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* School of Economics, The University of Queensland, St Lucia, 4072, Australia. Email: c.tisdell@economics.uq.edu.au

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For more information write to Professor Clem Tisdell, School of Economics, University of Queensland, Brisbane 4072, Australia. Email
c.tisdell@economics.uq.edu.au

Influence of Knowledge of Wildlife Species on Patterns of Willingness to Pay for their Conservation

Abstract

Examines the influence of respondents' knowledge of wildlife species on their willingness to pay for conservation of the individual species. It does so by using data generated by surveys of 204 individuals who participated in a structured experiment in which their knowledge of a selected set of wildlife species was increased. The species selected were Australian ones, mostly but not entirely, tropical ones. The species were divided into three taxa for the experiment; reptiles, mammals and birds. Each set of species in the taxa included some species expected to be poorly known initially and some anticipated to be well known. Respondents rated their knowledge of each species on a Likert scale, and changes in their average allocation of funds for the conservation of each species were examined as their knowledge increased. Some general relationships are observed.

Keywords: Australia, contingent valuation, environmental education, environmental valuation, knowledge, wildlife conservation.

Influence of Knowledge of Wildlife Species on Patterns of Willingness to Pay for their Conservation

1. Introduction

Knowledge is a core factor influencing individuals' valuations of environmental commodities (Jakobsson and Dragun, 1996, p.86). For example, Randall states that individuals' valuations of biological species depend crucially on their knowledge or information about these species (Randall, 1986, p.86). Boyle (1989, p.57) stresses that "contingent-valuation studies comprise a process of information transfer. A researcher, through a survey instrument, conveys information about the item being valued and respondents, in turn, provide information about the value they place on this item. Considering contingent valuation from this perspective, nearly all of the research evaluating the validity of this valuation method is in a general sense, focused on examining the effects of "information structures on value estimates".

The nature of information available to and provided to respondents and their existing information about environmental goods significantly influences their valuation of these. Samples, Dixon and Gowen (1986), found from their specific experiment that respondent's willingness to pay to conserve a particular species was significantly influenced by information provided about a species, for example, its appearance. They also found that respondents allocated more of their conservation funds to the type of animal that was "endangered but saveable as compared with ubiquitous or extremely rare animals" (Samples et al., 1986, p.341). Thus the willingness to pay for the conservation of a species is not purely determined by its value per se, but also by strategic considerations. For example, if the species is endangered, the likely effectiveness and urgency of any payment to ensure its survival will influence contributions of respondents for its conservation. Willingness to pay is influenced by the perceptions of respondents about such matters and these perceptions in turn depend upon their knowledge and the information provided to respondents. Such strategic considerations imply that willingness to pay estimates do not solely reflect underlying utilities associated with the abundance of the population of a species, as for example, found by Bandara and Tisdell (2003).

As is evident from the literature cited above, the stated willingness to pay (WTP) of individuals for the preservation of species is sensitive to their knowledge about these species.

But we have little knowledge about the general nature of the relationships involved and even whether such systematic relationships exist. This article is a step towards rectifying this deficiency.

It relies on analysis and data obtained experimentally from a sample of respondents about their WTP for the conservation of Australian wildlife species. These are mostly, but not entirely, tropical species and for the purpose of the surveys or experiments these species were divided into three groups or taxa – reptiles, mammals and birds. Information was elicited from respondents for their WTP for the conservation of the listed species, given their initial knowledge. This was Survey I. Then each of the respondents was provided with additional information about each of the species and they were requested again to provide data about their WTP for the conservation of each of the species. Comparison between their WTP values given their initial knowledge and subsequent knowledge forms the basis for identifying general relationships.

In presenting this material, the nature of the experiment is first described. Then the results concerning the respondents' magnitude of knowledge about the species and subsequent changes in those magnitudes are reported. The WTP of respondents for the conservation of the listed species is then related to measures of knowledge about the species and changes in the amount of this knowledge. A general discussion of the results and their relationship to the existing literature follows before concluding.

2. The Experiment and Surveys – Methodology

The results reported and analysed here are based on two surveys of the same sample of 204 respondents from Brisbane, Australia. The sample was drawn from suburbs with differing socio-economic backgrounds and obtained by letter drops in post boxes and other means. While the sample should be fairly representative of the general population in Brisbane, for the current purpose this representativeness is not so important because predictions of population parameters is not the aim.

In effect, an experiment was undertaken in 2002. Respondents were invited in groups of 40-50 to come to a central place, mainly the University of Queensland. They were first asked to complete a questionnaire for Survey I. The coverage of this survey included a question about whether they regarded their knowledge of each of a specified set of Australian wildlife species to be very good, good, poor or non-existent. The specified species are listed in Table 1.

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

The initial typed survey forms took about one hour to complete because respondents were asked several additional questions to those analysed here. The completed forms were then collected and respondents had a break for tea or coffee. Following this break, Dr Steven van Dyk, curator of birds and mammals at the Queensland Museum made a presentation to the respondents. He concentrated on the mahogany glider *Petaurus gracilis* which he had rediscovered. This was an entertaining presentation, and was accompanied by video clips and some stuffed specimens of the mahogany glider.

