Public Preference for Endemism over Other Conservation-Related Species Attributes

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Abstract: *Public preferences are likely to play an important role in prioritizing species at risk for conservation. We conducted a survey of British Columbians (Canada) (n = 555, r = 73%) to examine how the public ranks a species' attributes (rather than named species) with respect to conservation priority. Endemism, defined as species only or mainly occurring in British Columbia or species occurring in British Columbia and nowhere else in Canada, was considered the most important among the measured attributes. This preference was strongest among men and among respondents who had completed postsecondary education. The preference for endemism is generally consistent with science-based federal listings of British Columbian species. This congruence between listing and public opinion is welcome if such congruence is considered important. We suggest that investigating how much the public values species' attributes, as opposed to named species, provides a more efficient way of incorporating public opinion into policies on species at risk, especially if large numbers of species must be ranked for conservation priority.*

Keywords: British Columbia, Canada, conservation priorities, endemism, species attributes

Preferencia del Público por el Endemismo por Encima de Otros Atributos de las Especies Relacionados con la Conservación

Resumen: *Es probable que las preferencias del público jueguen un papel importante en la priorización de especies en riesgo para la conservación. Realizamos un muestreo de ciudadanos de Columbia Británica (Canadá) (n = 555, r = 73%) para examinar cómo clasifica el público a los atributos de una especie (en lugar de nombres de especies) con respecto a la priorización de conservación. El endemismo, definido como especies que ocurren solo o principalmente en Columbia Británica o especies que ocurren en Columbia Británica y en ningún otro lado en Canadá, fue considerado el más importante de los atributos medidos. Esta preferencia fue mayor entre varones y entre respondientes que completaron su educación post-secundaria. La preferencia por el endemismo es generalmente consistente con las listas de especies de Columbia Británica basadas en ciencia. Esta congruencia entre listas y opinión pública es bienvenida si tal congruencia es considerada importante. Sugerimos investigar qué tanto valora el público a los atributos de las especies, en lugar de nombres de especies, para tener una forma más eficiente de incorporar la opinión pública en las políticas sobre especies en riesgo, especialmente si un gran número de especies debe ser clasificado para priorizar su conservación.*

Palabras Clave: atributos de las especies, Canadá, Columbia Británica, endemismo, prioridades de conservación

Introduction

Given that resources available for conservation of species are limited, it is necessary to make trade-offs regarding which species should be protected and which cannot. Most current prioritization frameworks focus on the degree to which a species is threatened with extinction (e.g., IUCN Red List 2001; Canada's Species at Risk Act

2002). Some authors (e.g., Avise 2005) suggest, however, that other species attributes, such as economic or ecological importance, charisma, evolutionary distinctiveness, and endemism, should be considered alongside threat when determining conservation priority. One way in which the structure of such a framework can be investigated is to determine how the public ranks these attributes in terms of importance to conservation decisions. Incorporating public opinions into conservation policy, although perhaps philosophically controversial is, at least, pragmatic: much of biodiversity owes its continuing existence to human intervention, and publicly supported interventions will be more likely to succeed.

An approach for gauging public support for species conservation is to examine people's willingness to pay to conserve single species or sets of species (Martín-López et al. 2008). Such species-specific valuation studies, however, do not point to any general principles for conservation purposes. Asking about more general factors, such as species attributes, would allow researchers to investigate the types of species that people value, provided respondents understand the attributes and the researcher can describe different species in terms of their attributes in a relatively objective manner. A few studies have attempted to elucidate such valuations of species attributes (Czech et al. 1998, 2001; Montgomery 2002; Knegtering et al. 2002), but none have incorporated an explicit treatment of endemism.

In the context of a recent survey about the opinions of British Columbians (Canada) toward species at risk, we explored the relative importance of species attributes without making use of named species. We also investigated whether public preferences are congruent with current federal science-based listings of at-risk species in British Columbia.

Methods

Survey Design and Sample

In 2008 we conducted a survey of the opinions of British Columbians regarding the management, protection, and recovery of at-risk species within the province. We reviewed draft versions of the survey and tested a draft version with graduate students at the University of British Columbia to judge time needed for completion and identify problem areas.

We obtained a stratified sample of British Columbians that was representative across eight provincial economic development regions. To do so, we used random-digit telephone dialing to solicit mailing addresses from individuals willing to participate in the survey. We asked to speak with the resident of the household with the most recent birthday to ensure even representation based on gender. Of 2993 contacts, 770 agreed to participate in

our mail survey, and we had valid addresses for 762. Following Dillman's (2000) tailored design method, we contacted potential respondents four times, and received 555 completed questionnaires (response rate 73%).

