Article Title: The conservation and economic potential of vagrant birdwatching

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Abstract.

There is increasing recognition that the world's ecosystems offer valuable direct and indirect economic services to humanity. Despite this growing recognition, there is generally poor application of economic environmental value into conservation decision-making because of limited data. Consequently, uncosted environmental values are often discounted in favor of costed development. Avitourism has a recognized economic value, sometimes driven by the occurrence of individual rare birds whose economic value remains largely unknown. Using the travel cost method in a readily-quantifiable environment, we estimated that a vagrant Black-backed Oriole in Pennsylvania, United States of America, accounted for about $223,000 USD or about $3,000 per day over 67 days. A subset of birdwatchers value rare birds, contributing significant time and financial resources to their viewing. Such significant real economic value from avitourism, one of the faster growing sectors of ecotourism, should be incorporated into conservation decision-making.

Introduction.

Birdwatching tourism or avitourism (Steven et al. 2015) is one of the faster growing sectors of ecotourism, potentially generating significant conservation income (Ṣekercioḡlu 2002). For instance, Point Pelee National Park, Canada generated $3.2 million USD of local income (Hvengaard et al. 1989), while five birdwatching sites in the USA each generated $2.4-$40 million USD (Ṣekercioḡlu 2002). Understanding what motivates birdwatchers' travel is critical for estimating the financial benefits of avitourism (Steven et al. 2015) which could support adequate cost benefit analyses for developments that might affect conservation of ecosystems.

Birdwatchers are motivated to view birds based on endemism, diversity, and rarity (e.g., McFarlane 1994, McFarlane & Boxall 1996, Scott et al. 2005), potentially positively and negatively impacting avian communities (e.g., Jones & Nealson 2005). In so doing, they contribute to local economies (e.g., Hvenegaard et al. 1989, Measells & Grado 2007, Lawton 2009, Biggs et al. 2011). Most of our current understanding is based on birdwatching at specific sites (e.g., Hvenegaard et al. 1989, Kerlinger & Brett 1995, Gürlük & Rehber 2008), regions (e.g., Burger et al. 1995, Kim et al. 2010), bird festivals (e.g., Isaacs & Chi 2005, Kim et al. 1998), or bird-events (e.g., migration: Eubanks et al. 1993; communal roosting: Clark 1987; breeding: Czajkowski et al. 2014). No studies have quantified the economic value of birdwatching for an individual, rare bird.

People value 'rare' species (Angulo & Courchamp 2009, Booth et al. 2011), as well as overall biological diversity (Fuller et al. 2007). For example, the public valued rare more than common species, using online photographs (Angulo & Courchamp 2009). To what extent people value rarity is poorly understood (Booth et al. 2011), primarily dependent on estimations of a traditional definition of rarity (i.e., very uncommon, scarce, or infrequently encountered species; e.g., Courchamp et al. 2006, Gault et al. 2008, Angulo & Courchamp 2009). We specifically focused on a different definition: a species observed outside its normal geographic range (where it may be abundant; *sensu* Booth et al. 2011) – i.e., a vagrant.

Birdwatchers vary, ranging from casual to dedicated, with varying levels of experience (McFarlane 1994, Hvengaard 2002, Scott & Thigpen 2003). Some specialized birdwatchers competitively aim to develop the most extensive list for a specific geographic location. These 'listers' or 'twitchers' (Booth et al. 2011) often travel great distances, expending significant resources to see rare and/or vagrant birds. Many vagrant birds occur in natural, sometimes remote areas (i.e., parks and wildlife refuges), which makes it difficult to quantify their economic contribution (e.g., number of birdwatchers) to local communities. The transient nature of vagrants also compounds this problem, leading to a paucity of studies. In one exception, rarity of birds in the United Kingdom was positively correlated with the number of birdwatchers and the distance they travelled - simple measures of value (Booth et al. 2011). We quantified the economic value of a birdwatching event, using a unique dataset, generated by the occurrence of a vagrant Black-backed Oriole (*Icterus abeillei*), observed by 1,824 birdwatchers in a suburban backyard in Pennsylvania, USA.

Methods.

Study site and species

The oriole was initially photographed on January 26th, 2017 visiting a bird feeder in a backyard (40.33278, -76.03826) in rural Berks County, Pennsylvania, USA. This species is endemic to Mexico, and this record represented only the second occurrence in the United States (ABA Blog 2017). The previous record (San Diego, California) was rejected by the official listing committee of California, deemed an escapee, rather than a vagrant (ABA Blog 2017), making this Pennsylvania individual particularly appealing to many birdwatchers. Its location was advertised 7 days later to the birdwatching community, after which birdwatchers travelled to see the bird. Unusually, the homeowners kept a logbook of birdwatchers and their origins (cities and states), until the oriole was last seen on April 10th, 2017.

