An analysis of 15 years of trends in children’s connection with nature and its relationship with residential environment

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ABSTRACT

Introduction: We assessed recent trends in children’s connection with nature over the period of 2000–2015, using indices of wildlife awareness that focus on changes in wildlife abundance and the level of apathy among children. We used data from a survey conducted in 63 junior high school districts in the city of Sendai in Japan. In these surveys, children were asked whether they had seen 12 species groups within the past year. To examine changes in children’s connection with nature, we used observed frequencies as an indicator of both the abundance of the species and children’s apathy toward it.

Results and Discussions: Results indicated an increase in children’s apathy toward species that had low popularity regardless of residential environment. Our results suggest that regular exposure to wildlife would be effective in preventing the loss of children’s connection with nature, particularly by reducing children’s apathy toward less-popular species.

Introduction

Connecting with nature is extremely important for our physical and mental well-being (Chawla et al. 2014; Mustapa, Maliki, and Hamzah 2015; Sandifer, Sutton-Grier, and Ward 2015). People who have connected with nature or experienced natural environments tend to have a deeper understanding of biodiversity and exhibit pro-environmental behavior (Beery and Jørgensen 2016; Raudsepp 2005; Kais, Schumacher, and Montada 1999). Therefore, it is crucial to maintain and strengthen human connections to nature, particularly at an early age, to promote healthier living. Such communion with nature may also support the mainstreaming of biodiversity issues across society and help realize a more sustainable society that is harmonized with nature.

However, children in contemporary society have fewer opportunities to spend time in nature than previous generations (Driessnack 2009; Ministry of the Environment 2016; Louv 2005; Skår and Krogh 2009). Pyle (1993) termed the loss of intimate experience with the natural world the “extinction of experience,” predicting that this loss would breed apathy toward nature and inevitably further degrade the common habitat. The population concentration in urban area and changes in lifestyle and industrial infrastructure have led to reduced opportunities for contact with nature in daily life and consequently affect human–nature interactions (Ministry of the Environment 2018; Miller 2005; Soga and Gaston 2016). Moreover, the pressure of development and the change in forestry and agriculture in to modern manners have reduced the abundance of many species in Japan (Ministry of the Environment 2018). Many studies have focused on the lack of human connection with nature; however, research on long-term changes over recent decades remains limited.

Lin et al. (2014) suggested that the motivation to visit parks and interact with nature is driven more by an orientation toward nature than by opportunity; thus, without a positive orientation toward wildlife, the loss of awareness of species among children is inevitable, even for children living in wildlife-rich environments. The decline in abundances of wildlife is reducing the number of opportunities for children to encounter it in daily life, thus reducing the chances that children will become interested in it. The study focused on both of children’s apathy and wildlife abundance at the same time also remains limited. Here, we aimed to reveal the detail about manner of changes in children’s disconnection from nature.

In this study, we predict that two causes have led to children’s disconnect from nature: an increase in children’s apathy toward wildlife and environmental changes that reduce the abundance of wildlife. We also consider the residential environment of children. Human attitudes toward wildlife vary among species...
(Campos et al. 2012; Cox and Gaston 2015; De Pinho et al. 2014; Schlegel and Rupf 2010), but the residential environment also affects attitudes toward species and nature (Hinds and Sparks 2008; Shanahan et al. 2017; Shumway et al. 2014; Zhang, Goodale, and Chen 2014).

We developed two hypotheses: (1) the degree of increase in children’s apathy toward a species and decrease in its abundance varies among species due to their inherent characteristics, (2) nature-rich residential environments prevent both reductions in the abundance of wildlife and increases in children’s apathy toward wildlife species.

Materials and methods

Study area
We used data from a survey on familiar wildlife conducted by the city of Sendai, Japan. This city contains 1.08 million people in an area of 786.3 km² (Sendai City 2016) and is the largest city in the Tohoku region (northern Honshu Island). The city faces the Pacific Ocean in the east, and the Ou mountain range runs along its western border. Sendai harbors various ecosystems, such as coastline, paddy fields, urban areas, rivers, satoyama (outskirts of the countryside), and forests (primary, secondary, and plantation) (Figure 1). The city is divided into 63 junior high school districts, covering a wide range of environments. Because the population is concentrated in the central urban district, the junior high school districts in the central urban district are small, whereas forest ecosystems cover more than 90% of the area in western districts, and paddy fields cover up to 50% in eastern districts. A child’s school is determined by the district of their residence.

