# A common bird in your garden is worth two rare ones in the woods: Consumption and altruistic values of local wildlife

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**Work in progress**

Abstract

*In order to investigate how exposure to and interaction with everyday wildlife is valued, we conduct a discrete choice modelling study on garden birds in Norwich, UK. Our results indicate that wildlife living at people's doorsteps substantially contributes to welfare and potentially more so than protection of endangered species in more remote locations. We also test for different motivations to engage in bird feeding and find that direct consumption is the main motivating factor. Concern regarding the birds' but not neighbours' welfare is a smaller but highly significant driver. This is in line with conjectures on the role of nature connectivity in subjective wellbeing and informs the literature on the private provision of impure public goods.*

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## SECTION 1: INTRODUCTION

Engagement with the natural environmental holds the potential to substantially enhance human well-being through visual, therapeutic and interactive channels. Consequently, the value contained within the natural world is possibly vast and multi-faceted. Attempting to capture the worth that people may attribute to 'backyard wildlife' would begin to explore some of these relationship intricacies. This study looks to investigate this through analysing the value people hold for garden birds. Using bird seed, a well understood market good, as an instrument of payment, the study looks to uncover what bird characteristics people enjoy and thus which species invite a greater human value over others.

Discovering if, and if so to what extent, differences exist between the valuations attributed to garden bird species form only one of the major motivations for this research. A challenge of equal significance attempts to gain an understanding not just of whether valuation exists *per se*, but also *why* it might exist and differ, both across species and between individuals. When reviewing the literature on activities which seemingly enhance Subjective Wellbeing (SWB), it becomes clear that engagement with the natural world exhibits many of the qualities which are seen as beneficial to deriving lasting life satisfaction. 'Interconnectedness' is a good example of this, and is an emotion common to many of the supposed SWB enhancing actions such as involvement with religion(Frey & Stutzer (2010)), community (Dutcher et al (2007)) and wider society. Furthermore, the repetition associated with 'everyday wildlife' interactions can potentially induce positive feelings of responsibility (Rappe (2005); Jacobssen et al (2008)), routine (Diener & Biswas-Diener (2008)) and achievement of success under uncertainty (Dolan et al (2008)). The dynamics of these interactions may be of substantial interest for areas such as planning policy. By way of example, the current UK procedure of prioritising Brownfield and urban in-fill planning ahead of that upon Greenfield or rural sites might be contradictory to a population who apparently value 'backyard and everyday' wildlife more heavily than that which is endangered and/or present in habitats further afield. Discovering such worth would complement existing work investigating the values of UK Urban Greenspace (Perino et al, forthcoming),

Exploring our behavioural motivations for interacting with the natural world serves not only to help gauge a better grasp of the potential enhancements 'Nature Connectivity' (Dutcher et al (2007)) might contribute towards our SWB, but also holds the potential to be transcended to other allied research areas. One of the greatest empirical anomalies for behavioural economists is the human desire to contribute to pure or impure public goods. It often defies standard 'rationality' because by contributing to a common cause, individuals are often choosing a strategy which is suboptimal to maximising their private utility. Whilst an intense research field, surprisingly few applications are contained within an environmental setting, although Kotchen (2005; 2009) does provide two fine papers in this area. Feeding garden birds is a classic example of an environmental action which can be decomposed into a privately attained benefit, namely the enjoyment from feeding and viewing birds, and a public goods externality, pertaining either towards raised bird populations which it affords the neighbourhood or through inter-species altruism. By including attributes of nutrition, existence value and donation opportunities, we look to separate these various influences and thus investigate the underlying reasoning by which people feed the birds. Furthermore, by studying this action, we may begin to understand how the private and public aspects of utility derivation interact. In this case, whilst we may enjoy aiding the provision of a

public good through feeding birds, there remains a need to retain some of the privately acquired benefits from doing so, such as the birds coming to our particular garden. The notion of 'Nature Connectivity' described above, and the way by which we extract utility from such engagement, may well be inherent to this.

Over the past two decades, the use of Stated Preference techniques to uncover environmental valuation has evolved into a robust and well-defined literature. Whilst already widely established in research fields such as transport and communication (Louviere & Woodworth (1983)); Louviere (1988), Louviere (1992)), the application of Discrete Choice Modelling (DCM) to environmental cases is relatively recent. Hanley et al (1998a) provide one of the earliest and most comprehensive contributions, illustrating how the use of choice experimentation is able to provide a potentially insightful alternative to Contingent Valuation. In light of the Exxon Valdez Oil Spill (1989), the latter method received intense scrutiny (Diamond & Hausman (1994)), and Adamowicz's paper on the valuation of Canadian rivers outlines how this allied Stated Preference method might look to counteract some of the deficiencies affiliated with Contingent Valuation (Adamowicz et al (1994)). Later studies have echoed this emphasis, with works demonstrating how using a DCM format might help combat potential disadvantages of 'yea-saying' (Buzby et al (1996)), ethical protesting (Hanley et al (2001)) and other "internal inconsistencies" (Jacobssen et al (2008), p.258), such as embedding.

In the field of wildlife valuation, a range of both Revealed and Stated Preference techniques are used to determine people's assessments of different species. Examples include the estimated worth of US mega-fauna (Loomis & White (1996)), the role of flagship or keystone species in Africa (Navrud & Mungatana (1994)); (Morse-Jones et al (2012)), Asia (Kontoleon & Swanson (2003)) and Europe (White et al (1997)) and the importance of familiarity in establishing valuation for species (Jacobsen et al (2008)); (Christie et al (2006)).

Whilst wildlife studies show that the DCM format is able to extract a person's worth for individual or groups of species, they share a common obstacle in order to calculate such value. A quintessential component in extracting monetary quantifications from choice experimentation is to include an adequate payment vehicle through which people are able to balance the financial cost of an option against the supposed benefits it would derive. Akin to many environmental entities, wildlife cannot be presented as a marketed good and thus it becomes difficult to convey a payment mechanism which maintains realism to respondents whilst they undertake the choice exercise. The majority of studies, including those aforementioned, overcome this barrier by informing respondents that the 'cost' element will be charged through the form of either a charitable donation or, more often, through a wildlife taxation mechanism.

Two potential drawbacks immediately spring from this restriction the research field finds itself bound by. The first issue involves the constraints that are placed on the types of wildlife that can be credibly afforded valuation through a taxation or donation system. If researchers are informing respondents that a levy or donation is required, there is naturally an obligation to justify this necessity. Consequently, wildlife valuation studies to date generally concentrate upon species which are perceived to require conservation or preservation, be it on local, regional, national or international scales. In the former cases, researchers may be required to explain the population status of the wildlife under investigation to reassure participants of the necessity for this action,

whilst in the latter cases the species are often already widely acknowledged as endangered and thus in need of aid.

Secondly, taxation has a strong potential to act as either an evocative or impotent stimuli to respondents. For some individuals, the mandatory nature of taxation causes them to disassociate themselves from the research topic (Rosen & Small (1979)), whilst for others the complexity of the taxation system means they fail to appropriately configure the budgetary implications of these costs in their responses.

Whilst the adoption of choice modelling to species valuation has been relatively intense over the past decade, the consequences of such constraints are that large swathes of species are devoid of valuation through an inability to convey an appropriate and credible payment mechanism. By constructing a discrete choice experiment which instruments costs through the purchase of seed in order to attract wild birds to people's gardens, we believe that this paper exploits a unique opportunity to counteract this deficiency, and is able to use an intuitive and consumerist payment vehicle to invite valuation for 'everyday wildlife'.

The flexibility contained within the choice modelling technique is mutually beneficial for both the researchers and participants alike. On our part, we are able to test our multiple research questions simultaneously, using attributes corresponding to motivations of pure altruism, philanthropy and self-interest in conjunction with species diversity. For respondents, the repetitive nature of choice experimentation assures them of multiple opportunities to display more accurately their true preferences. This means that, compared with a 'one-shot' valuation study, any ethical or moral obligations are considerably mitigated against.

There are a variety of possible benefits in conducting research of this nature. At a topic-specific level, delving into the dynamics of valuation for 'everyday wildlife' such as garden birds may yield a wealth of information for a range of affiliated parties. These include conservationists, seed manufacturers and urban planning authorities. Because the additional facets of nutrition, existence valuation and species abundance are all contained within one choice model, each of these stakeholders might wish to utilise such data to tailor their efforts and resources so as to maximise societal well-being. More generally, this paper combines environmental valuation with behavioural economics and psychology and we hope that, by adopting an inter-disciplinary approach, this may invite further developments both within and between these fields. To this end, this study begins to investigate some of the existing gaps in the literature regarding both the dynamics of and motivations behind human interaction with the natural environment. The circumstances by which we do or do not engage with nature, alongside the social and psychological benefits of such activity, are conundrums whose findings would be both intriguing and inviting for future research.

The remainder of the paper is as follows. Section 2 concentrates on the methodology, outlining how the experiment was designed, its structure and how the selection of its constituting attributes correlate to the aims of the study. Section 3 presents the results and explores socio-demographic variation within these findings. Section 4 discusses these findings, and relays this to the initial motivations for conducting this research paper. Section 5 concludes and gives some recommendations for future research and continuations within this field.

## SECTION 2: METHODOLOGY

*Designing the Survey*

The survey itself contained three main sections; the DCM exercise, an ornithological quiz, testing each individual's avian knowledge, and finally a standard questionnaire, gauging information regarding both attitudes towards bird-feeding, alongside information on socio-demographic characteristics.

