

1 **Urban bird feeding: connecting people with**
2 **nature**

3 **Short Title: Motivations behind garden bird feeding**

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9 Tables 2; Figures 3; References 57

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11 **Key words:** Garden birds; Human-avian interactions; Nature orientation;

12 Supplementary bird feeding; Urban ecology; Well-being benefits

13 **Abstract**

14 At a time of unprecedented biodiversity loss, researchers are increasingly
15 recognizing the broad range of benefits provided to humankind by nature.
16 However, as people live more urbanized lifestyles there is a progressive
17 disengagement with the natural world that diminishes these benefits and
18 discourages positive environmental behaviour. The provision of food for garden
19 birds is an increasing global phenomenon, and provides a readily accessible way
20 for people to counter this trend. Yet despite its popularity, quite why people feed
21 birds remains poorly understood. We explore three loosely defined motivations
22 behind bird feeding: that it provides psychological benefits, is due to a concern
23 about bird welfare, and/or is due to a more general orientation towards nature.
24 We quantitatively surveyed households from urban towns in southern England,
25 to explore attitudes and actions towards garden bird feeding. Each household
26 scored three Likert statements relating to each of the three motivations. We
27 found that people who fed birds regularly felt more relaxed and connected to
28 nature when they watched garden birds, and perceived that bird feeding is
29 beneficial for bird welfare while investing time in minimising associated risks.
30 Finally, feeding birds may be an expression of a wider orientation towards
31 nature. Overall, we found that the feelings of being relaxed and connected to
32 nature were the strongest drivers. As urban expansion continues both to
33 threaten species conservation and to change peoples' relationship with the
34 natural world, feeding birds may provide an important tool for engaging people
35 with nature to the benefit of both people and conservation.

36 **Introduction**

37 Globally, biodiversity and natural habitat continue on trends of apparently
38 inexorable loss [1]. This is at a time when researchers are increasingly
39 recognizing the broad range of physical, mental and social benefits that
40 interacting with nature provides to people (e.g. [2-4]). As both a greater number
41 and proportion of us live in cities there is growing concern that many people are
42 becoming disengaged from the natural world (termed the 'extinction of
43 experience'; [5-6]). This is potentially serious, because it may lead, first, to a loss
44 of people's desire to interact with nature, so cutting them off from the associated
45 benefits [6-8], and second, to a reduction in broad-based public support for
46 biodiversity conservation [6,9-11], because people's awareness of environmental
47 issues is influenced crucially by their experiences of nature in everyday
48 surroundings [12]. However, despite the oft-reduced opportunities, many people
49 still seek out regular interactions with nature (e.g. [13,14]). Strengthening
50 understanding of the motivations behind why they do so may be key both to
51 maximising the benefits, and harnessing support for broader conservation issues.

52
53 For many people, particularly those living in urban areas, their interactions with
54 wild birds may form the main wildlife interactions that they experience in daily
55 life [15]. So, it is perhaps unsurprising that despite the widespread extinction of
56 experience there is frequent provision of food by people for garden birds. This is
57 often the most common form of wildlife gardening, with around a half of urban
58 households in some western countries putting out food on a regular basis
59 (estimated from [16-21]). The large scale provision of supplementary food for
60 wild birds has significant ecological (reviewed by [22]) and economic [23]
61 impacts. Increasingly it is also being recognised as being an important potential
62 tool for stimulating a broader interest in the natural world [7,17,23-26].
63 However, despite the clear importance that feeding wild birds has for both birds
64 and people there is still no clear understanding of people's motivations for doing
65 so. Here we distinguish three possible mechanisms, namely potential
66 psychological benefits from watching wild birds; a concern about the welfare of
67 wild birds; and/or as a more general orientation towards interacting with nature.

68

69 The psychological benefits that people receive from watching birds in their
70 garden, such as feelings of pleasure, are the most obvious motivation for feeding
71 them [21-27]. We explore two such benefits that might drive garden bird feeding.
72 First, attention restoration theory proposes that the natural world promotes
73 recovery from mental fatigue and offers opportunities for reflection [28], while
74 stress reduction theory indicates that natural environments facilitate reductions
75 in physiological arousal following stress [29]. Both of these theoretical
76 frameworks promote relaxation thus leading to reduced stress and improved
77 mental health (e.g. [30-31]). Watching birds and their behaviour as a visible
78 component of nature may contribute significantly to these feelings. Second,
79 watching garden birds may provide people with a feeling of being connected to
80 nature, contributing towards an increased sense of belonging in the natural
81 world (reviewed [32]). How a person relates to nature (i.e. how connected they
82 are) has been shown to be a strong predictor of environmental attitudes
83 (reviewed in [32]), and has been positively associated with subjective well-being
84 [33-34] and reduced anxiety [35].