Survey design and questionnaire
We used data from a survey enquiring familiarity with wildlife (local flora and fauna) conducted in 2001, 2010, and 2015 by the local government of Sendai City. For each survey, the questionnaires were distributed to all public junior high school students in the class 1 (12- to 13-year-olds; the average number of students per class was approximately 30) and their families (parents in most cases, sometimes grandparents or siblings). Here, we only examine student responses. There were about 1800 respondents in total for each survey, which is equivalent to 20% of all students in Sendai of the same age (Sendai City 2016).

The respondents were asked if they had seen or heard 12 species groups within the past year (Appendix). The 12 species groups were: dandelions, frogs, swallows, cuckoos, fish, cabbage butterflies, swallowtail butterflies, fireflies, crickets, cicadas, dragonflies, and beetles. These 12 groups were chosen because they were thought to be familiar to most people and can be frequently observed (directly seen or heard) in typical residential environments. Most of the species are native to Japan, although the dandelion, frog, and fish groups may include alien species.

For each species group, respondents selected one answer from among three options: (A) yes, I have seen or heard it within a year, (B) no, I have not seen or heard it within a year, and (C) I don’t know. We assumed that children who chose (A) or (B) could identify the target species. On the other hand, we assumed that children who chose (C) lack interest in or knowledge of the species and were thus unaware of its existence.

We calculated observation and apathy indices for the 12 species groups for each school district and for each survey year. The observation index was the percentage of respondents who chose (A) among the total number of respondents.

Figure 1. The study area in the city of Sendai, Japan. The city area is divided into 63 junior high school districts. Six types of land use are shown.
respondents who chose (A) or (B). We used this index as a general proxy for the relative abundance of the species within the district during the survey years. The apathy index was calculated as the percentage of respondents who chose (C) among all respondents. We used this index as an indicator of apathy toward the species.

To calculate the indicator of residential environment, we used vegetation maps published by Sendai (Sendai City 2001, 2009, 2015). Because no significant land-use changes occurred among the three years during which the maps were created, we used the vegetation map of 2009 for our analyses. The categories used in the map were too detailed for our purposes; therefore, we combined the categories into six major types of land use: urban, natural forest (primary and secondary, mostly deciduous broad-leaved trees), tree plantation (conifers), water, paddy field, and cropland. We calculated the percentage of area in each district for each junior high school district using QGIS software (ver. 2.14.2). We used the percentages of each type of land use as environmental variables. We performed principal component analysis (PCA) to further integrate the environmental variables into a smaller subset of variables using R software ver. 3.3.1 (R Development Core Team 2016). We adopted the first and second principal component scores (PC1 and PC2) as indicators of the residential environment, as explained below in more detail.

Data analyses

Relationship between residential environment and observation/apathy
To examine the relationship between the residential environment and indices of observation/apathy, we applied multiple regression analyses. The observation and apathy indices for each species group were treated as response variables, and PC1 and PC2 (see above) were treated as explanatory variables.

Changes in observation/apathy over 15 years
To detect differences in the observation and apathy indices among survey years, we performed analysis of variance. For cases of statistically significant $P$ values, we conducted post-hoc multiple comparison analysis (Bonferroni method). To analyze trends over 2001–2015, we regressed the linear changes in observation and apathy indices using the least-squares method; the slope of the line was used as an indicator of the degree of change.

Relationship between residential environment and changes in observation/apathy over 15 years
Multiple regression analyses were conducted to determine which factors best explained changes in observation/apathy over 2001–2015. The response variables were the slopes of regressed changes in observation/apathy, and the explanatory variables were PC1 and PC2, extracted from the PCA of land-use patterns.

All analyses were conducted using R software ver. 3.3.1 (R Development Core Team 2016).

Results

Residential environment
The two primary axes of the PCA of land-use patterns explained 75.6% of the total variance (Figure 2). Values of PC1 increased with the percentage of urbanization in a district ($r = 0.99$, $P < 0.001$), while values of PC2 increased with the percentage of natural forest area ($r = 0.52$, $P < 0.001$) and plantation area ($r = 0.45$, $P < 0.001$) and decreased with the percentage of paddy ($r = -0.72$, $P < 0.001$), cropland ($r = -0.70$, $P < 0.001$), and water ($r = -0.72$, $P < 0.001$); thus, PC2 roughly represents a gradient of vegetation height.