Data analysis

We estimated the economic value of the event, using the zonal travel cost method (Morrison 2009, Czajkowski et al. 2014), which identifies the travel cost based on the proportion of people visiting a site from different distances. First, we defined ‘origin zones’, as counties from which visitors originated. For each origin (i.e., city/state combination), we calculated mid-point coordinates (https://www.gps-coordinates.net/), which were then pinned to the midpoint of their county. We then calculated the return distance to the bird’s location, from each county. A double log regression model was used to estimate the trip generation function, where the response variable was the number of visitors per 1000 population in each zone, with the travel cost as the explanatory variable. Population data for each county were calculated using the “USA Counties” GIS layer (ESRI 2017), with travel cost based on the standard cost of operating an automobile (i.e., variable vehicle cost) and the cost of time (McConnell & Strand 1981). The standard operating cost for operating an automobile was set at 23.69 cents USD per km (AAA 2016) and an average speed of 104.61 kilometers/hour was used to calculate time spent for the trip. The opportunity cost of time was valued at half the hourly wage rate for the United States in February ($13.05; Bureau of Labor Statistics 2017). We then used hypothetical entry fees ($0 - $100, in increments of $10) to determine the number of theoretical visitors at each price. The number of visitors at each price point were used as inputs to calculate a demand curve to estimate the total consumer surplus of the oriole, determined as the area under the curve. Given the debate over the incorporation of the opportunity cost of time into travel cost methods (e.g., McConnell & Strand 1981), we followed the two most common approaches: 1) incorporating a fraction of the wage rate, and 2) not incorporating time costs (*sensu* Czajkowski et al. 2014).

Qualitative data

We also designed an anonymous survey in google forms, which examined motivation, mode of travel, and actual travel costs (Appendix S1). To characterize the frequency of such birdwatching activity, we asked birdwatchers how often they 'chased' rare birds, defined as species on a state's review list. Because addresses of the birdwatchers visiting the oriole were not known, the survey was distributed through Facebook pages (including the Facebook page dedicated to the oriole: https://www.facebook.com/groups/1830559317197575/), birdwatching list-servs, and by word-of-mouth.

Results.

Economic value

Of the 1,824 people who signed the logbook, 68 and 13 respectively did not provide or provided illegible origins. Two individuals from the United Kingdom and 15 from Canada were excluded from the analysis because of the undue leverage these data would have on analyses, given a lack of evidence that they had travelled specifically for the oriole. This left 1,726 individuals in our analysis.

Most people who visited (57%) the site of the vagrant oriole originated from within 100 km, with 28% from within 50 km, while 9% were from > 500 km and 3% of trips were > 1000 km (Fig. 1). Numbers of visitors decreased strongly over time, with 48% of visits occurring within the first week (Fig. 2), despite the residency of 67 days. In total, the economic value of the vagrant oriole ranged from ~ \$119,000 USD - \$129,000 USD, or ~ \$69 - \$75 per trip, depending on how we accounted for opportunity cost (Appendix S2, Fig. 3).

Survey results

There were 235 valid responses to our survey which comprised 13% of the total visitors recorded in the logbook. Of the survey respondents, most (97%) successfully saw the oriole and most (96%) for the first time. Ninety percent of respondents belonged to a local, state, or national bird-conservation based group. Most (85%) made one trip to see the oriole, while 11% travelled twice, and 4% travelled three or more times. Also, most (85%) stated that the oriole was the ‘sole reason’ for their trip, but 66% of respondents also did additional birdwatching in the area.

We characterized three economic aspects of respondents’ trips, travel, food, and lodging, based on self-estimation responses of the amount of money spent. Respondents estimated an average of \$58 ± \$103 (mean ± sd; N=216) on travel. In total, 54% of people car-pooled, with an average of 1.9 ± 1.03 (range: 1-6) people per vehicle. Mostly, they travelled in a private vehicle (96%), but also rental vehicles (2.5%) and aeroplanes (1.6%). They spent an average of \$28 ± \$45 (N=221) on food, with 55% of respondents only dining out, 25% only making their own meals, and 19% doing both. Of those that dined out (N=176), they did so on average 1.8 ± 1.7 times. Of the total survey respondents, 16% included an overnight stay, with most (78%) of these staying in a hotel/motel, while some stayed at friends’/relatives’ homes (17.1%) and others camped (4.8%). Of the 32 respondents willing to estimate their accommodation costs, on average they paid \$149 ± \$125 (N=32). Finally, on an annual basis, 44% of respondents (N=231) chase rare birds 1-3 times, 26% 3-7 times, 10% 7-10 times, 17% more than 10 times, and 3% never chase rare birds.

Total economic value

Assuming the 13% response rate of the survey was representative of the entire sample (N=1824) of visitors, the total economic input of food expenditure was ~ $51,000 USD while accommodation expenditures were ~ $43,000 USD. If combined with the travel cost based on transport and time, the total economic value of the oriole was ~ $223,000 USD.

Discussion.