85

86 Traditionally, and currently, people in the northern hemisphere more often
87 provide food for birds in winter when they are perceived to need more
88 assistance with resources [23,27,36]. This is despite daylight hours being shorter,
89 with people spending less time in their gardens and so arguably there being less
90 likelihood of viewing the birds directly. This suggests that a concern about bird
91 welfare may be an important motivation behind providing food. Indeed, many
92 people feel passionately about their birds and are keen to learn best feeding
93 practises. The aggregation of large numbers of birds around a food source has
94 been associated with an increased risk of disease transmission [22], and best
95 practice guidelines recommend that this risk can be reduced by the regular
96 cleaning of feeders (e.g. [37]). However, this entails a time investment and
97 because householders often cannot see the effects of disease transmission it may
98 have little visible effect. Therefore people who clean feeders can be regarded as
99 showing an increased concern for bird welfare.

100

101 Finally, there is increasing evidence that some people are more orientated
102 towards interacting with the natural world than others [4,6,8], and are willing to
103 invest more to obtain this interaction even when they have a reduced
104 opportunity for doing so [38,39]. It can be relatively easy to attract birds to a
105 feeder through the provision of food. We explore whether the mechanism behind
106 people doing so is either a response to the opportunity of birds already present
107 in the garden, or some people being orientated towards specifically attracting
108 birds even when there are none. Indeed, a bird feeder plays a unique role in
109 attracting birds to a focal location where they can be viewed more closely and for
110 longer periods. People who invest in maintaining a bird feeder, so seeking the
111 closer interaction provided, might be seen to be more orientated towards
112 interacting with nature through bird feeding.

113

114 Here we ask survey respondents to rate three Likert statements as components
115 of each motivation, to explore the degree to which they drive people's bird
116 feeding activities: the psychological benefits they receive; their concern about
117 bird welfare; and/or as a way to express their general orientation towards
118 interacting with nature.

119

120 **Materials and methods**

121 **Ethical statement**

122 This research was conducted with approval from, and in accordance with, the
123 University of Exeter Biosciences ethical review committee, project number
124 2013/320. Before completing the survey respondents were asked to provide
125 written consent by checking a box stating their agreement to participate in the
126 survey. Respondents were also asked to confirm that they were over 18 years of
127 age. On the written consent form, participants were told that data would remain
128 anonymous and would be protected and stored in a secured format. There is an
129 electronic log of consent procedure to document the process.

130

131 **Survey methods**

132 We surveyed garden bird feeding activities and perceptions of common garden
133 bird species using a questionnaire approach across three English towns located,
134 in close proximity (~60 km to the north of London, UK): Milton Keynes (52°02'N,
135 0°45'W), Luton (51°53'N, 0°25'W) and Bedford (N52°58'N, 0°28'W). These each
136 have sizeable human populations of, respectively, c. 230,000, c. 240,000, and c.
137 160,000 (2011 Census, UK). Two general survey methods were used. First,
138 between November 2013 and February 2014, 20 households were selected at
139 random in each of the three towns. A researcher knocked on the doors of the
140 houses and asked one member of the household to complete the questionnaire.
141 The survey participant in each household was also asked to enlist two other
142 known households from within ~500m to participate in the survey. Potential
143 participants were contacted by email or phone and the questionnaire was
144 delivered by hand. Second, between March and July 2014 up to ten streets in
145 each town were selected at random. A researcher then knocked on the doors of
146 all houses with evidence that someone was home, e.g. from a car in the drive. The
147 project was explained to the resident, who was then asked to complete a
148 questionnaire in his or her own time. In order to minimize possible bias resulting
149 from certain groups being more likely to be at home, different streets were
150 targeted at different times of day either late morning (11:00 to 13:00), mid
151 afternoon (14:30 to 16:00) or late afternoon (17:00 to 18:30). Surveys were
152 conducted at both weekdays and at weekends. For both survey methods a first
153 attempt to collect the questionnaire was made two days after delivery, and if
154 unsuccessful a subsequent attempt was made two days after that. One hundred
155 and forty responses were collected by the first survey method, and 191 by the
156 second. The survey was conducted in a stratified random way because we were
157 not interested in the proportion of the urban population who fed birds, but
158 instead wanted to understand the reasons those that fed birds had for doing so,
159 whilst having a sufficiently large sample of people who did not feed birds for
160 comparison purposes.