Respondents were then given a second set of survey forms and asked to take these home together with a booklet that contained a coloured picture of each of the species in the survey plus a short natural history description of each. Each species had about equal coverage. This booklet was prepared by Dr Clevo Wilson using secondary sources.

Respondents were asked to study the booklet and then to complete the forms for Survey II. They were provided with a self-addressed postage paid envelope for this purpose. They were requested to post the completed second survey form within a month. Non-replies were followed up and we succeeded in getting all respondents to complete the second survey form.

The same questions about knowledge of the specified species were asked in Survey II as in Survey I.

In addition, respondents were asked in both surveys how they would allocate $1,000 in percentage terms between each of a set of reptile species for their conservation if this sum was given to them but could only be used for helping conserve the species of reptiles listed in Table 1. The actual question was:-

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 organisation 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	
Fresh Water Crocodiles	
Hawksbill Sea Turtles (a marine species with a beautiful shell)	
Northern Long-necked (Freshwater) Turtles	
Taipan Snakes	
	100

A similar question was posed for the group of mammal species listed in Table I and for the group of bird species listed there. The same sets of choices were presented in Survey I and Survey II.

Using these sets of data, it was possible to consider how the knowledge of respondents of the Australian wildlife species surveyed altered in Survey II compared to Survey I and also how their allocation of $1,000 for conservation altered within the group of reptile species, within the mammal group and between the bird species. This enables one to explore how the changed allocation of the conservation fund might be related to changes in respondents' knowledge of the species.

Let us consider the results. First of all let us examine the variation in knowledge in the surveys and the relationships between knowledge and subsequently the sums allocated by the respondents for the conservation of the species.

3. Change in Knowledge of Respondents About Wildlife Species: Knowledge of Species in Survey I Compared to that for Survey II

While on average respondents' knowledge of all wildlife species increased in Survey II compared to Survey I, the extent of the increase in knowledge was much greater for less well known species than for the better known one; as might be expected. This can be seen by considering a weighted average index of knowledge. Let us assign a weight of 2 for knowledge of a species stated by respondents to be very good or good, 1 for knowledge stated to be poor and zero for non-existent knowledge. Therefore, the analysis relies on respondents' own assessment of their knowledge using a Likert scale. While this approach can be subject to measurement errors and similar limitations, it does provide a basis for commencing some analysis of these previously neglected matters.

Figure 1 provides a scatter of the change in the average index of the respondents' knowledge for each of the wildlife species under consideration compared with the initial average index of respondents' knowledge of each species reported in Survey I. The averages are simple averages of all respondents stated knowledge of the species. It can be seen from Figure 1 that observations closely follow the line

$$\Delta k = k_2 - k_1 = 1.286 - 0.757k_1 \qquad (1)$$

where k_1 represents the index (average) of initial knowledge and k_2 is the index (average) of subsequent knowledge reported in Survey II.