1. The Choice Experiment

With origins rooted in Lancaster's Characteristics Approach (Lancaster (1966)), discrete choice experiments require any researcher to identify the salient components, or attributes, of a particular product and present these as a compartmentalised demonstration of the overall good itself. Furthermore, each attribute should be presentable across a range of clear and distinct levels. Subsequently, any 'product', or alternative, which a respondent sees contains a bundle of these attributes, each shown at one of their various levels.

The trade-off each choice modeller faces is to present a range of options which are judged as plausible to the sampled population, whilst inviting trade-offs which can provide statistically meaningful outcomes. The retention of orthogonality within a choice set is an essential example of such diligence. Orthogonality ensures that no two attributes are collinear, and thus econometrically it is possible to disentangle the reasoning upon which participants' responses are based. Each of the survey's components are presented in the subsequent paragraphs

*The Bird Species*

A crucial aspect of this DCM was to ensure that an appropriate number and variety of bird types were included. This required balancing the benefits of dataset richness which could be obtained by encompassing a greater volume of species against the costs of cognitive burden that respondents would then be subjected to.

Six differing types of bird were deemed optimal to satisfy the trade-off and the RSPB's Big Garden Bird Watch (BGBW) Survey results were used to select the particular species. The survey, which is the largest publicly-participated wildlife data collection scheme in the UK, invites British citizens to record both the diversity and frequency of bird types witnessed in their gardens for one hour of a pre-determined date in January. Because geographical species mapping is one of the key objectives of the project, Norfolk data could be isolated from the main database for examination. Figure 1 displays those birds selected using this county-specific data from 2012:


Figure 1: The Bird Species

"Rank" relates to the frequency estimations as calculated by the BGBW data collection, and Figure 1 confirms that five of these species ranked among the most common Norfolk garden birds in 2012. The hope is that a respondent who engaged in bird-feeding activities stood a good chance of recognising these birds as visitors to their own garden. By contrast, the Bullfinch ranked a lowly 32$^{nd}$. This disparity was deliberately designed to see if aspects of rarity invoked any greater stimuli for valuation, as has been supposed by other Stated Preference studies (Hanley et al (1998b)).

A further dimension looked to identify whether aestheticism, another previously supposed indicator for valuation enhancement, played any significant role in the derivation of worth (Metrik & Weitzman (1994)). The three birds on the right-hand side of Figure 1 possess a greater degree of vibrancy in their plumage, which we proxy to insinuate that they present a more aesthetically pleasing option. Furthermore, the Woodpigeon is widely perceived as a pest species among gardening and agricultural communities, and it seemed worthwhile to include this 'undesirable' bird.

Endorsing both the specifics of this investigation and recommendations from the literature (Kontoleon & Swanson (2003));(Bateman et al (2009)), the display of alternatives through the medium of imagery invited many potential advantages. Using diagrams gave each choice set a more realistic ambience, allowing participants to visualise each bundle in their home location. Furthermore, imagery did not exclude or restrict participants whose lesser knowledge would otherwise have inhibited their ability to express well-informed preferences. Overall, an image-based design was therefore seen to broaden the experiment's accessibility.

Great consideration was also taken when regarding the possible levels that each of the species attribute would take. The instructions' exact interpretive wording is contained within Appendix B, and Table 1 describes the three imposed levels below:

| Rating | Description |
|---|---|
| | This species will not come to your garden |
|  | Expect **1** bird of this species to come to your garden |
|  | Expect an average of between **2 and 5** birds of this species to come to your garden |

Table 1: Bird Species levels

These frequencies complied with those displayed within the BGBW dataset. Another ornithological consideration was to ensure that choices only showed birds at the attribute levels which were concurrent with their social behaviour. For instance, Robins are highly territorial and therefore constructing a choice set which included more than a single entity contradicted this element of their behaviour.

Another facet which the survey looked to uncover was whether existence values occurred at a localised level. To do this, individuals were informed that sometimes birds may be fed but not seen. This naturally deprives them of the personal visual benefits they obtain from bird-feeding, which may constitute a sizeable proportion of their private incentives for engaging in such activities. However, this description also conveys that the birds would still benefit from their action. Furthermore, feeding these birds still meant that other parties, such as neighbours, could still potentially benefit from the increased bird populations drawn to the vicinity. Thus, this element disentangles the extent to which people would contribute to bird-feeding as an Impure Public Good - expressing value for their aiding of the wildlife and/or wider community even if this derives them little or no private utility enhancement.

Instructions relayed that the presence of a 'faded' bird would indicate to this "feed but not see" situation. Figure 2 was used to reinforce this message and highlight the disparity between a bird in full and faded plumage:

Figure 2: Instructions regarding local existence value

We restricted the number of birds investigated under localised existence value to just two; Woodpigeon and Bullfinch. These displayed starkly different characteristics, the former a common, pest and plain species whilst the latter possessed *a priori* positive qualities of colour and rarity.

*Nutrition*

To explore the dynamics of human engagement with nature, the construction of an attribute which pertained to altruistic behaviour seemed logical. Classic economic literature on altruism identifies a range of plausible motivations for such action, including reciprocity (Sugden (1982)), moral satisfaction (Kahnemann & Knetch (1992)) and warm glow (Andreoni (1989); Andreoni (1990)). However, the extent to which we can identify an act a 'purely altruistic' ((Hardin (1977)) is, psychologically, indeterminable. This is because even if the intention of our action is to aid another, there is no guarantee that, even inadvertently, we do not assume increments to our own utility as a consequence. The psychological debate regarding the extent to which pure altruism exists does not form part of this paper's focus, yet it is always an important consideration to remember whenever the term 'altruism' is phrased.

For us, the more poignant focus was to discover whether respondents were happy to expend their finances on an aspect of the seed where the primary beneficiary would not be themselves. The solution was to include a 'nutritional star rating' for each option, ranging from basic nutrition (one star) up to very nutritious (three star) levels. Considering the econometric implications of this attribute helps identify its assimilation with altruism. A positive coefficient implies, *ceteris paribus*, a willingness to purchase a more nutritious seed without witnessing a greater volume of birdlife itself. In other words, the private gains of feeding and seeing the birds remain unchanged, but the cost increment is driven by the desire of people to aid the bird's well-being.

It is noteworthy to explain how this nutritional element differs from the 'faded birds' characterised by those shown in Figure 2. With the latter, it is impossible to identify who the respondent perceives the beneficiary to be (birds or neighbours), yet in the former case the predominant recipient must be the wildlife.

*Price and Donations*

Including a cost attribute is an essential facet of any Stated Preference study, enabling respondents to contextualise the subject amidst their budgetary obligations whilst at the same time granting the researcher the opportunity to convert econometric findings into numerical evaluations. Exceptional to other studies in the field, this DCM is spared the task of formulating a taxation or donation instrument and can instead simply express this cost as the market price that must be paid in order to acquire that bird-seed.

To ensure the task remained realistic, some basic research was undertaken to establish current market prices. The study did not want to convey that any alternative aimed to attract a particular species of bird and so any types of seed currently on the market which portrayed these 'specialisation' characteristics were omitted from the scoping task. After accounting for these refinements, the prices ranged from £0.99 to £4.49 and were issued in £0.50 increments.

The final characteristic was the donation. Respondents were informed that sometimes the price of the bird-seed included a contribution to a wildlife charity which would seek to restore wetland habitats in East Anglia. The endeavour of such work would be hoping to raise the population of the Bittern. This species was chosen due to its regional recognition as a flagship

species for conservation and tourism. Furthermore, individuals were informed that the Bittern was a rare and elusive species, a reminder that the contribution to this charity would be unlikely to reward them with any greater chance of actually *seeing* Bitterns in future years.

This attribute looked to gauge whether respondents possessed a more stereotypical existence value. Furthermore, the opportunity to compare and contrast this form of non-use value with that of the localised one could prove potentially insightful regarding the priorities people held for wildlife. This served as another reminder of the study's policy implications regarding urban and rural planning laws.

2. The Ornithological Quiz

This section tested respondents' knowledge of garden birds. It was a short exercise whereby the six species in Figure 1 were labelled A-F. From a list of 16 possible options, participants were asked to try and match these letters to the correct names. Appendix C contains this list. Whilst asking respondents to actually write down the birds' names held the potential to overcome any confounding issues of blindly guessing, it was felt that framing the exercise in this way would unnecessarily extend the completion time for participants and also avoided any ambiguity that arose from spelling or illegibility of responses.

The purpose of the identification quiz was to try and identify whether any link arose between knowledge and valuation. Previous studies (Metrick & Weitzman (1994)) have assumed that knowledge is a key determinant of value, but regarding 'everyday wildlife' this assertion remains questionable.

3. Socio-demographic and Attitudinal Questionnaire

The final section comprised a standard tick-box survey to discover people's stated habits regarding bird-feeding and confirm their socio-demographic status. A copy of this is contained within Appendix D. The former section enquired over the type and regularity of feeding individuals undertook, alongside whether they contributed to environmental charities. Furthermore, it looked to uncover their motivational foundations for feeding birds by asking them to rate on a Likert scale a range of plausible reasons for engaging in the act. Socio-demographic questioning simply established each respondent's gender, age and post-tax household income. Individuals were instructed that this data would remain both anonymous and compliant with data protection laws.