Survey Components

Here we report results of responses to three survey questions focused on assessing the importance of endemism, defined as species only or mainly occurring in British Columbia or species occurring in British Columbia and nowhere else in Canada, versus other species attributes as described later. These questions were formulated with input derived from a draft framework for the protection and recovery of species at risk in British Columbia (Harshaw 2008).

The first question asked respondents to rank the importance of six different factors natural resource managers might use to allocate resources for protection and recovery of species at risk: species at risk in British Columbia but common elsewhere; species at risk that occur only or mainly in British Columbia; chances of successful protection and recovery; cultural and traditional importance of species at risk; economic costs of protection and recovery; and common species whose numbers are in rapid decline.

The second question asked respondents to allocate CAD$100 for species conservation among four different species attributes: distinctive species (defined as species that look or act differently from other species or that play a unique role in the ecosystem); species that exist only in British Columbia and no other area in Canada; species that are important to British Columbia's economy; and species that are common but whose numbers are decreasing quickly. This constant-sum question provided a ranking of attributes and a measure of the extent of respondents' preferences for these attributes.

The third question asked respondents to choose between pairs of statements describing different species values. For each pair, respondents identified the attribute they thought should be a higher priority for identifying which species should be protected. The constant attribute in each pair was "species only or mainly occurring in British Columbia." The other factors were species at risk in British Columbia but common elsewhere; cultural and traditional importance; likelihood of the species being protected; common species whose numbers are in rapid decline; and costs associated with protecting the species.

For the first two questions, we compared the rank or allocation for each factor across respondents with Wilcoxon signed-ranks tests. For the last question, we tested for differences in pairwise comparisons with binomial tests. For each of these questions, we also explored whether respondents' rankings differed by education and gender with Mann–Whitney tests.

Species Listings

We also investigated whether respondents' preferences (for endemism, based on the results of our survey; see Results) were reflected in the current listing of species at risk. To do so, we determined whether the proportion of endemic species listed as being at risk by the federal body responsible for science-based species listing (COSEWIC [Committee on the Status of Endangered Wildlife in Canada]) was higher than the proportion of nonendemic species so listed. We used the NatureServe (2008) database to identify all species, subspecies, and populations (designatable units, Green 2005) represented in British Columbia within six taxa: vascular plants, lepidopterans, fishes, herpetofauna, birds, and mammals. From these lists, we determined which designatable units were unique to British Columbia (a strict definition of endemism), which occurred in British Columbia and nowhere else in Canada (a broader definition of endemism), and which were not endemic. We also determined which of these designatable units were listed as being at risk (endangered, threatened, or special concern) by COSEWIC and used *G* tests to examine differences between the proportion of endemic and nonendemic species listed.

Results

Survey Components

For all three questions, respondents ranked endemism as most important relative to the other species attributes (Tables 1–3). This result was significant for all comparisons in questions 1 and 2 (Tables 1 & 2) and for four out of five comparisons in question 3 (Table 3).

Respondents who completed college or university education ($n = 232$) were more likely to rank endemism higher than those who had not ($n = 323$). For the ranking question, respondents with postsecondary education assigned endemism an average of 1.57 ranks over other species attributes versus 1.23 for those with no postsecondary education (Mann–Whitney $U = 27,512$, $Z = -2.82$, $n = 512$, nominal $p = 0.005$). For the funding allocation question, respondents with postsecondary education allocated an average of CAD$6.54 more than the expected (CAD$100/4) CAD$25 to endemic species, whereas those without postsecondary education allocated CAD$4.16 more than expected (Mann–Whitney $U = 30,070$, $Z = -2.01$, $n = 524$, nominal $p = 0.045$). Those with postsecondary education chose endemism over any other species attribute more often than those without for the paired comparison question as well (4.00/5 times vs. 3.68/5; Mann–Whitney $U = 24,463$, $Z = -3.32$, $n = 490$, nominal $p = 0.001$).

In addition, women ($n = 267$) generally showed a weaker preference for endemic species than did men ($n = 272$). Women (vs. men) assigned endemism an average of 1.13 (vs. 1.60, $p = 0.005$) ranks over other species attributes, allocated an average of CAD$4.51 (vs. CAD$6.02, $p > 0.05$) more than expected to endemic species, and chose endemism over the paired attributes 3.65 of 5 (vs. 3.97/5, $p = 0.001$) times.

Gender and level of education attained were not correlated in our data set (Spearman, $p = 0.891$), which suggests the patterns of increased support for endemic species conservation among males and those with higher education are due to different underlying causes.