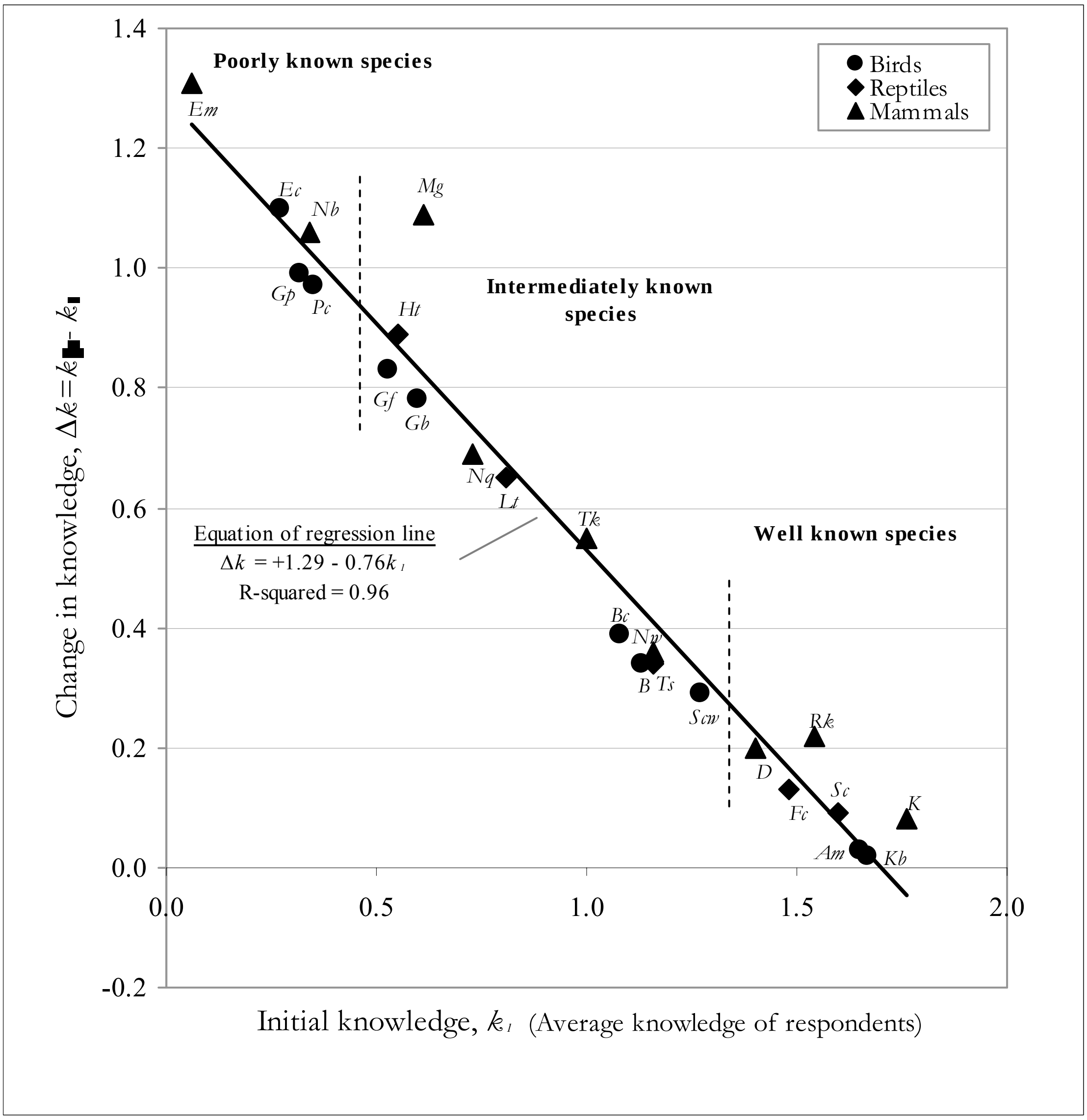

Figure 1: Initial knowledge index versus change in knowledge index for bird, reptile and mammal species in surveys

Despite the closeness of the fit of the line specified in equation (1), there is an outlying observation. The outlier (see Figure 1) occurs for the mahogany glider. Given the focus of Dr Steven van Dyck on the mahogany glider in his presentation, this is not surprising. Respondents obtained more knowledge about this species than others in the set, and that is why this species is an outlier.

As mentioned before, after respondents had completed Survey I, they were presented with a booklet containing approximately an equal amount of similar information about the nature and ecology of each of the listed species. A coloured photograph of each of the wildlife species accompanied its description. Of course, it is a matter of judgement whether an equal amount of information was provided about each of the species, but this was the aim. The available evidence suggests that this objective was achieved on the whole because from Figure 2 it can be seen that at the time of Survey II respondents' disparity of knowledge about the wildlife species was much reduced compared to that when Survey I was conducted.

In Survey I, the mean index (the average for each of the species) of the respondents' knowledge of the listed species was 0.96 with a variance of 0.27. For Survey II, this mean index rose to 1.52 and its variance fell to 0.02. On average, the stated knowledge of respondents of the species was much more even in Survey II than Survey I, and in fact was relatively even in Survey II. However, for reasons already indicated, the mahogany glider is an outlier in Figure 2.

Note that on average, the greatest gain in knowledge was for the species that were relatively poorly known initially. Such a result is in accordance with expectations. While species that were initially well known continued on the whole to be better known than the others even when Survey II was conducted, the knowledge gap between the species was much reduced at the time of the second survey.