The questionnaire's main objectives were to confirm the extent to which the sample delivered population representation, and to analyse whether aspects such as feeding regularity, philanthropy and motivational differences played any significant role in deriving valuation.

*The Econometric Infrastructure*

The associated econometric procedure generally tends to simulate DCM data through a Multinomial Logit (MNL) function. Such models apply a Gumbel distribution to the random element of people's utility, which, when used as an additive element to the utility function, is deemed appropriate (McFadden (1974); Louviere et al (2000); (Hoyos (2010)). Compliant with the DCM format, each attribute's corresponding coefficient represents the projected probability change for a

participant's selection of an alternative if, *ceteris paribus*, there is a unit change in that attribute's level (Bennet & Blamey (2001)). The formulae demonstrating this calculation is shown below:

$$Prob\ (i) = \frac{exp^{\mu V_i}}{\sum j exp^{\mu V_j}} \qquad (1)$$

It is natural to presume that, under the belief the environmental entity acts as an ordinary good, that the coefficient of any price attribute should be negative. This means that, all things held equal, a rise in a particular bundle's price should induce a fall in the probability that bundle is then chosen. This therefore means that the coefficient on price ($\beta_{price}$) represents the marginal utility of income and is assumed to remain constant (Hanley et al (1998a)). The derivation of any attribute's marginal valuation, shown by Equation (2), can then be generated by taking the ratio of its coefficient in relation to that of price (Hoyos (2010)).

$$WTP_x = \frac{-\beta_x}{\beta_{price}} \qquad (2)$$

Given that individuals were essentially asked to rank the three alternatives in each choice set, the information which is gleaned from participants can either be inspected through Conditional Logistic regression analysis. This takes into consideration that each individual is making a multiple decisions and therefore accounts for patterns in decisions established per participant.

Before conducting the survey, data was simulated using a utility function which complied with *a priori* intuitions over attributes. The intention of this action was to confirm that sensible coefficients were derived from the design, and that no statistical anomalies, such as collinearity, were contained within the model once it had undergone logistical regression.

*Conduct and Execution of the Survey*

The survey presented respondents with 16 choice sets. The optimal number of cases to give participants is a widely debated discussion within the field, with considerable heterogeneity existing in this domain (Swait & Adamowicz (1997); Adamowicz et al (1998)); (Scheufele & Bennett (2012)). However, given the familiarity with both the topic and its presentation as a consumerist product, the number of choices seemed to align with assimilated works.

Each choice set (an example of which is provided in Appendix E) presented two bird food alternatives, alongside a constant baseline to not feed. Presenting a three-alternative set is believed to improve the robustness of a model (Bennett & Rolfe (2009)), and of these three options, respondents were asked to mark their most preferred option with a "1" and their second most preferred with a "2". Subsequently, we obtained a complete preference structure for each and every choice set any individual answered. A description of the baseline was given at the instructions stage, and a copy was available on the respondents' desk for them to review if necessary. Whilst answer sheets were paper-based, the instructions and survey were presented on computer screens, with a researcher reading these instructions and a tutorial aloud to overcome any issues of illiteracy or ambiguity. A laminated copy of the tutorial was also available for respondents to return to if required. Participants seldom referred to either this Key or the baseline aid, inferring task comprehension was good.

Surveys were conducted at a Norwich garden centre in mid-July. By locating here, it was reasonable to assume the sample base would hold an interest in garden-related issues and therefore were better positioned to partake in the experiment. In light of this, consideration was made that subsequent valuations might be inflationary through sample selection biases. However, a public and thus non-obligatory environment was chosen to ensure proposed candidates could decline more easily if desired.

## SECTION 3: RESULTS

Face-to–face surveys at a Norwich Garden Centre provided 200 completed questionnaires to be used for statistical analyses. By surveying respondents in-person, the study did not restrict the sample to those with computer literacy. Furthermore, this method also enabled participants to verbally engage with the researcher regarding the topic, potentially providing the authors with complementary qualitative data to accompany that which had been established for quantitative manipulation. Generally, the response rate was good (approximately 50%) and reasons for decline consisted of time constraints as opposed to miscomprehension or disengagement with the subject. Whilst uptake was roughly consistent across genders, in total 119 (59.5%) of respondents were female.

Table 2 decomposes the age profile of participants, and contrasts this against that of the Norfolk population, derived from 2011 Census data (www.norfolkinsight.org.uk). We see a significant difference between these two groups ($\chi^2$ = 95.6597, $p(z)$ = 0.000). This is predominantly derived from a slight underrepresentation of those belonging to lower age brackets (in particular those aged 26-45) and over abundance of respondents aged 56 and over (more than 60%). Whilst acknowledging this difference, its impact regarding the legitimacy of our findings are potentially lessened when we consider the population we wished to survey. To aid the retention of realism, the research hoped to survey those who were responsible for a garden area and were financially responsible for such household budgeting. This means that students or those who were still financially dependent in the home were suboptimal candidates for the purposes of the survey. These groups tend to belong to age categories underrepresented in our sample. To this end, we were satisfied that the age profile of the sample would not inhibit the transferability of our results to a wider (albeit adjusted) population.

| Age Bracket | Sample Population (%) | Norfolk Representation (%) |
|---|---|---|
| **18-25 years** | 11/200 (5.5%) | 52/681 (7.6%) |
| **26-35 years** | 15/200 (7.5%) | 96/681 (14.1%) |
| **36-45 years** | 11/200 (5.5%) | 105/681 (15.4%) |
| **46-55 years** | 42/200 (21%) | 118/681 (17.3%) |
| **56-65 years** | 46/200 (23%) | 114/681 (16.7%) |
| **Over 65 years** | 75/200 (37.5%) | 196/681 (28.7%) |

Table 2: Age Profile Comparison

Table 3 gives identical analyses regarding the income profiles of the sample. 12% of respondents chose not to divulge this information.

The table shows a broadly representative income distribution for the sample based against the Household Incomes for the Norfolk region (www.norfolkinsight.org.uk). The slight

underrepresentation of those among the lowest income brackets can potentially be ameliorated by the inadequate proportion of respondents aged 45 and under, as previously described in Table 2.

| Income Bracket | Sample Population (%) | Norfolk Representation (%)* |
|---|---|---|
| **Under £20,000** | 55/200 (27.5%) | 39% |
| **£20,000 - £29,999** | 48/200 (24%) | 21% |
| **£30,000 - £39,999** | 25/200 (12.5%) | 24% |
| **£40,000 - £49,999** | 18/200 (9%) | |
| **£50,000 - £59,999** | 9/200 (4.5%) | |
| **£60,000 - £69,999** | 7/200 (3.5%) | |
| **£70,000 - £79,999** | 3/200 (1.5%) | 16% |
| **£80,000 - £89,999** | 2/200 (1%) | |
| **Above £90,000** | 10/200 (5%) | |
| **Preferred not to disclose** | 24/200 (12%) | N/A |

Table 3: Income Profile Comparison

*Data approximations from Norfolk Insight (CACI), 2010

Our survey yielded that 110 of those 200 questioned (55%) had given some form of donation to an environmental charity within the last 12 months. Whilst this proportion may seem somewhat inflated, no specific restrictions were imposed in people's interpretation of the statement, and thus 'donating' could have been established from a range of methods, be it environmental membership, a direct donation or direct engagement in conservation work. In contemplation of this wider spectrum of definitions, this percentage did not seem unreasonable.

Given an agreement to engage in the survey, it is perhaps unsurprising that 80% of respondents stated that they fed birds at least occasionally. Three quarters of respondents fed the birds with sustenance in some purchased form, whilst one third confirmed they fed leftover food alongside or instead of this option. Of the 14 respondents who stated they fed 'Other' foodstuffs, their description generally alluded to the dispensing of fresh fruit, lard or domestically harvested corn and maize.

Conducive with expectations, summer was the least prolific season for bird-feeding, with only 61.5% feeding birds at all over this period. The desire to feed birds under weather conditions where it is deemed they require the sustenance corresponds to seasonal increments for autumn (76%), spring (76%) and winter (81%). It may be posed that feeding birds through the summer bears a motive more anthropocentric in nature. In this season people are afforded a greater opportunity to spend time in the proximity of bird-life (for example gardening or sunbathing), whilst it is less clear that the birds actually need the food through the summer months. The advice from avian charities is ambiguous on this issue; with some advocating year-round aid whilst others stating that natural food is abundant in this season. Whilst not analysed within this investigation, it would be interesting to see how the other seasons' increments corresponded to the altruistic indicators contained within the questionnaire to see if such assertions were justifiable.