161

162 **Questionnaire design**

163 We developed a questionnaire to explore people's knowledge and experience of,
164 and attitudes towards, garden bird feeding. The questionnaire took

165 approximately six minutes to complete and consisted of close-ended questions.
166 Only those questions used in the analyses reported here are discussed (See
167 Tables A-E in S1 File for a fuller description of the questionnaire). To explore
168 respondents' motivations behind garden bird feeding, we asked people to rate
169 the extent to which they agreed with each of nine statements. Responses were
170 given on a five-point Likert scale, from strongly disagree to strongly agree. Three
171 statements related to the psychological benefits that people obtain from
172 watching birds in their garden (Table B in S1 File). These stemmed from known
173 psychological benefits of interacting with nature (e.g. [28,40]). A further three
174 statements explored perceived welfare benefits and a respondents' willingness
175 to minimise potential risks associated with bird feeding (Table C and D in S1
176 File). Finally, three statements assessed respondents' orientation towards bird
177 feeding over their opportunity for doing so, and the role that a bird feeder plays
178 in this (Table D in S1 File). Five of the above statements related to bird feeding
179 generally and were completed by all respondents, while four related directly to
180 bird feeding activities and so were not completed by people who did not feed
181 birds. Item phrasing can influence outcomes, and statements were designed to
182 be neither strongly positive nor negative, nor to lead respondents. We also
183 collected data on the socio-demographic status of the respondents, along with
184 information on their bird feeding activities and their general awareness of the
185 birds around them (Table A in S1 File). To try and understand why some people
186 don't feed birds, we also asked people who did not do so to score the Likert
187 statement 'I am not interested in feeding birds', and why those that engaged in
188 some form of bird feeding activity don't do so more regularly 'I don't always
189 remember to put out food'. As a crude measure of the independence of surveying
190 multiple people from each street we also asked people to score the five point
191 Likert statement 'I feed birds because my neighbours do'. See Table C and D in S1
192 File.

193

194 Prior to statistical analysis we created a three-level factor pertaining to how
195 regularly a household provided food for birds: regularly (those that replied daily
196 or weekly), irregularly (those that replied monthly or less than once a month) or
197 never (those that didn't feed birds). Second, as a measure of people's awareness

198 of the birds around where they live and work, respondents were also asked to
199 select one or more periods during the day when they usually noticed birds (the
200 day was divided into four approximately equal periods; morning, lunchtime,
201 afternoon and evening). We then constructed a second factor on a scale of 0-4
202 according to what proportion of their average day people reported noticing birds
203 (e.g., someone who reported that they notice birds in the morning and afternoon
204 would be given a score of 2). Those that answered 'I don't notice birds' were
205 given a score of zero. We created a third factor on gender (male/female).
206 Respondents were asked their age within a five-year window, we then developed
207 a fourth factor with ages pooled from 20 to 40 years, 40 to 60 years and >60
208 years. Finally we controlled for gross annual income by obtaining the 'expected'
209 income categories for each postcode in which respondents resided (Office for
210 National Statistics, Small Area Income Estimates 2007/08, Gov UK). These were
211 then included as a four-level factor.

212

213 **Statistical analyses**

214 All analysis was conducted in R 3.1.2 [41]. We did not find a difference in
215 responses between the two methods of data collection (coefficient = 0.02 ± 0.04
216 (SE), $p = 0.7$), so we pooled responses from each (Appendix A in S1 File) and
217 from the three towns. For any completed questionnaire, if any of the questions
218 were incomplete, then that respondent's question was removed from the
219 analysis. Generalized Variance Inflation Factors (GVIFs) were used to check for
220 multi-collinearity between factors, and found to be within acceptable norms,
221 with all GVIFs < 1.3 . To determine whether bird feeding activities, bird awareness,
222 age, gender and/or income were important predictors of answers to each of the
223 nine statements we used ordinal regression models using the 'ordinal' package
224 [42]. We then applied an Information Theoretic approach that simultaneously
225 evaluates hypotheses by balancing between model complexity and goodness of
226 fit [43]. We used the 'MuMIn' package [44] to produce all subsets of models
227 based on the global model and rank them based on AICc. Following [45], and to
228 be 95% sure that the most parsimonious models were maintained within the
229 best supported model set, we retained all models where $\Delta AIC_c < 6$. We then used

230 model-averaging to produce the average parameter estimates of each parameter
231 [43]. We used the 'HH' package to produce the Likert plots [46].