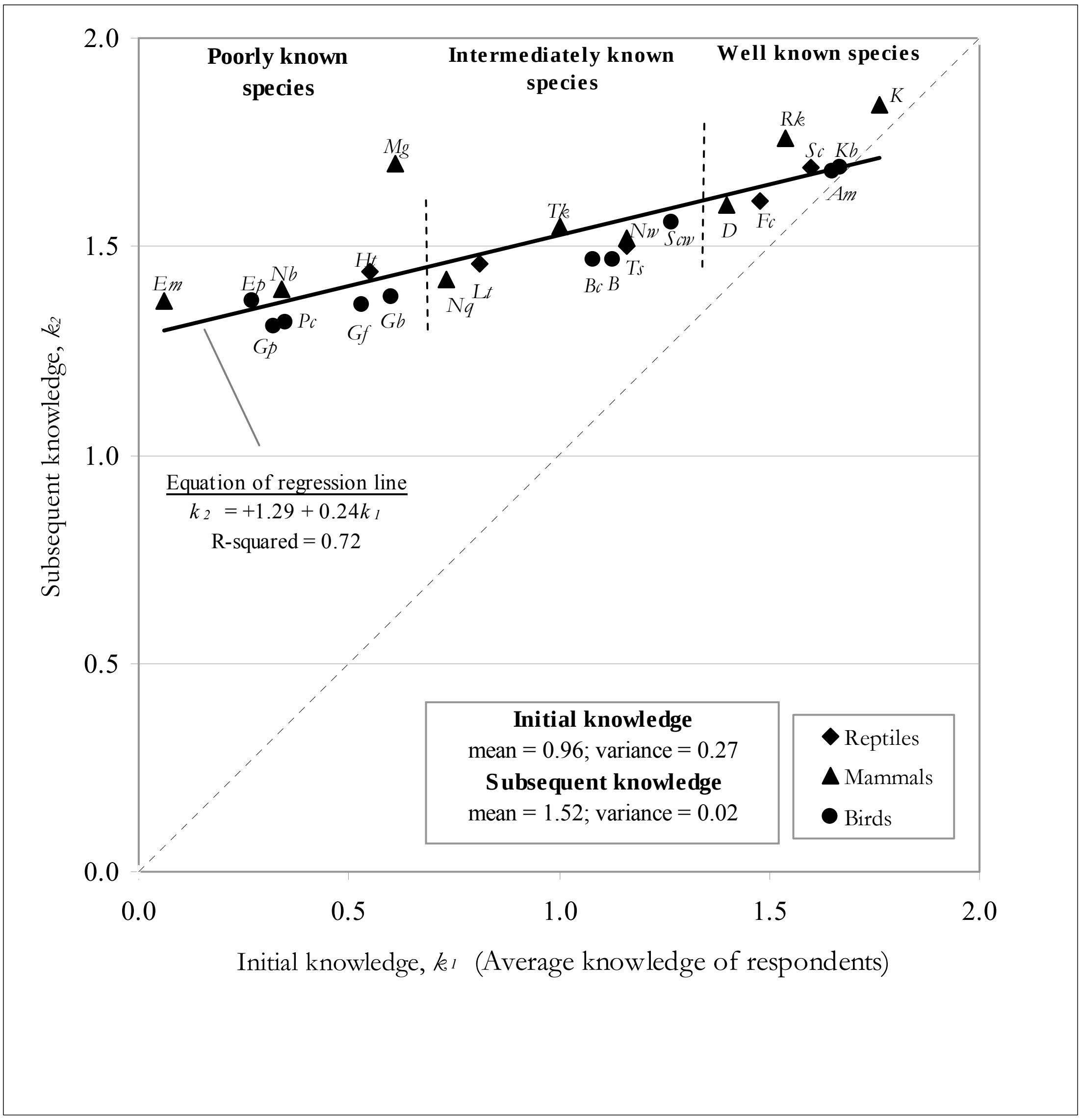

Figure 2: Initial knowledge index versus subsequent knowledge index for bird, reptile and mammal species in surveys

4. Changes in Respondents' Allocations of Funds for Conserving Species as Respondents' Knowledge of These Alters

The above discussion indicates that by the time respondents answered the form for Survey II they had a more balanced knowledge of all the wildlife species in the survey than initially, and their total knowledge of the species had risen. Let us now consider whether any systematic relationships exist between the respondents' stated knowledge of the species and their stated willingness to pay for their conservation.

Figure 3 shows the scatter of the **change** in allocation on average of conservation funds between surveys for each of the wildlife species in relation to the initial knowledge of respondents about the species. It indicates that as respondents' knowledge of the species was increased and became more even across the species the average allocation of funds increased for species that were initially poorly known, whereas the average allocation to the initially well known species fell. The average allocation to the initially poorly known species rose by 3.2 per cent and for the initially well known species declined on average by 2.7 per cent. On average, those species for which initial knowledge was of an intermediate value fell by 1.2 per cent after knowledge enhancement. This suggests the presence of some risk or uncertainty aversion amongst the respondents.