Relationship between species groups and observation/apathy
The observation index considerably varied among species groups though apathy index did not vary greatly among species groups (with the exception of cuckoos and crickets), and values were generally low (Figures 3 and 4). Cuckoos and crickets exhibited higher values of apathy than other species groups.

Relationship between residential environment and changes in observation/apathy over 15 years
Multiple regression analyses were conducted to determine which factors best explained changes in observation/apathy over 2001–2015. The response variables were the slopes of regressed changes in observation/apathy.
and PC2 in all survey years (Table 1, left). Frogs, swallows, cuckoos, fireflies, and beetles were significantly negatively related to PC1 in all survey years; thus, the abundances of these species groups increased in suburban districts. On the other hand, swallows, cabbage butterflies, fireflies, cicadas, and beetles were moderately affected by PC2; thus, the observation of these species groups tended to increase in districts containing high vegetation such as natural or artificial (i.e., plantation) forest.

By contrast, the apathy index exhibited few correlations with environment, and no consistent trends were observed among survey years (Table 1, right).

**Changes in observation/apathy over 15 years**

The ANOVA results for the observation index indicated that 10 of the 12 species groups (excluding fireflies and beetles) varied in abundance among survey years (Table 2, left). Multiple comparison analyses for these 10 species groups indicated that observations of 5 tended to decrease (frogs, cuckoos, crickets, cicadas, and dragonflies) and those of 2 tended to increase (dandelions and cabbage butterflies) over the 15 years. Observations of dragonflies, cicadas, and crickets decreased the most over this time period (Figure 5).

The ANOVA results indicated that 6 of the 12 species groups (cuckoos, fish, crickets, cicadas, dragonflies, and beetles) varied on the apathy index among survey years (Table 2, right). Multiple comparison analyses revealed that observations of all 6 of these species groups tended to increase over the 15 years, particularly cuckoos and crickets (Figure 6).

**Relationship between residential environment and changes in observation/apathy over 15 years**

Changes (i.e., the regressed slope) in the observation index were significantly affected by the residential environment (PC1 or PC2) for cabbage butterflies, dragonflies, and beetles (Table 3, left). Cabbage butterflies, observations of which tended to increase over time (Table 2), were weakly negatively correlated with PC1 ($P < 0.05$) and strongly positively correlated with
PC2 ($P < 0.001$). Dragonflies, observations of which tended to decrease over time (Table 2), were positively affected by PC2 ($P < 0.001$). Beetles, observations of which did not exhibit a significant pattern over time (Table 2), were positively correlated with PC1 ($P < 0.05$).

Changes in the apathy index indicated that only fireflies were significantly affected by the residential environment and were negatively related to PC1 ($P < 0.05$) (Table 3, right).

**Discussion**

**Variation among species**

This study is the first to objectively document the decline of children’s connection with wildlife species, which appears to be caused by reductions in the abundances of wildlife and/or increases in children’s apathy toward them. In support of our first hypothesis, the degree of the reduction in abundance and the increase in children’s apathy varied among wildlife groups (Table 2). For cuckoos, crickets, cicadas, and dragonflies, changes in both abundance and apathy affected the loss of children’s connection with these species. The loss of connection to frogs appeared to only be affected by changes in its abundance.

The results of the observation index, which was a proxy for wildlife abundance, indicated that five species groups (frogs, cuckoos, crickets, cicadas, and dragonflies) have likely been declining since 2001. Several studies have documented recent decreases in the relative abundances of these species, including frogs (Katayama et al. 2015; Stuart et al. 2004; Suzuki, Okubo, and Sawahata 2001; Tsuji et al. 2011), cuckoos (BirdLife 2005; Douglas et al. 2010; Minegishi 2007; Vickery et al. 2014), and dragonflies, particularly the red dragonfly (Fukui 2012; Futahashi 2012; Jinguji 2012; Kasai et al. 2016). Our results are consistent with the findings of these previous studies. Although drastic land-use changes have not occurred in the study area since 2001, minor changes, such as the deterioration of cropland and forest due to abandonment and increases in exotic species, have likely been ongoing.

![Figure 4. Comparison of the apathy index among 12 species groups for each survey year. Boxplots represent medians (bold black horizontal line), and the first and third quartiles (box perimeters). The whiskers are 90th percentiles, and the small circles are outliers.](image-url)
We were unable to determine the factors causing declines in the observation and abundance of the two other groups (crickets and cicadas). However, in addition to the existence of declines in species abundance, it is also possible that children in contemporary society have fewer opportunities to encounter these species due to reductions in outdoor activities or are not mindful of observing the wildlife. Further investigation is regarded for this point.

