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Birds are valuable: the case of vagrants

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ABSTRACT

Biodiversity values need to be appropriately quantified and thence incorporated in future land development decisions. We assessed the economic and conservation-fundraising potential of vagrant Aleutian Terns in New South Wales, Australia. We found that an estimated 375–581 birdwatchers travelled far (580 ± 522 km [mean ± SD]) and reacted quickly (22% of visits were within the first week and 47% within the first two weeks) to see Aleutian Terns in an area where they had never been seen. We estimated that the total expenditure of these birdwatchers ranged from ∼ $199,000–$363,000 AUD and we further estimated that birdwatchers would have been cumulatively willing to donate upwards of $30,000 AUD to a non-governmental conservation organisation in order to have viewed the terns. These results suggest that birdwatchers highly value vagrant birdwatching and conservation campaign potential should be explored in future long-staying vagrant bird occurrences.

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Introduction

Measuring the economic contribution of wildlife observed for recreation, or nature-based tourism, is one way in which biodiversity can be valued (e.g. Kim & Park, 2017; Maille & Mendelsohn, 1993; Menkhaus & Lober, 1996) and thus accounted for as a forgone opportunity cost resulting from land development. Nature-based tourism also offers potential to educate the public about conservation issues (Orams, 1995, 1997) and generate conservation funding (Hvenegaard, 2002; McFarlane, 1994). However, the value of wildlife watching in this regard is poorly understood (Booth, Gaston, Evans, & Armsworth, 2011). Within the nature-based tourism field, one of the fastest growing subsectors is avitourism, or birdwatching tourism (Steven, Morrison, & Castley, 2015).

Birdwatching has its origins in everyday recreation that has grown into a significant attraction for travel (Dooley, 2007; Moss, 2004), making it an excellent model for understanding the value of wildlife. Birdwatchers spend a lot of money at single sites (Eubanks, Kerlinger, & Payne, 1993; Gürlük & Rehber, 2008; Hvenegaard, Butler, & Krystofiak,

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1989), during single breeding seasons (Czajkowski, Giergiczny, Kronenberg, & Tryjanowski, 2014), at bird festivals (Kim, Scott, Thigpen, & Kim, 1998; Measells & Grado, 2007), and across regions (Eubanks & Stoll, 1999). In 1990, a study found that the average birdwatcher spent $1,884 annually on binoculars, field guides, transportation, accommodation, and food (Kerlinger & Wiedner, 1990) – about $3,500 when accounting for inflation, at the time of writing. Birdwatchers are also conservation aware (Booth et al., 2011; Hvenegaard, 2002; McFarlane, 1994), which could translate to conservation funding potential (Steven, Smart, Morrison, & Castley, 2017).

Birdwatchers are generally well-educated and committed to their hobby (Connell, 2009; Kim, Keuning, Robertson, & Kleindorfer, 2010; Ṣekercioğlu, 2002), ranging from occasional birdwatchers to committed specialised birdwatchers (Eubanks, Stoll, & Ditton, 2004; Hvenegaard, 2002; McFarlane, 1994; Scott, Ditton, Stoll, & Eubanks, 2005), some of whom even treat birdwatching as a sport (Sheard, 1999). Avid birdwatchers will 'chase' vagrant birds (i.e. birds outside their usual species distribution; Dooley, 2005). These vagrant occurrences are notoriously difficult to quantify because they predominantly occur in remote natural places; are unpredictable; require intensive monitoring by someone at the site; and they are transient, ranging in duration from minutes to months. As a result, there are relatively few instances of quantification of these vagrant birdwatching events and their interaction with the birdwatching community.

The primary aim of this study was to assess the sociodemographic and economic expenditure of avitourists by focussing on a case study involving birdwatchers travelling to view vagrant Aleutian Terns (*Onychoprion aleuticus*) in Australia. To collect sociodemographic and economic data, we surveyed a sample of birdwatchers who travelled to observe the birds, and estimated the total number of birdwatchers who participated in the event. We then adapted the individual travel cost method (Burt & Brewer, 1971) to estimate the total economic value of the event. Lastly, we estimated the potential conservation value by assessing potential monetary donations that birdwatchers would have been prepared to donate to see the species.

Methods

Study site and species

Aleutian Terns breed in Alaska (USA) and east Siberia (Russia), spending the austral summer in the North Pacific, and in parts of Indonesia (North, 2013). They were first recorded on the north coast of New South Wales, Australia at Old Bar, on 4 December 2016, but only positively identified from photographs in October 2017. On 11 December 2017, Aleutian Terns were spotted at the same site (31° 57′ 8.6004″ S, 152° 36′ 7.3332″ E), which was announced with photos on social media. Old Bar is a small coastal community with a population of approximately 4,400 people, with a median age of 48, and a median weekly household income of $917 AUD (Australian Bureau of Statistics, 2016).