We estimated considerable economic value and avitourism potential of one vagrant bird, an oriole in Pennsylvania. This single event contributed a conservative estimate of ~$223,000 USD to the economy. But, such ‘twitching’ or ‘chasing’ of rare birds is relatively frequent, given that 17% of respondents (N=235) did it in more than 10 such trips per year. This represents a substantial and sustainable contribution to the economy which highlights the economic value of vagrant birds. Given that approval of many deleterious developments of biodiversity become primarily decided on the basis of contributions to the economy, there is a need for decision-makers to include such real economic values of biodiversity in decision-making. This economic effect was likely even higher, given the conservative nature of our estimate.

Our estimate of travel costs, through the travel cost method, excluded accommodation costs and additional food expenditures which are commonly included as part of travel cost when estimating recreation values. Rather, these were estimated through the use of an online questionnaire. Further, not every birdwatcher who visited the bird would have signed the logbook. Also, some birdwatchers may have discounted this occurrence due to uncertainty as to whether it was an escapee or vagrant (i.e., approved on the American Birding Association's checklist; the benchmark for legitimate 'ticks').

Vagrant birdwatching is a unique form of recreational avitourism, given its unpredictable and ephemeral nature (Booth et al. 2011), making it difficult to estimate economic value. Our study relied on unique incidental data collection (the logbook), which ultimately restricted the power of *a priori* planning. In future, inclusion of demographic variables (i.e., socioeconomic, age, and marital status; Garrod & Willis 1999) and investigation of relative impacts of other factors (e.g., bird beauty, 'accessibility') would add to our understanding of the relationship between vagrant birds and their economic value.

Birdwatchers are well-educated, wealthy, and committed (Ṣekercioḡlu 2002), making them a potential group from which to generate conservation funding. Furthermore, birdwatchers of vagrant birds support bird conservation (Booth et al. 2011). Indeed, 90% of people in our survey were members of a local, state, or national bird conservation-based group. Additionally, visitors of the Black-backed Oriole donated ~ $2000 to The Nature Conservancy, through a provision provided by the home owners where the bird occurred. Specialized, committed, birdwatchers probably chased the vagrant oriole (McFarlane 1994, Hvengaard 2002) but there are many other less-motivated birdwatchers. An estimated 17.8 million people in the United States birdwatch away from their home (USFWS 2011), potentially contributing considerable, largely unrepresented economic impact in decisions relevant to conservation.

There were minimal birdwatching impacts, viewing the oriole in the residential area of Pennsylvania, because birdwatchers were largely restricted to a driveway (Fig. 4). Vagrant birds often occur in protected areas, where there is significant potential of recreation disturbance (Taylor & Knight 2003, Gallet et al. 2004, Reed & Merenlender 2008) which should be managed. This includes dealing with trespassing, climbing over fences, and disregarding sensitive habitats (Booth et al. 2011). Rarity clearly has an important part to play in the economic value of such events.

Rarity of vagrants can predict the number of visitors that travel to view vagrants (Booth et al. 2011). This positive relationship, between rarity of a species and its potential economic value, runs counter to goals of conservation; a perverse argument might be to increase rarity to increase economic value. Clearly there is a limit to such an argument as rarity is often a precursor to extinction, but, as noted, this study focused on an alternative definition of rarity. The pursuit of identifying, twitching, and listing vagrant birds frequently occurs among birdwatchers globally (e.g., Sheard 1999, Dymond et al. 2010, Howell et al. 2014). The level of economic value will inevitably depend on ease of travel, a bird's 'attractiveness', overall rarity, duration of rare bird presence, and region of the world; all of which influence the level of interest by the birdwatching community and their motivation to travel and spend money.

Conclusion.

In general, land managers seldom capitalize on tourism opportunities from vagrant birds (Booth et al. 2011) or bird events (e.g., stork breeding; Czajowski et al. 2014), which clearly exist, given the high level of economic value of the oriole in Pennsylvania. Although vagrant bird events are highly unpredictable, their potential economic benefits to local and surrounding economies is certainly exploitable. Such real economic values need to be increasingly incorporated into cost benefit analyses for developments that affect conservation of organisms and their ecosystems. Policy-makers could at least incorporate potential economic values of vagrant birds, ultimately dependent on natural habitats and populations where they originate. At least broadly, there needs to be explicit understanding and discussion of the economic values of vagrant birds and their role in contributing to direct and indirect conservation benefits.

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Figure 1. Frequency distribution of one-way distances that bird watchers travelled to view the Black-backed Oriole in Pennsylvania, USA (N=1,726), based on the great circle distance from the city/state origin they provided in the logbook.

Figure 2. Distribution of visits through time in the number of birdwatchers (N=1,726) travelling to view the Black-backed Oriole over its duration of residency (67 days).

Figure 3. The demand curve for a double-log regression model, excluding (dashed line) and including (solid line) the cost of time. Entry fees were restricted to values between $0 USD and $100 USD.

Figure 4. A typical gathering of birdwatchers early in the period of residency of the Black-backed Oriole in Pennsylvania. Photo by Jeffrey Gordon.