By contrast, observations of other species groups, such as dandelions and cabbage butterflies, tended to increase (Table 2). The increased observations of dandelions may be related to the expanded distribution of an exotic dandelion, *Taraxacum officinale*, throughout the city, allowing children to readily encounter these plants. The increased observations of cabbage butterflies may be explained by the expanded distribution of its host plant (species of Brassicaceae) throughout the city. Considering the large number of exotic species belonging to Brassicaceae (Ministry of the Environment 2018), this explanation is plausible.

The patterns of change in the level of apathy toward species may be related to their popularity. Since 2001, children’s apathy clearly increased for six species groups (cuckoos, fish, crickets, cicadas, dragonflies, and beetles), while the remaining species groups (dandelions, swallows, cabbage butterflies, swallowtail butterflies, and fireflies) did not exhibit consistent trends (Table 2). Although we did not assess the popularity of each target species among the children in our study, several previous studies have examined humanity’s preferences or biophilia for these species groups. For example, Soga et al. (2016) conducted a survey in Japan targeting children aged 9–12 and observed that birds and butterflies were preferred over cicadas, dragonflies, and crickets. The NHK (Nippon Hoso Kyokai, or Japan Broadcasting Corporation) Broadcasting Culture Research Institute examined the favorite things of the Japanese people and reported that dandelions and swallows were on the top-ranking lists for favorite flower and bird species, respectively (NHK

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**Table 1. Results of multiple variable regression of the relationships between the observation/apathy index (%) and environmental factors (PC1 and PC2).**

|                | Observation (%) | Apathy (%) |
|----------------|----------------|------------|
|                | PC1 | PC2 | Adjusted R² | p-value | PC1 | PC2 | Adjusted R² | p-value |
| **2001**       |     |     |             |         |     |     |             |         |
| Dandelion      |    + |    + | 0.25        | 0.17    | −0.015 | 0.584 |
| Frog           |     |     | 0.275       | <0.001 ***| 0.033 | 0.136 |
| Swallow        |     |     | 0.133       | 0.005 **| 0.018 | 0.216 |
| Cuckoo         |     |     | 0.167       | 0.002 **| −0.027 | 0.841 |
| Fish           |     |     | 0.016       | 0.233    | 0.001 | 0.366 |
| Cabbage butterfly |    + |    + | −0.015      | 0.591 | 0.015 | 0.234 |
| Swallowtail butterfly |    + |    + | −0.029      | 0.875 | 0.052 | 0.075 |
| Firefly        |     |     | 0.288       | <0.001 ***| 0.087 | 0.024 |
| Cichlid        |     |     | −0.031      | 0.943    | −0.003 | 0.405 |
| Dragonfly      |     |     | 0.176       | 0.001 **| 0.127 | 0.006 **|
| Beetle         |     |     | 0.003       | 0.337    | −0.023 | 0.745 |
| **2010**       |     |     |             |         |     |     |             |         |
| Dandelion      |     |     | −0.020      | 0.674    | 0.052 | 0.074 |
| Frog           |     |     | 0.330       | <0.001 ***| −0.024 | 0.769 |
| Swallow        |     |     | 0.096       | 0.018 *| 0.008 | 0.294 |
| Cuckoo         |     |     | 0.125       | 0.007 **| −0.006 | 0.443 |
| Fish           |     |     | 0.004       | 0.001    | −0.014 | 0.575 |
| Cabbage butterfly |     |     | 0.066       | 0.048 *| −0.017 | 0.616 |
| Swallowtail butterfly |     |     | 0.304       | 0.051    | −0.026 | 0.805 |
| Firefly        |     |     | 0.262       | <0.001 ***| 0.032 | 0.142 |
| Cichlid        |     |     | 0.020       | 0.203    | −0.018 | 0.644 |
| Dragonfly      |     |     | 0.054       | 0.007 *| 0.009 | 0.017 **|
| Beetle         |     |     | 0.304       | 0.119    | −0.065 | 0.499 **|
| **2015**       |     |     |             |         |     |     |             |         |
| Dandelion      |     |     | 0.050       | 0.081    | 0.123 | 0.007 ***|
| Frog           |     |     | 0.490       | <0.001 ***| 0.011 | 0.272 |
| Swallow        |     |     | 0.131       | 0.005 **| 0.048 | 0.084 |
| Cuckoo         |     |     | 0.091       | 0.021 *| −0.004 | 0.421 |
| Fish           |     |     | −0.020      | 0.674    | 0.048 | 0.086 |
| Cabbage butterfly |     |     | 0.391       | <0.001 ***| 0.092 | 0.020 *|
| Swallowtail butterfly |     |     | 0.126      | 0.007 **| 0.061 | 0.057 |
| Firefly        |     |     | 0.217       | <0.001 ***| 0.027 | 0.163 |
| Cichlid        |     |     | 0.037       | 0.120    | −0.003 | 0.413 |
| Dragonfly      |     |     | 0.123       | 0.007 **| 0.050 | 0.081 |
| Beetle         |     |     | 0.166       | 0.002 **| 0.118 | 0.009 **|