Table 4 shows an aggregated ranking of the reasons respondents gave for feeding birds. It shows that people's enjoyment from watching the birds is the most potent motive for engaging in feeding activities. Helping the birds' populations forms the second most popular reason given,

whilst their need for such nutrition is the tertiary priority. Both of these motivations fall under a far more altruistic umbrella than the primary goal, and the matrix contained in Table 5 confirms the correlation between these two factors is the highest. The relative distaste for the fifth motive is also enlightening, and shows that one environmental concern, namely that of heightening landfill rates in the UK, do not directly coincide with another.

| Rank | Description | Score (Average) |
|---|---|---|
| 1 | Enjoyment from looking at them (ENJOY) | 873 (4.37) |
| 2 | Helps Bird Populations (POP) | 835 (4.18) |
| 3 | Feel the birds need the food (NEED) | 793 (3.97) |
| 4 | Good feeling from helping (FEEL) | 709 (3.55) |
| 5 | Throwing food in the bin is a waste (FOOD) | 579 (2.90) |

Table 4: Motivational Hierarchy for Feeds

| | ENJOY | NEED | POP | FEEL | FOOD |
|---|---|---|---|---|---|
| **ENJOY** | 1 | | | | |
| **NEED** | 0.28 | 1 | | | |
| **POP** | 0.34 | **0.5** | 1 | | |
| **FEEL** | 0.08 | 0.24 | 0.14 | 1 | |
| **FOOD** | 0.11 | -0.08 | 0.04 | 0.22 | 1 |

Table 5 : Correlation across motivations

Table 6 summarises the results of the identification quiz. In congruence with expectation, the Robin and Blackbird proved easiest for respondents to identify. By contrast, the House Sparrow appeared the most difficult for people to guess correctly. Upon closer inspection, the right hand columns of Table 6 suggest that this relates more to misidentification (37.5%) then cluelessness (10.5%). Popular incorrect options included the Great Tit, Tree Sparrow and Dunnock. These species all possess similar plumages and this bears prominently in the data, where over 65% of incorrectly assumed identities for the House Sparrow were participants instead opting for one of these three allied birds (see Appendix F for the full matrix). Once this facet is accounted for, people would find it hardest to name the rarest species, The Bullfinch. Whilst nearly 56% did correctly identify this bird, we see a relatively high proportion fail to register an answer.

| | Guessed Correctly (%) | | Guessed Incorrectly (%) | | Missed Out (%) | |
|---|---|---|---|---|---|---|
| **Robin** | 198/200 (99%) | 1= | 0/200 (0%) | 1= | 2/200 (1%) | 1= |
| **Blackbird** | 198/200 (99%) | 1= | 0/200 (0%) | 1= | 2/200 (1%) | 1= |
| **Blue Tit** | 179/200 (89.5%) | 3 | 11/200 (5.5%) | 3 | 10/200 (5%) | 4 |
| **Woodpigeon** | 169/200 (84.5%) | 4 | 26/200 (13%) | 4 | 5/200 (2.5%) | 3 |
| **Bullfinch** | 111/200 (55.5%) | 5 | 58/200 (29%) | 5 | 31/200 (15.5%) | 6 |
| **House Sparrow** | 104/200 (52%) | 6 | 75/200 (37.5%) | 6 | 21/200 (10.5%) | 5 |

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Number guessed Correctly** | 1 | 2 | 22 | 50 | 62 | 63 |
| **(%)** | 0.5% | 1% | 11% | 25% | 31% | 31.5% |
| **Mean: 4.78** **Median: 5** | | | | | | |

Table 6: Identification Quiz results

The lower portion of Table 6 identifies that nearly two-thirds of respondents were able to match at least five of the six birds correctly, whilst just one in eight mis-specified three or more birds. This infers that the sample population possessed a fairly good level of knowledge regarding local wildlife. Even those who show a lessened interest in feeding birds still hold background knowledge over them, with proclaimed non-feeders still managing a mean score of 4.36. The extent to which true knowledge can be verified is reliant on low incidences of pure guesswork.

The valuations produced through modelling the responses of the DCM involved data input and analysis through $STATA_{11}$. Original regression outputs for the four models illustrated through Table 9 are held within Appendix G.

Table 9 displays the results from four Conditional Logit models. Each regress the same explanatory variables but from a specified group or subgroup of respondents with particular or distinct characteristics. Model (1) estimates the logistic valuations of the complete sample. For each individual, the fact that fully ranked preferences were established across each set enabled an extensive dataset to be obtained. Model (2) is selecting the responses of those who confirmed they had donated to an environmental charity (n = 110). The intuition is that this sub-sample represents those who already feel a heightened degree of environmental responsibility. Model (3) isolates those within the sample who correctly named all six of the species in the bird identification quiz (n = 63). By modelling this sub-group, we explore whether any de-linearization might occur in valuation from those who hold superior knowledge. Finally, Model (4) derives the part-worth values for those individuals who scored highly on motivations which allude to altruism (n = 124). Referring to Table 4, this involves those respondents whose aggregated score for reasons ranked 2, 3 and 4 exceeded 12 of a possible 15.

For each model, Table 10 describes the implied monetary calculation, expressed in pounds sterling (£). For bird-related valuations, an associated ranking is provided adjacent to this expression. Valuations for species of the highest frequency level (with (2)) give an weighted marginal ranking based on an equal probability of between 2 and 5 birds being seen (See Table 1).

| | Full Sample *Model (1)* | | Give to Environmental Charity *Model(2)* | | Bird Knowledge *(Model (3))* | | Altruistic Feeders *(Model (4))* | |
|---|---|---|---|---|---|---|---|---|
| | *Coef.* | *P>\|z\|* | *Coef.* | *P>\|z\|* | *Coef.* | *P>\|z\|* | *Coef.* | *P>\|z\|* |
| **Blackbird(2)** | 0.7455434 | 0.000 | 0.7769565 | 0.000 | 1.105667 | 0.000 | 1.015769 | 0.000 |
| **Sparrow(2)** | 0.6814952 | 0.000 | 0.7475914 | 0.000 | 0.9795964 | 0.000 | 0.8371943 | 0.000 |
| **Tit** | 0.5599263 | 0.000 | 0.6335593 | 0.000 | 0.7731799 | 0.000 | 0.6541141 | 0.000 |
| **Tit (2)** | 1.297145 | 0.000 | 1.675717 | 0.000 | 1.747881 | 0.000 | 1.449206 | 0.000 |
| $(\mathbf{e})^{+}$**Woodpigeon** | 0.0405273 | 0.640 | 0.0011897 | 0.992 | -0.0631698 | 0.707 | 0.2219364 | 0.051 |
| **Woodpigeon** | -0.1369086 | 0.068 | -0.3160129 | 0.004 | -0.1530202 | 0.308 | -0.1991779 | 0.048 |
| **Robin** | 0.9059818 | 0.000 | 0.8708107 | 0.000 | 1.304196 | 0.000 | 1.01477 | 0.000 |
| $(\mathbf{e})^{+}$**Bullfinch** | 0.2980427 | 0.017 | 0.3621973 | 0.035 | 0.4085744 | 0.077 | 0.1103045 | 0.493 |
| **Bullfinch** | 0.2313223 | 0.007 | 0.4675647 | 0.000 | 0.163062 | 0.316 | 0.2998668 | 0.008 |
| **2* Nutrition** | 0.8607292 | 0.000 | 1.231308 | 0.000 | 0.906238 | 0.000 | 1.05471 | 0.000 |
| **3* Nutrition** | 0.7373646 | 0.003 | 1.4658896 | 0.000 | 0.6334408 | 0.164 | 1.08126 | 0.001 |
| **Donation** | -0.0035081 | 0.000 | -0.027117 | 0.000 | -0.0047559 | 0.000 | -0.0025072 | 0.000 |
| **Nutnum** | -0.0633076 | 0.000 | -0.0781922 | 0.000 | -0.0823717 | 0.005 | -0.0754199 | 0.000 |
| **Price** | -0.0008119 | 0.001 | -0.0008847 | 0.012 | -0.0008945 | 0.060 | -0.0009771 | 0.003 |
| **Model Fit ($\chi^2$)** | 2638.9 | 0.000 | 1984.33 | 0.000 | 1215.64 | 0.000 | 2288.29 | 0.000 |
| **Pseudo $R^2$** | 0.1283 | | 0.1754 | | 0.1876 | | 0.1794 | |

$(\mathbf{e})^{+}$= 'Local Existence Value'

Table 9: The Conditional Logit Regressions

| | Full Sample *Model (1)* | | Give to Environmental Charity *Model(2)* | | Bird Knowledge *(Model (3))* | | Altruistic Feeders *(Model (4))* | |
|---|---|---|---|---|---|---|---|---|
| **Robin** | 0.56 | 1 | 0.49 | 1 | 0.73 | 1 | 0.52 | 1 |
| **Tit** | 0.35 | 2 | 0.36 | 2 | 0.43 | 2 | 0.33 | 2 |
| **Tit (2)** | 0.24 | 3 | 0.31 | 3 | 0.28 | 5 | 0.21 | 5 |
| **Blackbird(2)** | 0.24 | 4 | 0.23 | 5 | 0.32 | 3 | 0.27 | 3 |
| **Sparrow(2)** | 0.22 | 5 | 0.22 | 6 | 0.29 | 4 | 0.22 | 4 |
| $(\mathbf{e})^{+}$**Bullfinch** | 0.18 | 6 | 0.20 | 7 | 0.23 | 6 | 0.06 | 8 |
| **Bullfinch** | 0.14 | 7 | 0.26 | 4 | 0.09 | 7 | 0.15 | 6 |
| $(\mathbf{e})^{+}$**Woodpigeon** | 0.03 | 8 | -0.01 | 8 | -0.04 | 8 | 0.11 | 7 |
| **Woodpigeon** | -0.08 | 9 | -0.18 | 9 | -0.09 | 9 | -0.10 | 9 |
| **2* Nutrition** | 0.53 | | 0.70 | | 0.51 | | 0.54 | |
| **3* Nutrition** | 0.45 | | 0.83 | | 0.35 | | 0.55 | |

$(\mathbf{e})^{+}$= 'Local Existence Value'

Insignificant Coefficient

Table 10: Corresponding Model Valuations presenting Willingness-to-Pay for Bird Species and Nutritional Attributes, alongside Rankings for the Former

There are a number of key findings that can be derived from the data. The first of these relates to the bird valuations themselves. Across all four models, the assemblage of valuation across species follows a broadly consistent pattern; The Robin and Blue Tit evoke the greatest value, with diminishing returns being witnessed for the latter, whilst valuations for the Woodpigeon are either insignificant or negative. This result is conducive with prior intuition that people might value aspects such as colour or associated aesthetics when deriving wildlife valuation. By contrast, (but with the exception of Model (2)) the 'rarer' Bullfinch species languishes below the worth assumed for either the Blackbird or House Sparrow. These are the two species contained within the Baseline Option and therefore their valuations represent just an extenuation of abundance as opposed to that of species variety. This 'valuation ladder' of species is intriguing. Aesthetics clearly plays a critical role in deriving worth, yet the aspects of rarity nor colour cannot be fully assumed as sole drivers of value from the results which are discovered. We shall return to this apparent 'anomaly' later in the paper.