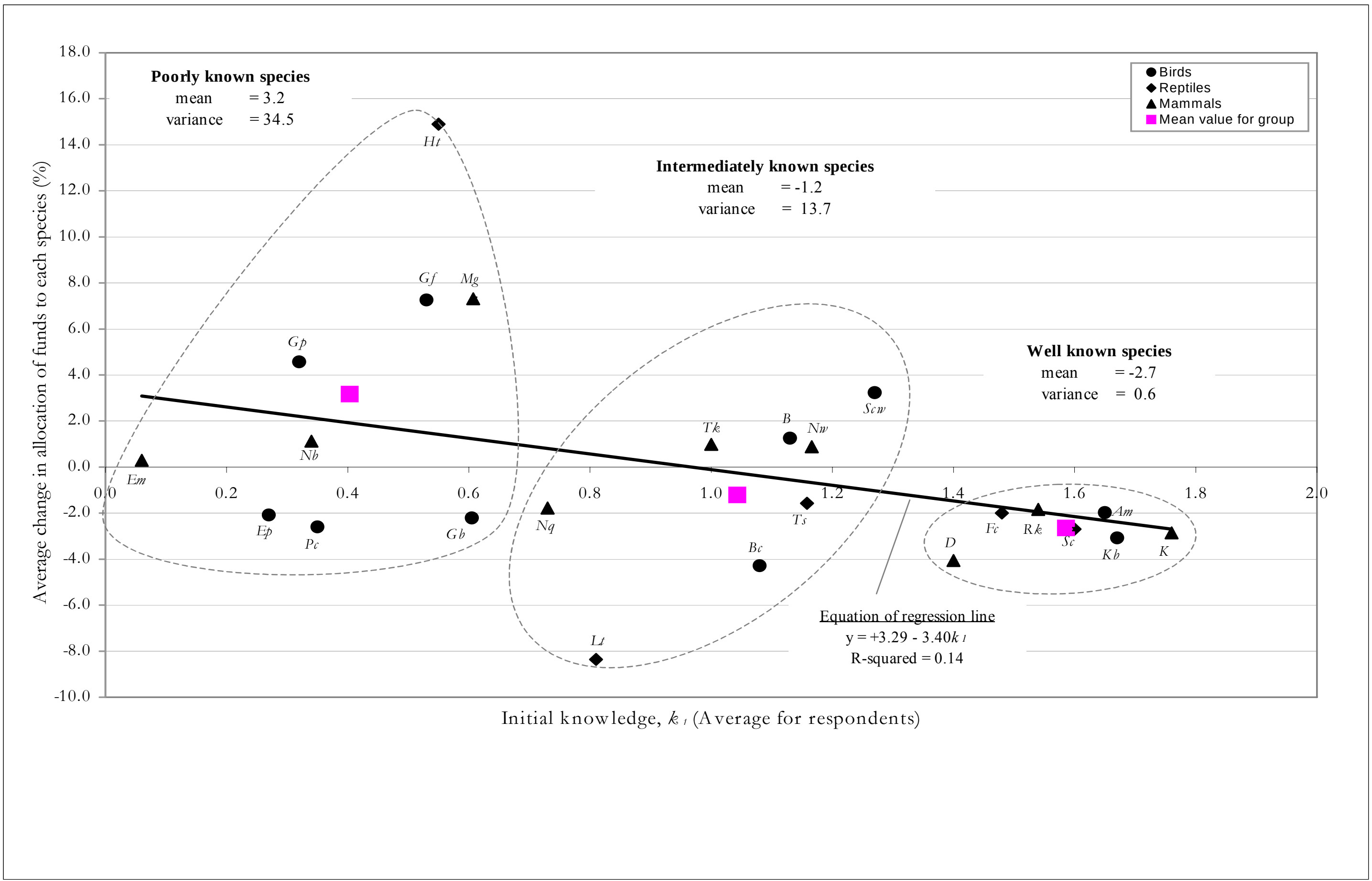

Figure 3: Initial knowledge index versus change in allocation of funds for bird, reptile and mammal species in surveys

With increased knowledge of species across the board, respondents become more discriminating in allocating funds as is apparent from Figure 3. Increased discrimination rose as indicated by greater variation in changes in average allocation of conservation funds. This occurred for well known species as well as for lesser known species. However, both the absolute variation (measured by the variances) and relative variation (as indicated by the coefficients of variation) were much greater for those species that were initially less well known than it was for the better known species.

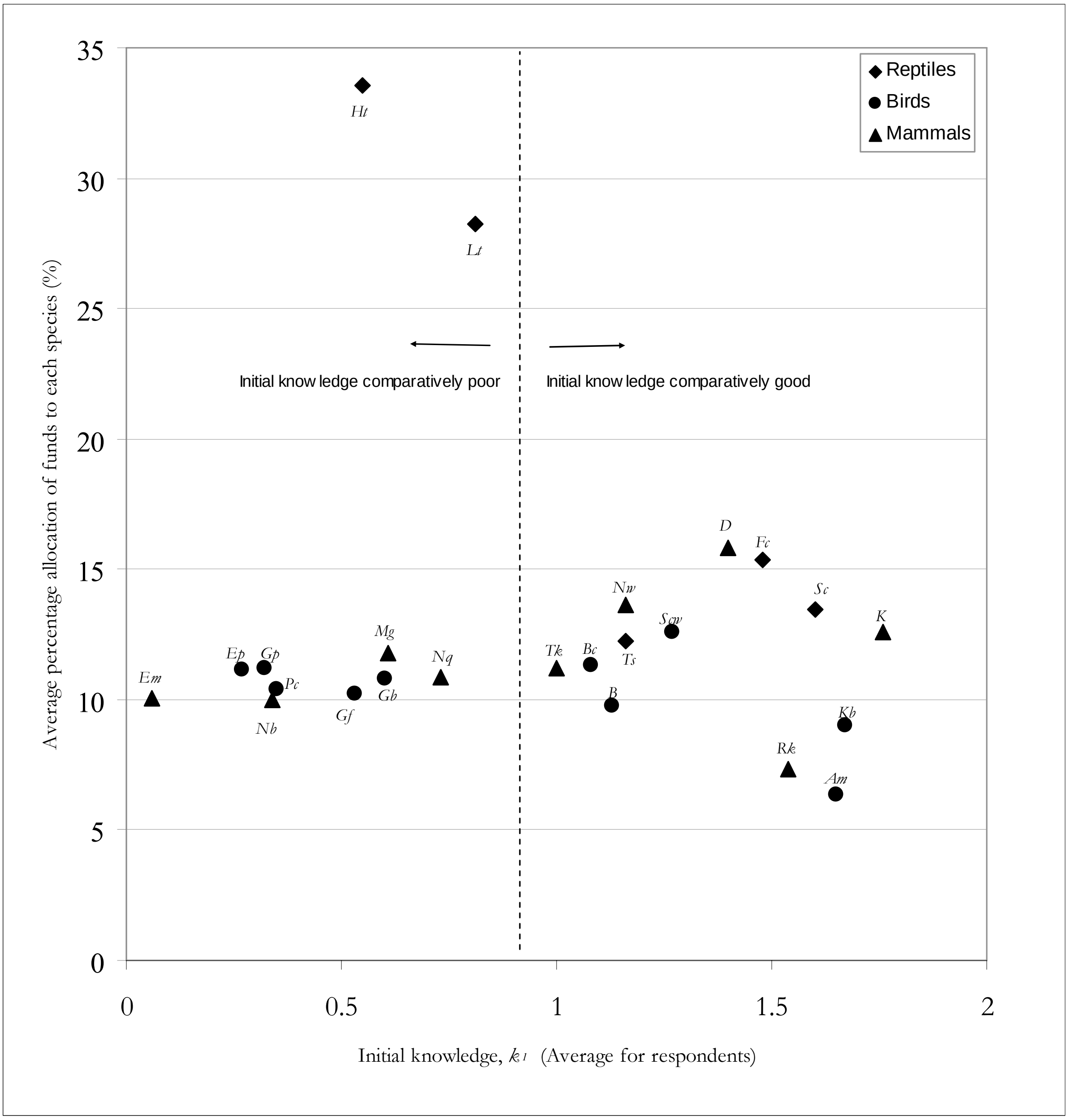

Figure 4: Initial knowledge index versus percentage allocation of funds to each species