Survey data

We collected survey data from birdwatchers who visited the terns, with survey questions delineated into four categories: (1) sociodemographic characteristics (e.g. age, sex, education, marital status), (2) visit details (e.g. motivation, time-spent, whether they car-pooled, number of other bird watchers present during their visit, whether they submitted an eBird record), (3) birdwatching habits (e.g. holiday birdwatchers, level of commitment), and (4) conservation potential (e.g. monetary donation). Because we were unable to conduct surveys on-site, the survey was shared on various social media platforms (e.g. Twitter, Facebook, birding listservs) and shared through newsletters of local bird clubs. The survey questions were developed based on previous research (e.g. Callaghan et al., 2018; Czajkowski et al., 2014) and by testing birdwatchers who did not see the Aleutian Tern. The surveys were collected through an online platform (i.e. google forms), between 20 January and 18 March 2018. We received a total of 204 responses. Full survey questions, as well as code and data to reproduce the analysis can be found here: https://zenodo.org/record/2658848.

Total number of visitors

Due to the relatively remote location of the study site, we did not directly count or sub-sample the numbers of birdwatchers. Instead, we estimated the number of people who visited the birds during their period of residency, using two methods. Firstly, we interrogated the eBird database (Sullivan et al., 2009) to determine the total number of records submitted for the Aleutian Tern and divided this by the proportion of survey respondents who reported that they submitted eBird records. Secondly, we summed the maximum number of birdwatchers present on each day that was reported by surveyed observers.

Economic value

We used the travel cost method (TCM), to value recreation services that are not bought or sold (Clawson & Knetsch, 1966; Ward & Beal, 2000). The premise of the method is that despite there being no price tag for a given recreation service (or, in our case, a specific event), the costs incurred by individuals travelling to the site provide an estimate of economic value (Špaček & Antoušková, 2013). Specifically, we used the individual TCM (Burt & Brewer, 1971) which determines the average amount that an individual paid to visit a site. We used the adjusted mean expenditure by an individual, as opposed to developing an elasticity curve to estimate the total surplus of the site (Špaček & Antoušková, 2013). This individual expenditure was adjusted using regression analysis, based on sociodemographic variables collected, and this allows for extrapolation to a larger population (see regression details below).

Postcodes identified origins of individuals, which were used to estimate the distance and travel time to the site, calculated using the 'gmapsdistance' package (Melo & Zarruk, 2017) in the R statistical environment (R Core Environment, 2017). The gmapsdistance package is an interface for google maps, and it returns the estimated distance driven in addition to the estimated travel time. An individual's travel cost ($N = 199$) was the product of their return distance and the standard cost of operating an automobile ($0.66 per km, Australian Taxation Office, 2017). Any estimate of money spent on accommodation was also included in the total travel cost estimate. Most individuals made only one trip ($n = 169$) and separate contribution estimates were made for those that travelled more than once. Only 8% of respondents travelled by air ($n = 17$), and so we treated them the same as other individuals in the analysis (i.e. distance was calculated in the same manner, based on automobile travel). For individuals who car-pooled, their individual travel costs were divided by the number of people in the vehicle. Incorporating travel time in travel cost methods is a debated topic (e.g. Cesario, 1976; Czajkowski, Giergiczny, Kronenberg, & Englin, 2015) and accordingly, we estimated cost including and excluding the time taken to travel to the site. For inclusion of travel time, we valued time at half of the average hourly wage rate ($31.04, a 38-hour work week, Australian Bureau of Statistics, 2017).

Both of the travel cost specifications (including and excluding travel time) were regressed against seven explanatory variables which included: sex, age, employment status, education, marital status, whether an individual car-pooled, and whether an individual stayed overnight. For some sample data ($n \leq 13$ depending on the variable), individuals did not fully respond and so we imputed missing data, using the Hmisc package (Harrell, 2018). We employed a generalised linear model with a normal distribution, after log-transforming the response variables. We then used the 'fitted.values' function in R to extract the adjusted values based on the model's fit, which represented the adjusted expenditure per individual.