Nutritional dummy variables retain a consistently high and positive status across models. Relative to the full sample in Model 1, we see a slight elevation among charity givers (Model (2); $\chi^2$ = 1.6587, $p(z)$ = 0.198), yet a reduction amid those who were knowledgeable (Model (3); $\chi^2$ = 33.5513, $p(z)$ = 0.000). The former of these results seems sensible, as it is highly plausible that those who already possess an environmental affiliation and express this through some form of giving should be more likely to derive worth from a characteristic which looks to primarily aid the birds. The insinuation from the latter finding is more surprising, especially when combined with the other comparative statics. Across models, the respondents of Model (3) derive the greatest value from the bird species themselves, yet appear not to value any other aspect of the seed beyond its ability to produce birds for them to view. The conclusion that perhaps may be drawn from this finding is that possessing a greater level of avian knowledge purely yields a heightened value for bird-life, without fuelling any of the altruistic or public-good aspects allied to bird-feeding.

Table 9 indicates that, on average, increasing the donation associated with an option creates a negative and significant dissuasion from choosing it, *ceteris paribus.* This at first might appear a surprising discovery, but is reinforced in anecdotal discussions from respondents who claim that they showed a distaste to engage in such compulsory philanthropy. This is something we shall return to in later discussion, yet it is worth noting that this effect is significantly reduced in Model (2) (charity givers) and somewhat lessened for the 'altruistically-motivated' respondents in Model (4).

Overall, the majority of our survey results adhere to the *a priori* intuitions surrounding the subject, with coefficients displaying magnitudes which paint a rather vivid and intriguing picture. The two over-arching aims of this paper were to discover if, and to what extent, people yielded valuation for 'everyday wildlife' and also to explore the underpinnings of such valuation in the context of enhancing their Subjective Well-Being. The positive values our sample attributes to both the bird species themselves and the associated altruistic elements such as nutrition unequivocally answer this first question. The next section now searches to contextualise these parameters within the field of behavioural economics in order to address the study's second objective.

## SECTION 4: DISCUSSION

Given the study's place of location and the non-obligatory conditions for respondent participation, these findings cannot be generalised to the full UK population. By the same token, not all participants were seen to hold a keen passion for ornithology, and thus whilst the sample may ineffectively represent the *whole* population, there appears no reason to prevent its extension to a significant fraction of the UK population, in particular those who hold interests in outdoor pursuits, horticulture or other assimilated activities. As a consequence, a multitude of meaningful avenues for debate are opened from the information contained in the above section.

From an ecological standpoint, the most poignant result extracted from the study is the avian rankings table (Table 10). This valuation profile seems to predominantly comply with both previous studies and our *a priori* intuitions. Species which possess qualities of colour and vibrancy, and thus are assumed more aesthetically pleasing, will invite the greatest human value. Furthermore, the undesirable attributes of greed and blandness of plumage, characterised by the Woodpigeon in our study, draw little or even negative feeling from respondents.

In contrast to these intuitively conducive results, the positioning of the Bullfinch on this ladder of valuation appears anomalous. The Bullfinch is a brightly colourful and relatively attractive bird, and furthermore exhibits a greater degree of rarity in the Norfolk region, a quality which ought, in the eyes of other studies, heighten the value we hold for it. Despite this, the species consistently fails to stimulate great value among our sample, often registering lower scores than less vibrant birds such as the common Blackbird. Thus, our bird valuation profile offers a mixed picture regarding its compliance with allied studies in this field.

By instead referring to the literature on Subjective Well-being (SWB), and the channels by which humans are assumed by behavioural economists to obtain utility, we can apply a method of analysing the attainment of value which corresponds more favourably to the hierarchy we have uncovered. This model echoes that which promotes aspects such as vibrancy and aestheticism as a source of value, but additionally advocates factors which endow humans with repeated interaction and invite the opportunity to exhibit emotions of responsibility and interconnectedness. Our two top ranked species, namely the Robin and Blue Tit, typify this profile perfectly. Not only are they visually pleasant, but their looks also omit a sense of vulnerability, which in turn infer that they may be more dependent on humans to increase their chances of survival and ability to reproduce. They are also common birds, and frequent visitors to the people's gardens. Thus, they offer the opportunity for repeated and uninterrupted interaction which serves to boost the utility people would derive from feeding them. Further crediting the plausibility of this approach, species who rank more lowly in our hierarchy are often missing one of more of these SWB enhancing qualities, be it aestheticism (House Sparrow), dependency (Blackbird), opportunity for repetitive interaction (Bullfinch) or a combination of all three (Woodpigeon).

Another key insight derived through this study pertains to the motivations people describe for feeding birds (Table 4). The self-rewarding enjoyment from viewing the birds constitutes the primary reason for engaging in this act. This is perhaps unsurprising, as this is a stimulus that all respondents are able to feel, whether complemented by altruistic motivations or not.

Of greater interest is the placement of 'help' above 'need' as an emotive defence for bird-feeding. This implies that a considerable component of the utility people gain from nature engagement originates from the sense of responsibility they are able to derive from aiding another species. The word 'need' indicates that respondents feel an obligation to do this, and failure to do so will be detrimental to the birds. Conversely, the word 'help' describes a slightly weaker phrase, whereby it might be seen that you wish to contribute to bird welfare, but failure to do so will not necessarily be catastrophic. Under these circumstances, you can be more selective with which birds you decide to aid. This is clearly congruent with the aforementioned findings of the bird valuations, where those species most highly valued correlated to those whose stature implied a sense of vulnerability and defencelessness.

A final noteworthy aspect regarding these reasoning rankings is the relative distaste of participants to feed birds because it 'made them feel good to feel they were helping'. Whilst respondents were happy to concede that they hold self-indulgent motives for feeding birds (namely the enjoyment from watching them), they are reluctant to present this allied motive as holding the same potency for their choice. This potentially conforms to the altruistic or public goods frameworks. In either case, our sample seems happy to partition and prioritise a private component they derive (watching birds), and also acknowledge that there are clear interactions between this and the publically spirited benefit of increased bird populations. However, they indicate that their provision to the impure public good (helping birds) will only produce a subsidiary private utility (feeling good) and this was not the primary driver of such action.

Returning to Table 10 of the results, regressor 'nutnum' describes the interaction between the number of birds which were present on an alternative and the nutritional star rating of the bird food. The coefficient is both negative and significant across all four models, suggesting that the importance of nutrition declines when more birds are attracted and fed by a particular option. Further analysis (not presented here) found that the number of birds fed *per se* (i.e. over and above, yet irrespective, of species) plays no significant role in people's choice-making, enhancing the trust we place in the negativity of this 'nutnum' variable.

At first inspection, this appears contradictory to previous analysis; surely individuals should retain a constant care for nutrition, or even increase it, as the volume of birds fed from the seed increases. However, if we apply this finding to that of the individual who derives utility from aspects of responsibility and repetitive interaction, then this negative coefficient may still seem sensible. Such people would clearly value the nutrition of a seed which attracted small number of dependent species, and which might identifiably return for further care. However, they would yield less utility over the nourishment provided from an option which brought them birds in a greater volume; where the interaction would take on a more anonymous and detached stance. Further to this tale, as bird numbers increase, the inherent perception would be of a lesser dependency- the populations are clearly thriving and are therefore now devoid of human intervention. The sense of responsibility in these cases diminishes, and with it the utility derivation obtained through this form of 'Nature Connectivity'.

The final channel of discussion for this paper regards the conclusions which can be drawn from the choice experiment's donation attribute. This characteristic attempted to relate 'everyday wildlife' to the value people attribute to more general conservation efforts, and those more typically

explored within the field. Consistent across all four of our models, the donation variable took on a negative and significant coefficient. The most plausible explanation for this dissuasion arrived from consistent verbal reasoning given by multiple surveyed respondents. These explained that they disliked the compulsory imposition of a donation as part of the purchase price, as this forced them to contribute to a specific cause and in pre-defined amounts. Further to this, individuals indicated a preference for compartmentalising their interactions with wildlife; on the one hand they enjoy contributing to environmental charities and gain utility from voluntarily doing so. On the other, they took pleasure from bird-feeding, but as a separate, private act which should be dis-associated from the philanthropy of charity-giving.