This indicates that when species are poorly known, allocation of conservation funds between the species tends to be rather similar but becomes more divergent when species become better known. Individuals are more discriminating in their WTP amongst those species for which they have greater knowledge. This is supported by analysis of the scatter of observations shown in Figure 4. This figure showed the average allocation of conservation funds initially in relation to knowledge of species as reported in Survey I. Although, the suggested relationship may not be immediately obvious to the eye it becomes obvious from consideration of some summary statistics.

Table 2 (corresponding to Figure 4) provides some summary statistics about mean values of WTP for the conservation of species and the variation in these. Observations are divided into the set for which knowledge is considered to be initially poor and another set for which initial knowledge is regarded as good. The boundary of these sets is demarcated by the broken line in Figure 4. Allocations by each of the taxa are identified.

Table 2

Descriptive statistics relating to the scatter in Figure 4

% allocation for 'poor' knowledge set					% allocation for 'good' knowledge set				
Taxa	$\bar{y}$	σ^2	σ	C.V.	Taxa	$\bar{y}$	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 the mean (WTP) allocation per species is higher for species in the poor knowledge set than for those in the good knowledge set, the difference being particularly marked in the case of reptiles. This may be because the better known reptiles are considered dangerous to man but turtles (the lesser known reptiles in this case) are not. The balance overall in WTP for conservation of the species may also reflect the fact that the better known species are more common and may be perceived as not being in immediate danger of extinction. The obverse would also hold; respondents could perceive that the survival of the less well known species is more precarious and that it is, therefore, more urgent to provide them with conservation funding.

It is also apparent from the measures of dispersion in Table 2 that the less well known species tend to be ranked more equally for conservation funding than the better known ones. This seems rational on the basis of Laplaces's principle of insufficient reason (Laplace

1814/1951). This principle implies that when one is very uncertain about the occurrence of different events or outcomes it is appropriate to give them equal weight. The coefficient of variation for the respondents' average allocation of conservation funds to the various wildlife species is slightly lower for the poor knowledge set in the case of reptiles, but markedly lower for the poor knowledge set in the case of birds and mammals than for the set about which respondents on average rated their knowledge as good. This supports the view that WTP for conservation tends to be more equal for less well known species (those about which respondents are relatively uncertain) than for better known ones. Increased knowledge about the wildlife species results in greater discrimination by respondents between species for conservation funding on average.

The latter proposition is also strongly supported by comparing the scatter shown in Figure 5 with the whole scatter shown in Figure 4. The differences in the statistical features of these scatters are apparent from Table 3.