*: + indicates that the observation/apathy index was positively affected by the environmental factors, while ‘−’ indicates negative effects. The symbols ‘++’, ‘+’ and ‘−’ represent the level of significance: <0.05, <0.01, and <0.001, respectively. Shaded rows are results that were not statistically significant.
In Switzerland, Schlegel and Rupf (2010) demonstrated that butterflies, birds, and most mammals are, on average, more highly appreciated than reptiles, insects (excluding butterflies) and amphibians. In addition, fireflies are also often a preferred species (Takada 2010, 2011, 2012) in Japan. Thus, the popularity of a species appears to prevent increases in children’s apathy toward it, maintaining an emotional connection between children and wildlife species.

**Effect of environment**

Our second hypothesis was not very well supported. In terms of changes in the observation index, or wildlife abundance, only three species were significantly related

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### Table 2. Results of analyses of variance and multiple comparison analyses (Bonferroni method) of the relationships between the observation/apathy index (%) and survey year. The Bonferroni method was only used for cases involving a statistically significant difference in the mean value of the observation/apathy index between different survey years.

| Species                  | Observation (%) | Apathy (%) |
|--------------------------|-----------------|------------|
|                         | ANOVA | Bonferroni | ANOVA | Bonferroni |
| Dandelion                | 8.62  | <0.001*** | 2.35  | 0.098     |
| Frog                     | 6.90  | 0.001***  | 1.00  | 0.372     |
| Swallow                  | 24.14 | <0.001*** | 0.88  | 0.418     |
| Cuckoo                   | 5.96  | 0.003***  | 99.42 | <0.001*** |
| Fish                     | 3.40  | 0.036      | 3.75  | 0.025*    |
| Cabbage butterfly        | 14.18 | <0.001*** | 0.31  | 0.737     |
| Swallowtail butterfly    | 21.68 | <0.001*** | 2.24  | 0.109     |
| Firefly                  | 0.29  | 0.75       | 3.02  | 0.051     |
| Cricket                  | 41.10 | <0.001*** | 39.86 | <0.001*** |
| Cicada                   | 188.73| <0.001*** | 16.99 | <0.001*** |
| Dragonfly                | 401.74| <0.001*** | 13.93 | <0.001*** |
| Beetle                   | 3.03  | 0.036      | 3.38  | 0.036*    |

“+” indicates that the awareness/unknown (%) increased and “–” indicates decreased values. The symbols “*”, “+”, and “–” represent levels of significance: <0.05, <0.01, and <0.001, respectively. Shaded rows are results that were not statistically significant.

### Figure 5. Comparison of the slope of change in the observation index among 12 species groups. Boxplots represent medians (bold black horizontal line), and the first and third quartiles (box perimeters). The whiskers are 90th percentiles, and the small circles are outliers. Positive values indicate increased values of the observation index, and negative values indicate decreased values.
to the residential environment (Table 3, left). Moreover, only children’s apathy toward fireflies was significantly associated with environment (Table 3, right). Based on these results, we suggest that reductions in both the abundance of wildlife and children’s apathy may occur throughout the entire city. In other words, all children in contemporary society are at risk of losing connections with wildlife species, regardless of their residential environment.