These anecdotal exclamations invite a number of conclusions to be drawn from our donation coefficient. The first regards the care which should be taken when interpreting this negative sign: the survey design made it very obvious that price differentials between two seed alternatives were often caused purely from the presence of the donation. This is clearly ill-aligned with the true nature of such 'bundling', where companies normally employ far more complex schemes including proportional or corporately-matched donations. Consequently, this study retains great caution in the assertions it makes over the absolute values people express for regional or national conservation causes.

Another insight pertains to the differences this form of existence value takes from that related to local existence value. These are characterised by the "ewoodpigeon" and "ebullfich" coefficients of Table 9, which appear as mostly insignificant or weakly positive. This is in stark contrast to the strongly negative donation variable. When contextualised within an impure public goods framework, the disparity between these two forms of non-use value seems reasonable. To do this, we must assume that humans value the interactions which occur between the private utility derived from engagement with wildlife and the associated public goods facet. In our example, it is possible that individuals can value seeing birds in their garden (private) and realise that this is also aiding the wider bird populations (public). However, they quite plausibly can yield contentment from realising that the two are interlinked. This helps explain the (albeit weakened) value held for our local existence variables, yet lack of value for donating, where the private and interactive elements are lost. Notwithstanding the issues regarding the construction of our particular donation characteristic, there appears considerable importance in grasping a more sound understanding of these non-use interactions and we would recommend such exploration for further research.

The more robust of the conclusions we can draw regarding our donation attribute returns to the theme of 'Nature Connectivity'. We see that the type of engagement which is yielded through the donation coefficient is very distant from that which might be obtained through our 'responsibility-repetitive interactions' model as outlined earlier in this section. People are not only unlikely, but are actively discouraged, from trying to 'connect' with species such as the Bittern. Wildscape conservation regions are, by definition, designed to resist human intervention or interaction. The utility that humans can extract from such expenditure can in no way be fuelling their SWB feelings of dependency-affiliation or repeated interaction. Indeed, the values which are assumed from engaging with backyard wildlife are akin more to that which might be established through domesticated nature (gardening or pets) than from regional or national wildlife preservation.

## 6. CONCLUSION

This study's major motivation was to explore how engaging with 'everyday wildlife' fared on the barometer of activities which can induce feelings of long-lasting satisfaction. A resounding and recurring theme has arisen when exploring the various arguments presented here. This theme proposes that humans approach 'everyday wildlife', such as garden birds, in a distinct and separate manner when compared against that of conservation or aid. The type of utility which can be extracted from such interaction encroaches into a very different area of our Subjective Wellbeing and can raise our contentment through a sense of responsibility and/or repeated engagement with other entities. Such attainment is not overly distant from the advocated practices of religion, culture and social-networking in raising one's life satisfaction. A need to distinguish between the values associated with local wildlife and that yielded from wider environmental causes appears a necessity if people are to maximise the utility which can be extracted from the natural world.

If studies such as these are able to identify the conditions under which valuation for local wildlife is assumed, then it is possible that research of this nature can be instrumental for future policy. Seeking to manage the natural environment so as to enhance people's well-being to the greatest extent would be widely beneficial, and this paper suggests the need to modify the approaches taken within a number of policy arenas in order to achieve this. These include both a reallocation of resources within the field of conservation and the redesigning of urban planning law. Furthermore, this investigation provides insights regarding the type of merchandising which, if implemented, could heighten the profitability of seed manufacturers and other complementary products within the private sector.

To the authors' best knowledge, this is the first paper seeking to extract the value people assume from 'backyard wildlife' and so its recommendations can only be strengthened or verified by the undertaking of assimilated work to either corroborate or refute the assertions made. Furthermore, we believe there is a need to investigate far more deeply the underpinnings of such value within the field of economics. In particular, the paper recommends further inspection regarding the conditions under which humans derive contentment from wildlife within an impure public goods framework, and the corresponding role of non-use values in this environment.

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## Appendix A: Rankings of the RPSB Big Garden Bird Watch (BGBW) Survey 2012

| Species | Average/Garden | Rank | % of Gardens | Rank | Rank |
|---|---|---|---|---|---|
| Blackbird | 3.649 | 1 | 96.64 | 1 | **1** |
| Blue Tit | 2.628 | 4 | 84.28 | 3 | **2** |
| Woodpigeon | 2.546 | 5 | 77.47 | 4 | **3** |
| House Sparrow | 3.498 | 2 | 57.75 | 9 | **4** |
| Collared Dove | 2.162 | 7 | 73.62 | 5 | **5** |
| Robin | 1.394 | 10 | 85.13 | 2 | **5** |
| Starling | 3.032 | 3 | 48.95 | 10 | **7** |
| Chaffinch | 2.245 | 6 | 63.53 | 7 | **7** |
| Great Tit | 1.664 | 9 | 65.15 | 6 | **9** |
| Goldfinch | 2.013 | 8 | 42.36 | 11 | **10** |
| Dunnock | 1.326 | 11 | 61.78 | 8 | **10** |
| Greenfinch | 1.193 | 12 | 36.46 | 12 | **12** |
| Long tailed tit | 1.135 | 13 | 30.82 | 14 | **13** |
| Coal Tit | 0.584 | 14 | 32.56 | 13 | **13** |
| Feral pigeon | 0.552 | 15 | 17.44 | 17 | **15** |
| Magpie | 0.461 | 16 | 26.16 | 16 | **15** |
| Wren | 0.350 | 20 | 29.17 | 15 | **17** |
| Jackdaw | 0.425 | 17 | 13.92 | 19 | **18** |
| Pheasant | 0.369 | 19 | 17.18 | 18 | **19** |
| Common gull | 0.404 | 18 | 7.60 | 24 | **20** |
| Carrion crow | 0.336 | 21 | 11.73 | 21 | **20** |
| Song Thrush | 0.165 | 24 | 13.01 | 20 | **22** |
| Black headed gull | 0.270 | 22 | 5.29 | 25 | **23** |
| Jay | 0.143 | 26 | 10.11 | 22 | **24** |
| Rook | 0.200 | 23 | 4.15 | 27 | **25** |
| Great spotted woodpecker | 0.107 | 28 | 9.38 | 23 | **26** |
| Moorhen | 0.088 | 29 | 4.32 | 26 | **27** |
| Fieldfare | 0.151 | 25 | 2.57 | 34 | **28** |
| Redwing | 0.116 | 27 | 2.41 | 35 | **29** |
| Nuthatch | 0.056 | 33 | 4.03 | 29 | **29** |
| Green woodpecker | 0.043 | 35 | 4.07 | 28 | **31** |
| Bullfinch | 0.060 | 32 | 3.50 | 32 | **32** |
| Pied wagtail | 0.053 | 34 | 3.79 | 30 | **32** |

**Bird Selected for This Study**

| | | | | | |
|---|---|---|---|---|---|
| Tree sparrow | 0.085 | 30 | 2.31 | 36 | **34** |
| Mallard | 0.085 | 31 | 2.05 | 38 | **35** |
| Sparrowhawk | 0.037 | 38 | 3.57 | 31 | **35** |
| Siskin | 0.042 | 36 | 2.05 | 38 | **37** |
| Marsh tit | 0.033 | 41 | 2.59 | 33 | **37** |
| Stock dove | 0.036 | 39 | 2.25 | 37 | **39** |
| Red legged partridge | 0.040 | 37 | 1.97 | 40 | **40** |
| Redpoll | 0.033 | 40 | 1.30 | 47 | **41** |
| Blackcap | 0.020 | 46 | 1.72 | 41 | **41** |
| Reed bunting | 0.027 | 42 | 1.34 | 46 | **43** |
| Goldcrest | 0.019 | 47 | 1.58 | 42 | **44** |
| Red Kite | 0.024 | 43 | 1.26 | 49 | **45** |
| Grey heron | 0.016 | 49 | 1.42 | 43 | **45** |
| Mistle thrush | 0.015 | 50 | 1.42 | 43 | **47** |
| Treecreeper | 0.015 | 51 | 1.38 | 45 | **48** |
| Herring gull | 0.024 | 44 | 0.89 | 53 | **49** |
| Yellowhammer | 0.023 | 45 | 0.99 | 52 | **49** |
| Brambling | 0.017 | 48 | 1.26 | 49 | **49** |
| Barn owl | 0.012 | 52 | 1.30 | 47 | **52** |
| Kestrel | 0.010 | 54 | 1.11 | 51 | **53** |
| Willow tit | 0.010 | 53 | 0.89 | 53 | **54** |
| Lesser spotted woodpecker | 0.009 | 55 | 0.79 | 55 | **55** |
| Grey wagtail | 0.008 | 56 | 0.77 | 56 | **56** |
| Buzzard | 0.008 | 57 | 0.53 | 57 | **57** |
| Grey partridge | 0.004 | 59 | 0.53 | 57 | **58** |
| Linnet | 0.005 | 58 | 0.39 | 59 | **59** |
| Chiffchaff | 0.004 | 60 | 0.36 | 60 | **60** |
| Tawny owl | 0.002 | 61 | 0.26 | 61 | **61** |
| Little owl | 0.001 | 62 | 0.20 | 62 | **62** |
| Lapwing | 0.001 | 63 | 0.14 | 64 | **63** |
| Great black backed gull | 0.000 | 64 | 0.16 | 63 | **63** |
| Lesser black backed gull | 0.000 | 65 | 0.12 | 66 | **65** |
| Waxwing | 0.000 | 68 | 0.14 | 64 | **66** |
| Corn bunting | 0.000 | 66 | 0.08 | 67 | **67** |
| Raven | 0.000 | 66 | 0.06 | 68 | **68** |
| Skylark | 0.000 | 69 | 0.06 | 68 | **69** |
| Meadow pipit | 0.000 | 70 | 0.02 | 70 | **70** |
| Black redstart | 0.000 | 70 | 0.00 | 71 | **71** |
| Hooded crow | 0.000 | 70 | 0.00 | 71 | **71** |
| Ring necked parakeet | 0.000 | 70 | 0.00 | 71 | **71** |

## Appendix B: Survey Instructions Key

**You will need to use this to understand the cases you are presented with**

### Species

Cases will indicate the type and frequency of species that may come to your garden. Frequency estimations are described in the table below:

| Rating | Description |
|---|---|
| | This species will not come to your garden |
|  | Expect **1** bird of this species to come to your garden |
|  | Expect an average of between **2 and 5** birds of this species to come to your garden |

This is the frequency estimation for **each time** the food is dispensed. The average person would expect to obtain **20** feeding opportunities from each bag.