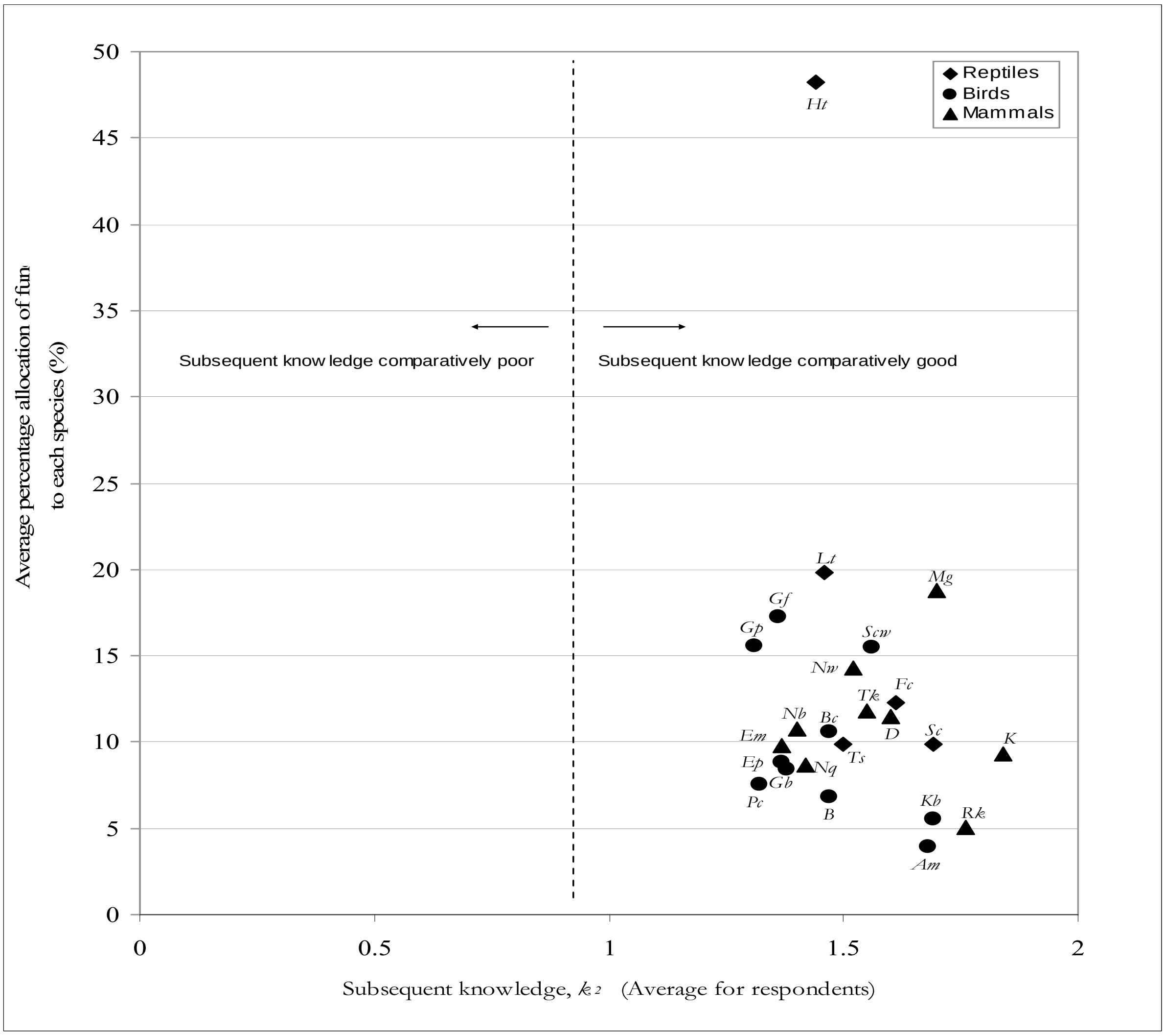

Figure 5: Subsequent knowledge index versus percentage allocation of funds to each species

Table 3

Descriptive statistics relating to the scatters in Figure 4 and 5 respectively

% allocation for whole sets with initial knowledge					**% allocation for whole sets with subsequent knowledge**				
Taxa	$\bar{y}$	σ^2	σ	C.V.	Taxa	$\bar{y}$	σ^2	σ	C.V
Reptiles	20.56	93.61	9.66	47.05%	Reptiles	20.03	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	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.

Comparing Figures 4 with 5, it is seen that at the time Survey II was completed, all respondents thought on average that they had relatively good knowledge of all the wildlife species in the survey. Respondents' knowledge of the wildlife species improved (on average) across the board. The variance of allocation of conservation funds for all taxa (reptiles, mammals and birds) are substantially higher for Survey II than Survey I. So also are the coefficients of variation because the mean allocation (by species) for each of the taxa should be the same for Survey I and Survey II. Theoretically (mathematically) these should be 20 per cent, 11.11 per cent and 10 per cent for reptiles, mammals and birds, respectively. In the initial set, the estimated figures are a little higher due to rounding and similar factors. These small 'errors' do not alter the basic result, namely that as balanced knowledge about species increases, willingness to contribute to their conservation becomes relatively more dispersed. In other words, respondents on average tend to become more discriminating in their allocation of funds for conservation between the various species.

5. Discussion

The fact that individuals have little or even no knowledge of a species does not mean that they are unwilling to pay for its continuing existence. In fact, on average in the experiment reported on here, individuals were prepared to pay more for the conservation of unfamiliar species than for familiar ones. This lends empirical support to the statement by Bishop and Welsh (1992, p.415) that it is "theoretically possible that existence values could exist" for obscure and previously unknown resources [in this case, wildlife species] as well as unique natural assets. In the case of all the 'obscure' species considered in this article, existence value is probably their main economic value. For example, Tisdell and Wilson (forthcoming) found that existence value accounted for more that 80 per cent of the contingent value of Australian tree kangaroos. Furthermore, **some** respondents allocated their conservation funds equally between all species in each of taxa in both surveys and stated that they did this because all species should be treated equally. This adds further support to the contention of Bishop and Welsh that unknown species have economic existence value.

Thus it is necessary to qualify the statement by Randall (1986, p.85) that "individuals place no value on resources of whose existence or usefulness they are entirely unaware". In the case of wildlife species, the experiment reported on here, reveals that it is not so. However, if individuals are entirely unaware of a species, they can do little effective political lobbying or adopt little effective action for its particular preservation.

Randall (1986, p.85) raises also the question of how increasing knowledge about wildlife species might impact upon their comparative valuation. He states: "As information (of varying degrees of reliability) is acquired, valuation may be quite volatile. Eventually, as knowledge becomes more correlated, valuations tend to stabilise and to reflect more accurately the individual's underlying preferences and endowments". While this could be so, it was found in the experiment described here, that valuations become more divergent for species that initially were poorly known as knowledge about the various wildlife species increased. This is not, however, inconsistent with such values eventually stabilising.

