evidence provided above. These WTP estimates appear to represent primarily non-use values, which may be partly influenced by ethical values. However, WTP estimates may be more a reflection of respondents' valuation of conservation policies or actions rather than an indication of their total valuation of species. Nevertheless, that is still policy relevant.

Apart from the public good considerations, there may be additional reasons to give particular attention to conserving Australia's tropical wildlife species. These relate to their potential

future economic use value for tourism. In the future, it is reasonable to expect that nature-based tourism in northern Australia will expand and the conservation of unique wildlife species in this area would add to future economic gains from such tourism. Future optional use values, in addition to economic non-use values may be important.

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