Visibility

If instead of being shown in full colour, a bird is shown faded, this will mean these birds will feed in your garden from the food you have dispensed, but you will not see them. An example illustrates this below. Here, whilst 2-5 of these birds will feed in your garden, you will only actually see one of them.

Here are the six different species that may be seen as a consequence of dispensing bird food. The species appear below in their natural plumage (colouring) and will always appear in the same position on a choice card if present.

Nutrition

Each option has a ☆ rating. These act like 'Hotel ratings', ranging from one-star to three-star categories. A one-star option will provide basic nourishment, and options with more stars will provide a greater level of nutrition to each bird which is fed.

Price and Donations

The price of an option represents the amount you would have to pay to obtain that seed bag [Please remember no actual purchases will be made as part of this survey].

In some cases, this price includes a donation. This donation contributes toward habitat restoration which aims to raise the population of the Bittern in East Anglia.

The Bittern is a very rare and elusive species, and over two thirds of its remaining UK population live among East Anglian reedbeds currently. If a donation is being made, this will be clearly indicated on the choice case.

The Bittern

**Appendix C: Bird Quiz Sheet**

| Possible Bird Names | Letter |
|---|---|
| Chaffinch | |
| Robin | |
| Grey Heron | |
| Lesser-Spotted Woodpecker | |
| Blue Tit | |
| Woodpigeon | |
| Blackbird | |
| Bullfinch | |
| Song Thrush | |
| Kestrel | |
| Collared Dove | |
| Dunnock | |
| Mallard | |
| Tree Sparrow | |
| House Sparrow | |
| Great Tit | |

Survey Number: ☐

**Appendix D: Template of Respondent Survey**

# Respondent Survey

**1.** Which of these best describes the garden space at the place where you live?

- ☐ No Garden
- ☐ Small Private Garden (area less than a tennis court)
- ☐ Large Private Garden (area larger than a tennis court)
- ☐ Farmland / Fields
- ☐ Communal Gardens

**2.** Which of these describe the food you put out for the birds (Tick all that apply)?

- ☐ I do not feed the birds
- ☐ Bird food
- ☐ Leftover food
- ☐ Other (please specify)

☐

**3.** If you do feed them, at what times of year do you do so and how often?

| | Never | Occasionally | Regularly |
|---|---|---|---|
| Winter | | | |
| Spring | | | |
| Summer | | | |
| Autumn | | | |

**4.** In the last 12 months, have you contributed to an environmental charity?

☐ Yes ☐ No

**5**. Please rate each of the options below, which represent your reasons, if any, for feeding birds:
(1 = Not important to me; 5 = Very important to me)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Enjoyment from looking at them | ○ | ○ | ○ | ○ | ○ |
| I feel they need the extra food | ○ | ○ | ○ | ○ | ○ |
| Help towards bird populations | ○ | ○ | ○ | ○ | ○ |
| It makes me feel good to think I am helping | ○ | ○ | ○ | ○ | ○ |
| Throwing leftover food in the bin is a waste | ○ | ○ | ○ | ○ | ○ |

---

**6.** Gender: ☐ Male ☐ Female

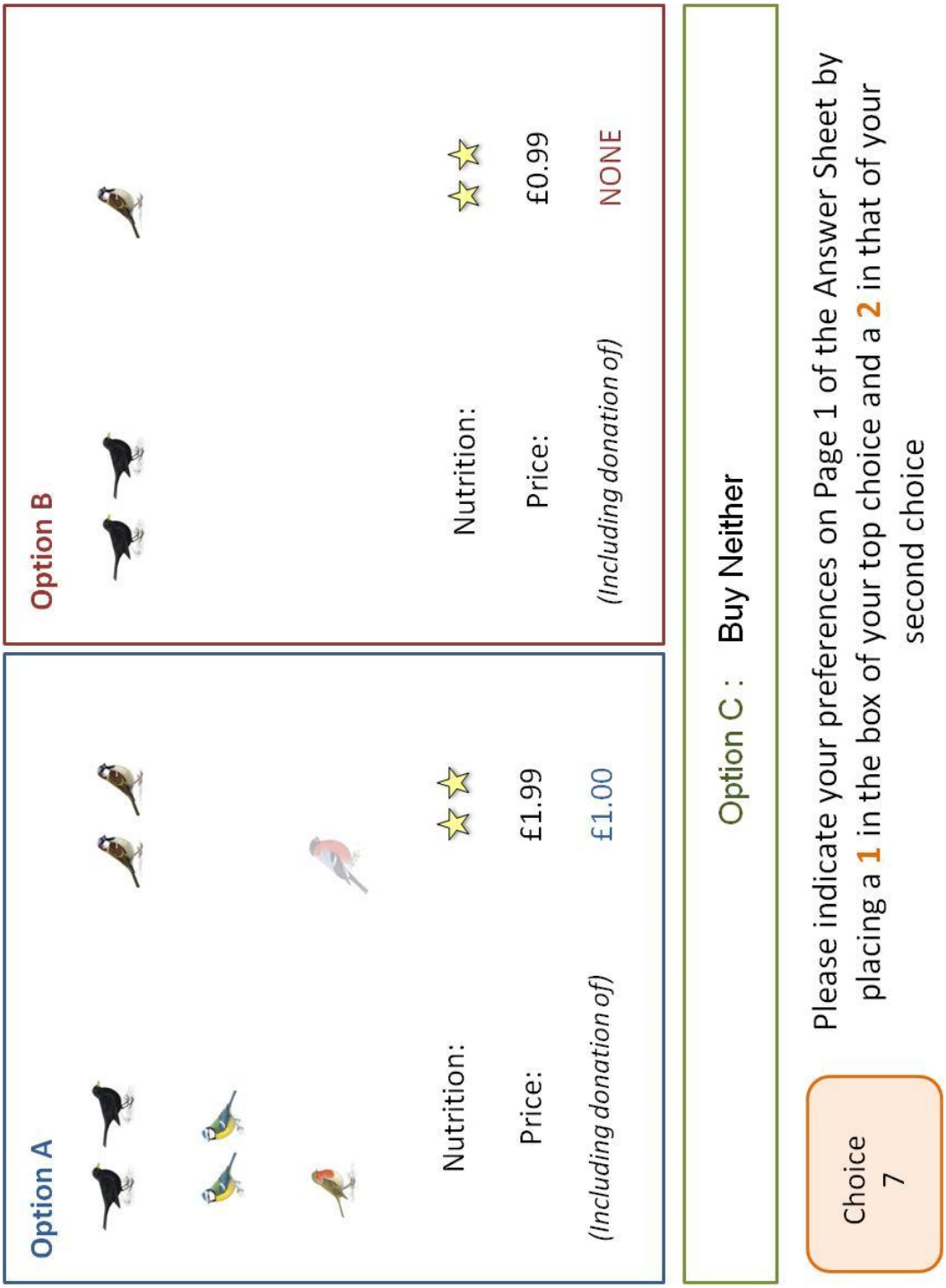
**7**. Age: ☐ 18-25yrs ☐ 26-35yrs ☐ 36- 45yrs ☐ 46- 55yrs ☐ 56 - 65yrs ☐ 65yrs +

**8.** What is your approximate annual *(monthly)* post-tax household income?

☐ Below £20,000 *(Below £1,667)*
☐ £20,000- £29,999 *(£1,668 - £2,499)*
☐ £30,000 - £39,999 *(£2,500 - £3,333)*
☐ £40,000 - £49,999 *(£3,334 - £4,166)*
☐ £50,000 - £59,999 *(£4,167 - £4,999)*
☐ £60,000 - £69,999 *(£5,000- £5,833)*
☐ £70,000 - £79,999 *(£5,834 - £6,666)*
☐ £80,000 - £89,999 *(£6,667 - £7,499)*
☐ Above £90,000 *(Above £7,500)*
☐ Prefer not to disclose

This is the end of the survey! Thanks again for your participation; both your responses and time have been invaluable and essential to the research.