Although our second hypothesis was not strongly supported, there was clear evidence that children who live in the district of not urbanized forest rich districts have a stronger direct connection with nature. Highly urbanized districts were significantly negatively related to the observation index for five species (frogs, swallows, cuckoos, fireflies, and beetles) (Table 1). In suburban districts, children likely have more opportunities to observe these species groups, perhaps due to their higher abundances. For example, fireflies and beetles (particularly Japanese rhinoceros beetles and stag beetles, which were target species in this study) generally live in rice paddies or copses and are rarely observed in urbanized areas (Hongo 2012; Kazama et al. 2007; Ohbayashi 2010; Picchi et al. 2013). The low observation indices for cuckoos, fireflies, and beetles (Figure 3) also support the potential for low abundances of these species groups. Daily exposure to these species would help children maintain a direct connection with wildlife. Thus, it is

**Figure 6.** Comparison of the slope of change in the apathy index among 12 species groups. Boxplots represent medians (bold black horizontal line), and the first and third quartiles (box perimeters). The whiskers are 90th percentiles, and the small circles are outliers. Positive values indicate increased values of the apathy index, and negative values indicate decreased values.

**Table 3.** Results of multiple variable regression of the relationships between the slope of change in the observation/apathy index (%) and environmental factors (PC1 and PC2).

| Species                  | Observation (%) | Apathy (%) |
|--------------------------|-----------------|------------|
|                          | PC1  | PC2       | Adjusted $R^2$ | p-value | PC1  | PC2       | Adjusted $R^2$ | p-value |
| Dandelion                | 0.028 | 0.162     |              |          | 0.002 | 0.348     |              |          |
| Frog                     | 0.021 | 0.197     |              |          | −0.031 | 0.941     |              |          |
| Swallow                  | −0.030 | 0.899     |              |          | 0.002 | 0.349     |              |          |
| Cuckoo                   | −0.004 | 0.421     |              |          | 0.009 | 0.287     |              |          |
| Fish                     | 0.018 | 0.220     |              |          | 0.018 | 0.215     |              |          |
| Cabbage butterfly        | +++ |              | 0.215         | <0.001** | 0.028 | 0.160     |              |          |
| Swallowtail butterfly    | +++ |              | 0.031         | 0.143    | 0.007 | 0.307     |              |          |
| Firefly                  | 0.004 | 0.332     |              |          | −0.011 | 0.512     |              |          |
| Cricket                  | −0.011 | 0.514     |              |          | −0.011 | 0.512     |              |          |
| Cicada                   | 0.000 | 0.376     |              |          | 0.044 | 0.098     |              |          |
| Dragonfly                | +++ |              | 0.152         | 0.003**  | 0.060 | 0.058     |              |          |
| Beetle                   | +   |              | 0.069         | 0.044*   | 0.006 | 0.310     |              |          |

* “+” indicates that the slope of change in the observation/apathy index was positively affected by the environmental factors and “−” indicates negative effects. The symbols “+++,” “++,” and “+” represent levels of significance: <0.05, <0.01, and <0.001 respectively. Shaded rows are results that were not statistically significant.
crucial to conserve wildlife species and their habitats to nurture the connection between children and wildlife as well as nature in general.

Conclusion

In this study, we assessed recent trends in children’s connection with nature over the period of 2000–2015, using indices of wildlife awareness that focus on changes in wildlife abundance and the level of apathy among children. Results indicated an increase in children’s apathy toward species that had relatively low popularity, such as insects, regardless of residential environment. The abundance of several species also appeared to be declining throughout the city. By this work, we suggest that regular exposure to wildlife would be effective in preventing the loss of children’s connection with nature, particularly by reducing children’s apathy toward less-popular species.

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Appendix. Did you see or hear these wildlife species within the past year in Sendai? Do not count what you saw or heard in pet shops or facilities where wildlife is housed for exhibition

| Wildlife Species                   | Yes, I saw or heard it | No, I didn't see or hear the sound of it | I don't know |
|-----------------------------------|------------------------|----------------------------------------|--------------|
| Dandelions                        | 1                      | 2                                      | 3            |
| Swallowtail butterflies           | 7                      | 8                                      |              |
| Frogs                             | 2                      | 3                                      |              |
| Swallows                          | 3                      | 4                                      |              |
| Fireflies                         | 8                      | 9                                      |              |
| Crickets (Umaoi)                  | 9                      | 10                                     |              |
| Fish                              | 5                      | 6                                      |              |
| Cabbage butterflies               | 6                      | 7                                      |              |
| Cuckoos                           | 4                      | 5                                      |              |
| Cicadas                           | 10                     | 11                                     |              |
| Dragonflies                       | 11                     | 12                                     |              |
| Beetles                           | 12                     |                                        |              |

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