Results

Number of visitors

We received 204 survey responses of which 199 were suitable for analyses (i.e. respondent > 18 years old). Most respondents (99%) successfully observed the Aleutian Terns, with 60 (30%) reporting that they submitted their observation to eBird. According to the eBird database, 113 unique individuals submitted records of the Aleutian Terns to eBird. Based on this response rate, we estimated that 375 individuals travelled to observe the Aleutian Terns (i.e. $\sim 113 \times 1/0.3$). Our second estimate was 581 individuals, representing the sum of the maximum number of birdwatchers reported per day, for each day a respondent to our survey travelled to the site, 11 December – 12 March 2018.

Trip details

For the 199 suitable survey respondents, the average one-way distance travelled (mean ± SD) was 580 ± 522 km. Only 4% of trips were < 100 km, while 56% of trips were < 500 km, and 18% of trips were > 1000 km (Figure 1). The more frequent distances travelled coincided with birdwatchers travelling from large cities, such as Sydney and Brisbane. For most respondents (83%, $n = 165$), the birds were the sole reason for the trip. Most birdwatchers (85%, $n = 170$) went to see the birds once, while 13% went twice and only 2% went three or more times. Numbers of visitors decreased over time (Figure 2), with 22% of visits within the first week, while 47% of visits were within the first two weeks.

Sociodemographic influences on travel costs

The mean age of a birdwatcher was 52 ± 16 years (mode = 65), and 75% ($n = 150$) of birdwatchers were male and 25% female. No sociodemographic variables (i.e. age group, sex,

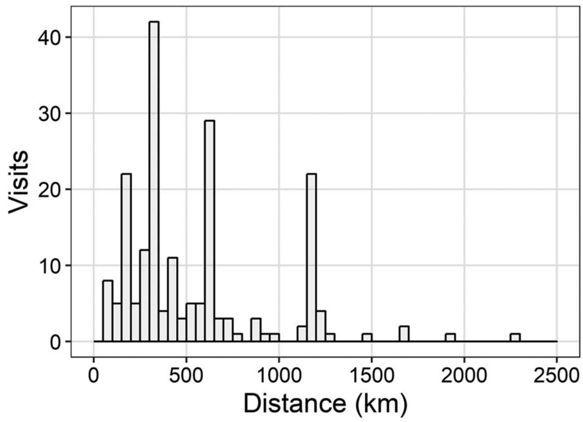

Figure 1. Estimated distances travelled by 199 birdwatchers to see Aleutian Terns. Distance represents driving distance, calculated using the gmapsdistance package in R based on responses to the survey.

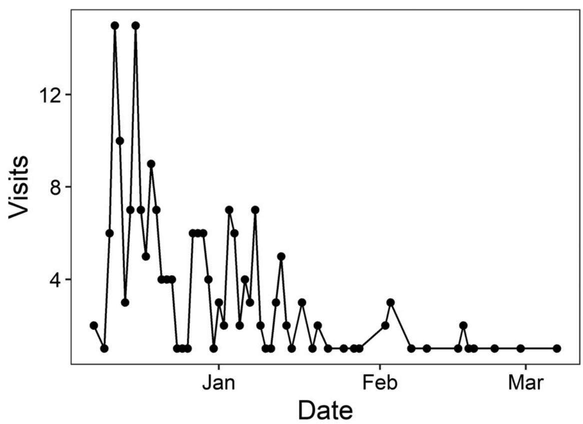

Figure 2. The number of birdwatcher visits over time to see vagrant Aleutian Terns, first reported on 11 December 2018. Surveys were completed on 12 March 2018.

marital status, employment status, or education level) were significant in the regression analysis for the two travel cost models (Table 1). As expected, travel costs were significantly higher for individuals who stayed overnight and/or did not car-pool (Table 1). Accordingly, the adjusted individual travel cost (see below) incorporated the variation among these various sociodemographic variables.

Economic impact

The adjusted individual travel cost, after modelling to incorporate sociodemographic variables, was $624 including travel time, or $532 when travel time was excluded. Given an estimated 375–581 birdwatchers visited the terns, the total economic value of the event was between $234,089 and $362,891, when including travel time or between $199,353 and $309,043 when not including travel time. Additionally, most birdwatchers (92%)

Table 1. Regression results for generalised linear models which treated an individual's total travel cost as the response variable, including demographic and travel variables as explanatory variables.