**Appendix E: Example of Choice Set**



## Appendix F: Mis-identification Matrix

| | Blackbird | House Sparrow | Blue Tit | Woodpigeon | Robin | Bullfinch |
|---|---|---|---|---|---|---|
| Chaffinch | 0 | 17 | 3 | 0 | 0 | 47 |
| Robin | 0 | 0 | 0 | 0 | | 0 |
| Grey Heron | 0 | 0 | 0 | 0 | 0 | 0 |
| Lesser-Spotted Woodpecker | 0 | 1 | 0 | 0 | 0 | 3 |
| Blue Tit | 0 | 2 | | 0 | 0 | 0 |
| Woodpigeon | 0 | 0 | 0 | | 0 | 0 |
| Blackbird | | 0 | 0 | 0 | 0 | 0 |
| Bullfinch | 0 | 6 | 1 | 0 | 0 | |
| Song Thrush | 0 | 0 | 0 | 0 | 0 | 4 |
| Kestrel | 0 | 0 | 0 | 0 | 0 | 0 |
| Collared Dove | 0 | 0 | 0 | 26 | 0 | 0 |
| Dunnock | 0 | 6 | 0 | 0 | 0 | 0 |
| Mallard | 0 | 0 | 0 | 0 | 0 | 0 |
| Tree Sparrow | 0 | 24 | 0 | 0 | 0 | 0 |
| House Sparrow | 0 | | 0 | 0 | 0 | 1 |
| Great Tit | 0 | 19 | 7 | 0 | 0 | 3 |
| | 0 | 75 | 11 | 26 | 0 | 58 |

Mis-Specification Matrix

| |
|---|
| None |
| 1 to 5 |
| 6 to 10 |
| 10 to 20 |
| More than 20 |

## Appendix G: Conditional Logit Regressions

*Model (1)*

```
Iteration 0:   log likelihood = -8966.6726
Iteration 1:   log likelihood = -8966.6148
Iteration 2:   log likelihood = -8966.6148

Conditional (fixed-effects) logistic regression   Number of obs   =      16000
                                                  LR chi2(14)     =    2638.90
                                                  Prob > chi2     =     0.0000
Log likelihood = -8966.6148                       Pseudo R2       =     0.1283
```

| choice | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| blackbird2 | .7455434 | .0883111 | 8.44 | 0.000 | .5724569 | .9186299 |
| sparrow2 | .6814952 | .0759267 | 8.98 | 0.000 | .5326817 | .8303088 |
| tit1 | .5599263 | .0700015 | 8.00 | 0.000 | .422726 | .6971267 |
| tit2 | 1.297145 | .1531027 | 8.47 | 0.000 | .9970689 | 1.59722 |
| ewoodpigeon1 | .0405273 | .0865502 | 0.47 | 0.640 | -.1291079 | .2101624 |
| woodpigeon1 | -.1369086 | .075041 | -1.82 | 0.068 | -.2839863 | .0101691 |
| robin1 | .9059818 | .0736238 | 12.31 | 0.000 | .7616818 | 1.050282 |
| ebullfinch1 | .2980427 | .1253322 | 2.38 | 0.017 | .0523961 | .5436893 |
| bullfinch1 | .2313223 | .0859637 | 2.69 | 0.007 | .0628365 | .3998082 |
| twostar | .8607292 | .1356279 | 6.35 | 0.000 | .5949034 | 1.126555 |
| threestar | .7373646 | .2503929 | 2.94 | 0.003 | .2466036 | 1.228126 |
| Donation | -.0035081 | .0005252 | -6.68 | 0.000 | -.0045374 | -.0024788 |
| nutnum | -.0633076 | .0160213 | -3.95 | 0.000 | -.0947088 | -.0319065 |
| price | -.0008119 | .0002538 | -3.20 | 0.001 | -.0013094 | -.0003144 |

*Model (2)*

```
Iteration 0:   log likelihood = -4665.0495
Iteration 1:   log likelihood = -4665.0423
Iteration 2:   log likelihood = -4665.0423

Conditional (fixed-effects) logistic regression   Number of obs   =       8800
                                                  LR chi2(14)     =    1984.33
                                                  Prob > chi2     =     0.0000
Log likelihood = -4665.0423                       Pseudo R2       =     0.1754
```

| choice | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| blackbird2 | .7769565 | .1203743 | 6.45 | 0.000 | .5410272 | 1.012886 |
| sparrow2 | .7475914 | .1052382 | 7.10 | 0.000 | .5413284 | .9538545 |
| tit1 | .6335593 | .0970938 | 6.53 | 0.000 | .443259 | .8238596 |
| tit2 | 1.675717 | .2119289 | 7.91 | 0.000 | 1.260343 | 2.09109 |
| ewoodpigeon1 | .0011897 | .1213768 | 0.01 | 0.992 | -.2367044 | .2390839 |
| woodpigeon1 | -.3160129 | .1093684 | -2.89 | 0.004 | -.530371 | -.1016549 |
| robin1 | .8708107 | .1036239 | 8.40 | 0.000 | .6677117 | 1.07391 |
| ebullfinch1 | .3621973 | .1714589 | 2.11 | 0.035 | .026144 | .6982506 |
| bullfinch1 | .4675647 | .1222488 | 3.82 | 0.000 | .2279614 | .7071679 |
| twostar | 1.231308 | .1877427 | 6.56 | 0.000 | .8633395 | 1.599277 |
| threestar | 1.465896 | .3455976 | 4.24 | 0.000 | .788537 | 2.143255 |
| Donation | -.0027117 | .0007193 | -3.77 | 0.000 | -.0041215 | -.0013019 |
| nutnum | -.0781922 | .0220617 | -3.54 | 0.000 | -.1214324 | -.0349521 |
| price | -.0008847 | .0003518 | -2.51 | 0.012 | -.0015743 | -.0001952 |

*Model (3)*

```
Iteration 0:   log likelihood = -2632.1344
Iteration 1:   log likelihood = -2632.1251
Iteration 2:   log likelihood = -2632.1251

Conditional (fixed-effects) logistic regression   Number of obs   =       5040
                                                  LR chi2(14)     =    1215.64
                                                  Prob > chi2     =     0.0000
Log likelihood = -2632.1251                       Pseudo R2       =     0.1876
```

| choice | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| blackbird2 | 1.105667 | .1601538 | 6.90 | 0.000 | .7917714 | 1.419563 |
| sparrow2 | .9795964 | .1403341 | 6.98 | 0.000 | .7045467 | 1.254646 |
| tit1 | .7731799 | .1310603 | 5.90 | 0.000 | .5163065 | 1.030053 |
| tit2 | 1.747881 | .2879502 | 6.07 | 0.000 | 1.183509 | 2.312253 |
| ewoodpigeon1 | -.0631698 | .1683361 | -0.38 | 0.707 | -.3931024 | .2667628 |
| woodpigeon1 | -.1530202 | .1501802 | -1.02 | 0.308 | -.447368 | .1413275 |
| robin1 | 1.304196 | .1407748 | 9.26 | 0.000 | 1.028282 | 1.580109 |
| ebullfinch1 | .4085744 | .2313482 | 1.77 | 0.077 | -.0448598 | .8620085 |
| bullfinch1 | .1630162 | .1624344 | 1.00 | 0.316 | -.1553493 | .4813817 |
| twostar | .906238 | .2462289 | 3.68 | 0.000 | .4236382 | 1.388838 |
| threestar | .6334408 | .4553091 | 1.39 | 0.164 | -.2589485 | 1.52583 |
| Donation | -.0047559 | .0009552 | -4.98 | 0.000 | -.0066281 | -.0028837 |
| nutnum | -.0823717 | .0292185 | -2.82 | 0.005 | -.1396389 | -.0251045 |
| price | -.0008945 | .0004749 | -1.88 | 0.060 | -.0018253 | .0000364 |

*Model (4)*

```
Iteration 0:   log likelihood = -5230.9065
Iteration 1:   log likelihood = -5230.9027
Iteration 2:   log likelihood = -5230.9027

Conditional (fixed-effects) logistic regression   Number of obs   =       9920
                                                  LR chi2(13)     =    2293.07
                                                  Prob > chi2     =     0.0000
Log likelihood = -5230.9027                       Pseudo R2       =     0.1798
```

| choice | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| blackbird2 | .5261569 | .1154069 | 4.56 | 0.000 | .2999636 | .7523503 |
| sparrow2 | .5977836 | .0801301 | 7.46 | 0.000 | .4407315 | .7548356 |
| tit1 | .5586458 | .0773041 | 7.23 | 0.000 | .4071326 | .710159 |
| tit2 | 1.821943 | .1483143 | 12.28 | 0.000 | 1.531252 | 2.112634 |
| ewoodpigeon1 | -.1938684 | .1080532 | -1.79 | 0.073 | -.4056488 | .017912 |
| woodpigeon1 | -.2133906 | .0978948 | -2.18 | 0.029 | -.4052608 | -.0215204 |
| robin1 | .624703 | .1103112 | 5.66 | 0.000 | .408497 | .840909 |
| ebullfinch1 | .6430672 | .156303 | 4.11 | 0.000 | .336719 | .9494155 |
| bullfinch1 | .6428405 | .1103158 | 5.83 | 0.000 | .4266254 | .8590556 |
| nutrition | .9003135 | .0994229 | 9.06 | 0.000 | .7054481 | 1.095179 |
| Donation | -.0017784 | .0006724 | -2.64 | 0.008 | -.0030963 | -.0004604 |
| nutnum | -.0912562 | .0140828 | -6.48 | 0.000 | -.1188579 | -.0636544 |
| price | .0000146 | .0003546 | 0.04 | 0.967 | -.0006805 | .0007097 |