232

233 Based on the statements behind each motivation, we estimated which motivation
234 was the strongest driver of bird feeding (i.e. which motivation had the strongest
235 support). For each statement a score of 1 corresponded to strongly disagree, a
236 score of five to strongly agree. Where necessary we then reversed the scores of
237 statements so a high score always indicated support for bird feeding and/or
238 welfare. Answers from all nine statements were then pooled, before building a
239 mixed effects ordinal regression of the statement score (five level factor of one to
240 five) against whether the statement represented a psychological benefit, welfare
241 issue or orientation towards feeding birds (three-level factor). We controlled for
242 the actual level of bird feeding activities because people who feed birds are likely
243 to have stronger motivations for doing so. We included a unique ID for each
244 respondent as a random effect.

245

246 **Results**

247 **Respondents**

248 A total of 331 questionnaires were completed and used in the analysis (140 and
249 191 completed from each survey method, respectively). For the first survey
250 method we received a response rate of 94%. For the second survey method, 90%
251 agreed to participate in the survey, of these 87% completed the survey giving an
252 overall return rate of 78%. We found that 89% of respondents answered
253 strongly disagree or disagree to the statement 'I feed birds because my
254 neighbours do' (average score 1.4 ± 0.8 (SE)). Although this is not conclusive it
255 does indicate that people believed that they were acting independently and so
256 we deemed that surveying multiple households from the same street did not
257 confound the study. There was an over representation of female respondents
258 (56% compared to 51% in Buckinghamshire and Bedfordshire county's, 2011
259 Census) and of respondents over 60 years (42% compared to 28% in
260 Buckinghamshire and Bedfordshire county's, 2011 Census; Table Fa in S1 File).
261 We found that 83% of households put out bird food, with 72% of those feeding

262 birds doing so regularly (Table Fb in S1 File). The proportion of respondents
263 who put out food did not vary by season ($\chi^2 = 4.2$, $df = 3$, $p = 0.2$). People most
264 commonly noticed birds in the morning and evening ($\chi^2 = 5.7$, $df = 3$, $p < 0.0001$;
265 Fig 1a), while respondents tended to notice birds for different proportions of the
266 day ($\chi^2 = 86.9$, $df = 4$, $p < 0.0001$; Fig 1b) with only 29% of respondents noticing
267 birds at all times of day (Fig 1b; acknowledging that individual respondents
268 could score more than one period of the day). A logistic regression of feeding
269 regularity against age, showed that people were more likely to feed birds
270 regularly as they got older (estimate = 1.7 ± 0.4 (SE), $p < 0.0001$).

271
272

273 **Fig 1. Summary statistics from 331 respondents**, showing the proportion of:
274 a) respondents that noticed birds during different periods of the day and, b) the
275 proportion of the day that most people noticed birds.

276
277

278 **Motivations behind bird feeding activities**

279 Testing for assessed psychological benefits, we found that most people felt
280 relaxed and connected to nature when they watched birds in their garden (Table
281 1a-c, Fig 2). The feeling of being relaxed and connected to nature increased with
282 the level of bird feeding activities (Fig 2a), and in people who noticed birds for a
283 greater proportion of the day (Table 1a-c). The feeling of relaxation also
284 increased in respondents over 40 years old (Table 1a-c).

285

286 **Table 1. Ordinal regression of responses to three Likert statements as**
287 **components of each of three motivations behind why people feed birds**, a)
288 psychological benefits, b) welfare issues, or c) nature orientation. We show
289 model-averaged coefficients and standard errors in brackets. Given the ordinal
290 nature of the predictor variables the results show the outcome as compared to a
291 base factor level (shown in second row of table). The significance of factor levels
292 are shown as: * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.