	Model results without time incorporated				Model results with time incorporated			
Coefficients	Estimate	Std.Error	*t*-value	Pr(>|*t*|)	Estimate	Std.Error	*t*-value	Pr(>|*t*|)
(Intercept)	6.186	0.495	12.491	<0.0001	6.309	0.477	13.228	<0.0001
Overnight stay – Yes	1.150	0.107	10.767	<0.0001	1.092	0.103	10.615	<0.0001
Sex – Male	0.129	0.126	1.020	0.309	0.144	0.121	1.183	0.238
Marital status – Married	−0.299	0.412	−0.724	0.470	−0.304	0.397	−0.765	0.445
Marital status – Single	−0.258	0.418	−0.617	0.538	−0.253	0.402	−0.628	0.531
Marital status – Widowed	−0.859	0.567	−1.516	0.131	−0.820	0.546	−1.501	0.135
Employment status – Employed – part time	−0.107	0.213	−0.504	0.615	−0.086	0.205	−0.419	0.676
Employment status – Retired	0.073	0.168	0.431	0.667	0.083	0.162	0.511	0.610
Employment status – Self-employed	0.048	0.160	0.300	0.764	0.039	0.154	0.253	0.801
Employment status – Student	−0.433	0.239	−1.817	0.071	−0.378	0.230	−1.646	0.101
Employment status – Unemployed	−0.026	0.361	−0.071	0.944	−0.015	0.348	−0.044	0.965
Education – Other	−0.019	0.321	−0.059	0.953	−0.027	0.309	−0.087	0.931
Education – Postgraduate	−0.001	0.153	−0.004	0.997	0.009	0.148	0.062	0.951
Education – University	−0.007	0.164	−0.043	0.966	0.007	0.158	0.042	0.967
Age group – 35–50	−0.095	0.177	−0.535	0.593	−0.091	0.170	−0.537	0.592
Age group – 51–65	−0.209	0.173	−1.206	0.229	−0.210	0.167	−1.256	0.211
Age group – 66+	−0.197	0.223	−0.886	0.377	−0.192	0.215	−0.894	0.373
Car-pool – Yes	−0.738	0.105	−7.016	<0.0001	−0.581	0.101	−5.730	<0.0001
Null deviance:	195.914 on 198 degrees of freedom				168.024 on 198 degrees of freedom			
Residual devience:	82.495 on 181 degrees of freedom				76.522 on 181 degrees of freedom			

Notes: The intercept is the reference level for each categorical predictor (i.e. Overnight stay – No; Sex – Female; Marital status – Divorced; Employment status – Employed – full time; Education – High school; Age group – 18–34; Car-pool – No).

were willing to donate $5 to conservation to see the bird, while 79% were willing to donate $25 and 36% were willing to donate $100 (Figure 3). Assuming this pattern holds true for the overall population of visitors (375–581), then there was the potential to fundraise between $19,712–$30,559 for conservation.

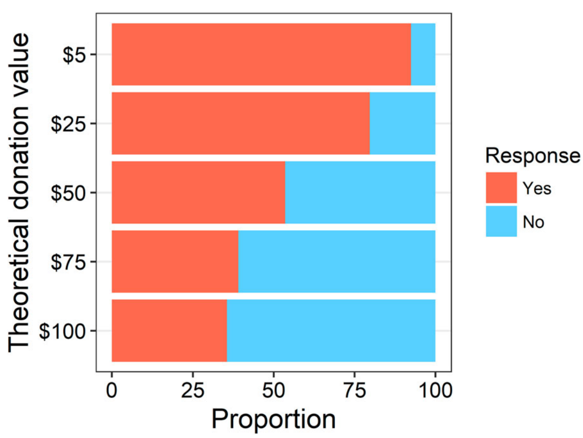

Figure 3. The theoretical donation values $5, 25, 50, 75, 100 and the proportion of birdwatcher respondents who would be willing to pay the values if they went to a non-governmental organisation for conservation purposes.

Discussion

In travelling to see vagrant Aleutian Terns, birdwatchers generated between $199,000 and $363,000 of economic activity. These broad estimates are likely conservative, given additional birdwatchers likely visited the site without being recorded. These estimates contribute to the growing understanding of the high value that birdwatchers place on vagrant birds, coinciding with significant economic value (e.g. Booth et al., 2011; Callaghan et al., 2018) which adds to the overall economic contribution by birdwatchers (Kolstoe & Cameron, 2017; Steven, Castley, & Buckley, 2013; Steven, Morrison, & Castley, 2017). Importantly, birdwatchers visiting the site would have donated between $19,000 and $30,500 to conservation, highlighting an opportunity for fundraising (Steven et al., 2013). Together, these results reinforce the importance of including birdwatchers' values into Cost Benefit Analyses (CBA) of planning decisions that affect potential habitat for birds.