It may be that this increase in knowledge as suggested by Randall (1996, p.85) informs respondents and enables them to better express their true preference (Freeman, 1979; Cummings et al. 1986). However, this assumes that true preferences already exist for the resource being considered; in this case various wildlife species. This need not always be the case. In the case of poorly known species, the nature of information provided may help to form preferences rather than be merely informative. Spash (2002) correctly identifies this as a troublesome problem for environmental valuation. It is certainly very difficult to present 'neutral' factual information.

This is supported by the finding of Ajzen et al. (1996) that information bias is extremely difficult to eliminate because provision of information can even involve bias from unintended persuasive communication. They state: “Just as expressed willingness to pay can be considered a measure of attitude or intention (Ajzen and Driver, 1992; Kahneman and Knetsch, 1992), providing information about a public (or private) good can be viewed as persuasive communication likely to change these attitudes and intentions. Even though we may make every effort to produce an accurate and balanced description of the proposed transaction, the information provided will almost inevitably alter the respondents’ beliefs and attitudes.”

Nevertheless, the objective in the experiment reported on here was to provide ‘neutral’ information. While the evidence suggests that the basic aim was achieved, it was impossible in the case of the mahogany glider to control the information provided to respondents by the invited speaker. There was a greater increase in the knowledge imparted about the mahogany glider than other species (see Figures 1 and 2) with a comparatively large increase in the allocation of conservation funds to this species in Survey II (see Figure 3). But apart from informing respondents about the mahogany glider, the excellent and entertaining presentation by Dr Steven van Dyck probably influenced preferences of the respondents along the lines indicated by Ajzen et al. (1996).

While information does influence choices, so do experiences even when the latter are not associated with the provision of information in any concrete way. Processes of conveying information can also create an experience that influences choice. For example, the same information presented in a very entertaining way may be more influential in changing choice than if it is less entertainingly presented. Information provision and experiences both influence choice. Tisdell and Wilson (provisionally accepted) found from a study of data obtained from tourists coming to watch turtles at an Australian sea turtle rookery that those who saw turtles were more likely to be willing to pay for their conservation than those who did not. This adds a complication to valuation studies because valuation is to some extent path dependent. Valuations are influenced by what respondents have had an opportunity to experience.

It is widely accepted that better informed individuals should be able to make better valuations and choices (Jakobsson and Dragun, 1996; Bishop and Welsh, 1992). Nevertheless, a mere increase in the amount of information or knowledge provided to individuals, even when it is accurate, may fail to do this. For instance, in choices between the conservation of individual species within a set of wildlife species, provision of extra information about one but not about others, for example, or extra information focusing on either the negative or positive attributes of a particular species could actually result in worse choices. This is so even though the information is accurate and its provision raises the actual amount of information available to the respondent. The provision of such extra information results in an imbalance in the set of information available to the respondent. What constitutes an imbalance is, however, to some extent subjective.

There is evidence that when individuals are provided with extra information about a particular species of wildlife and interact with it, their support for its conservation or their WTP for its conservation rises (see Fishbin and Manfredo, 1992; Bradley et al., 1999). While that may result in a better choice about conservation of species, it need not. Funding or support for other species that the respondent has less knowledge of or little experience with may fall. With more balanced experience and information of species, a different choice could emerge. For example, the respondent's WTP for conservation of the other species might rise and that for the species previously considered in relative isolation (for information provision and experiences) may decrease. Thus a form bias emerges.

6. Concluding Comments

There is no doubt that economic valuation of environmental goods, including wildlife species, continues to be fraught with difficulties. How to deal with lack of knowledge and experience of some respondents about environmental goods remains a major challenge. This is particularly so because the process of preference formation by individuals is often path dependent (Tisdell, 1996, Ch.3) and socially influenced (Tisdell, 1997). Therefore, as economists, we need to be rationally sceptical in a broader way than commonly acknowledged about the limitations contingent valuation and WTP estimates for environmental goods, including the conservation of species.

Despite such complications some interesting observations have emerged from the results reported here on WTP for the conservation of wildlife species. On average, there appears to be greater WTP for the conservation of little known or poorly known species than better known and possibly more common ones. This may reflect an underlying perception that the former are at greater risk of extinction and therefore, it is more urgent to contribute to their conservation. As information is increased for all the species, it was found that an average WTP for conservation of the more poorly known species increased and declined for the better known. Furthermore, the degree of disparity in WTP for conservation of the different species increased because most respondents became more discriminating between species after more information was supplied. This relative disparity or discrimination increased across the board but it rose most for species that were initially poorly known compared to species that were relatively well known initially. The WTP values of the latter showed greater stability than the former, a result inconsistent with the observation by Randall (1986, p.85) that values of environmental goods tend to stabilise eventually as knowledge increases.

Nevertheless, even though these results are interesting and useful, the question still remains open of how we should decide on the matter of what species to conserve. It is doubtful if Kantian-type considerations can be ignored (Tisdell, 1997) and processes of preference formation need to be an intrinsic part of economic studies of environmental valuation. As Hampicke (1999a, p.135) observes, "It is becoming increasingly obvious that decisions to sacrifice or conserve a species depend on ideas transgressing the realms of economics. Even if a species proves *worthless* on economic grounds, an attempt at its conservation may be warranted upon ethical considerations among others". Furthermore, he remains sceptical of monetary valuation as a basis for valuing biodiversity, not least because the demands or values of future generations are not known (Hampicke, 1999b).

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