The scope of future research is broad as vagrant birds are popular to birdwatchers, reflected in websites (e.g. http://blog.aba.org/category/abarare; https://www.rarebirdalert.co.uk) and books (e.g. Dymond, Fraser, & Gantlett, 2010; Howell, Lewington, & Russell, 2014) dedicated to summarising the historical significance of vagrant bird events. It is also a global phenomenon, occurring throughout the year, varying in duration, location, and rarity of vagrant species, presumably accounting for variation in visitor numbers (Booth et al., 2011). Given the relative frequency with which vagrant birds appear (e.g. Davis & Watson, 2018), local communities and businesses could cater to birdwatchers, offering additional birding opportunities. Future work should look to focus on the local-scale economic benefits of vagrants, possibly focusing on known birdwatching 'hotspots' for vagrants. This understanding should then be balanced against other forms of 'economic development'. For instance, Broome (a major hotspot for vagrants in Australia) is continuously under pressure for extractive resources industry (Syme Marmion & Co., 2010), but this should be balanced against any economic input of vagrant birds, and nature-based tourism more broadly. Increased economic value of these events, particularly if businesses understand their origin, may engender an increased commitment by businesses to conserve birds and their habitats (e.g. Orams, 1995).

More broadly, rare species excite the general public (Angulo & Courchamp, 2009; Gault, Meinard, & Courchamp, 2008; Verissimo, MacMillan, & Smith, 2011), highlighting the importance of quantifying this attraction. Similarly, other environmental assets command economic value that is quantified, such as whales (Rowat & Engelhardt, 2007; Valentine, Birtles, Curnock, Arnold, & Dunstan, 2004), coral reefs (Carr & Mendelsohn, 2003), and large mammals (Abrieu, Grünewald, Martín-López, Schleuning, & Böhning-Gaese, 2017). However, the notion of rarity in this study (i.e. a bird outside its usual distribution) contrasts with the traditional definition of rarity of most other studies (i.e. uncommon, scarce, or infrequently encountered species). Predicting how the public values biodiversity and how to manage these values is clearly complicated. Sometimes, rare species (i.e. uncommon, scarce, or infrequently encountered species) are under threat, but this is not necessarily linked with the notion of rarity as judged by birdwatchers, highlighting the potential sustainability of birdwatching as a nature-based tourism activity.

Despite the positives of nature-based tourism, with regard to conservation awareness (Orams, 1995, 1997) and potential fundraising (Callaghan et al., 2018), there are also negative effects (Green & Giese, 2004; Jones & Nealson, 2005; Zhang, Shi, Huang, & Liu, 2017). Many vagrant bird sightings can be associated with negative environmental behaviours (Booth et al., 2011; Steven, Pickering, & Castley, 2011), and the competitive nature of birdwatchers is evident in some instances where individuals prioritise seeing the bird rather than the birds' welfare (Copping, 2011; Goodfellow, 2017). For example, birdwatchers, and sometimes non-birdwatchers, have been known to trespass and trample on sensitive vegetation in order to see a rare or exciting species (Booth et al., 2011; Neilson, 2019). In the case of the Aleutian Terns at Old Bar, birdwatchers reportedly impacted the nearby Little Tern (*Sternula albifrons*) nesting colony by walking through fenced-off areas (S. Gorta pers. com.). But policing and mitigating these negative behaviours is difficult. In some instances, birdwatchers may police each other, evidenced by public 'shaming' on blogs and websites (e.g. https://commonbynature.co.uk/2017/09/21/birders-behaving-badly/; http://www.birdchick.com/blog/2012/02/documenting-bad-behavior-of-birders-photographers). In other instances, it may be up to local land managers to regulate potential disturbances from birders as well as other recreational users. In the case of Old Bar, a partnership of local land managers erected more signage, extended fences to help protect nesting shorebirds, increased media awareness of the nesting and threatened rare birds, and increased local ranger presence, in an attempt to mitigate potential threats for the nesting shorebirds (MidCoast Council, pers. comm.). Yet the efficacy of these approaches needs to be assessed.

Our example showed the significant economic value of vagrant Aleutian Terns visiting Australia. There are also obvious carbon footprint costs of birdwatchers' travel which need to be balanced against the fundraising potential for conservation. Local bird groups or non-governmental organisations could promote carbon-offset programmes to birdwatchers that chase vagrant birds. We also demonstrated the willingness of birdwatchers visiting vagrant birds to contribute to conservation, potentially providing an offset for negative impacts, but this aspect of vagrant birdwatching deserves more research. Understanding how people value such wildlife is important to understand. Conservation of birds is achieved by both taking positive steps to enhance a species' survival prospects and by diminishing the annexation of land for human development. We can support arguments for reducing habitat destruction by demonstrating the full benefits of birds, including economic benefits.

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No potential conflict of interest was reported by the authors.

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