Comparison with Species Listings

Overall, for both of our definitions of endemism, endemic species were more likely to be listed than nonendemic species: 10.6% of species occurring only in British Columbia versus 3.5% of nonendemic species were listed ($n = 508$ and 4445, respectively), whereas 8.9% of species occurring in British Columbia and nowhere else in Canada versus 1.9% of nonendemic species were listed ($n = 1646$ and 3307, respectively; G tests, $p < 0.001$). This pattern was also significant in five of the six taxa, with the exception being fishes. Species without complete distribution data, however, are less likely to be listed by COSEWIC, and only 94 of 478 fish species have

Table 1. Wilcoxon signed-ranks tests for differences in rankings of species attributes from question 1: rank attributes from 1 to 6 (with 1 being most important) in terms of importance to allocation of conservation resources.

Pairs of attributes[a]	Mean ranks	n[b]	Z[c]
Species at risk in British Columbia but common elsewhere	3.80	525	−14.24**
Species only or mainly occurring in British Columbia	2.20		
Chances of successful protection and recovery	2.70	519	−5.44**
Species only or mainly occurring in British Columbia	2.20		
Cultural and traditional importance	5.42	523	−16.88**
Species only or mainly occurring in British Columbia	2.20		
Economic costs of protection and recovery	4.31	520	−16.00**
Species only or mainly occurring in British Columbia	2.20		
Common species whose numbers are in rapid decline	2.48	527	−3.18**
Species only or mainly occurring in British Columbia	2.20		

[a]*For each pair,* H_0 *= no difference in rank of species attributes.*
[b]*For pairs.*
[c]*Based on negative ranks;* **p $\leq$ 0.001; p *value corrected for false discovery rate (Benjamini & Hochberg 1995).*

Table 2. Wilcoxon signed-ranks tests for differences in allocation of conservation funding to different species attributes from question 2: divide a hypothetical CAD$100, to be used for conservation, among these attributes.

Pairs of attributes[a]	Mean allocation (CAD$)	n[b]	Z[c]
Distinctive species	21.45		
Species that exist in BC and no other area in Canada	28.82	524	−9.01**
Species that are important to BC's economy	26.22		
Species that exist in BC and no other area in Canada	28.82	524	−2.76*
Common species whose numbers are decreasing quickly	23.33		
Species that exist in BC and no other area in Canada	28.82	524	−5.93**

[a]*For each pair, H₀ = no difference in allocation to species attributes; BC, British Columbia.*
[b]*For pairs.*
[c]*Based on positive ranks;* *p < 0.01; **p ≤ 0.001; p values corrected for false discovery rate (Benjamini & Hochberg 1995).*

such data on NatureServe. The pattern of biased listing of endemic species held for this subset with range data (*G* test, *p* < 0.0001).

Discussion

Our results suggest that the British Columbian public generally values endemism over other species attributes.

Table 3. Percentage of cases for which "species only or mainly occurring in British Columbia" was chosen over other species attributes from question 3: for each pair of statements identify the factor that should be a higher priority in identifying species for protection.

Factor[a]	Respondents choosing "species only or mainly occurring in British Columbia" over factor listed (%)[b]	n
Likelihood of the species being protected	58.30**	506
Cultural and traditional importance	85.24**	508
Common species whose numbers are in rapid decline	52.93 (n.s.)	495
Costs associated with protecting the species	81.20**	500
Species at risk in BC but common elsewhere	82.33**	515

[a]*British Columbia, BC.*
[b]*Significance: **p ≤ 0.001; n.s., not significant; p values corrected for false discovery rate (Benjamini & Hochberg 1995).*

This result is contrary to a recent meta-analysis by Martín-López et al. (2008), which suggests that public preferences for species conservation are not influenced by endemism. Nevertheless, and importantly, in the surveys reviewed by Martin-López et al. (2008), respondents were asked to choose between named species whose attributes (including endemism) were often not made explicit. In contrast, we asked respondents directly about species attributes instead of named species. If named species are not described to survey respondents in terms of their distribution and if the concept of endemism is not defined, respondents may not be able to consider this attribute in their decision-making process. This is consistent with other work showing that conservation preferences are related to respondents' knowledge about species (e.g., Martín-López et al. 2007; Tisdell et al. 2007). This highlights the importance of including supplemental information about species: we suggest that, all else being equal, the public would likely prefer to conserve endemic species rather than nonendemic species, even if they lack the knowledge base of whether certain species are endemic. This hypothesis is supported by the work of Wilson and Tisdell (2006), which suggests that public conservation funding allocations change when information is provided about species.

We also found that men and those with postsecondary education value endemic species to a greater degree than women and those without postsecondary education. Inglehart (1977) and Dunlap and Catton (1979) suggest that education is one of the more useful predictors of environmental concern (others are age, political ideology, and urban residence), and Kellert (1996) found that males are more likely to be concerned about conserving wildlife species than females. We do not know, however, to what extent or how value for endemism is related to concern about the environment or conservation of wildlife species in general. Although we explored the influence of other variables (e.g., household income, biocentrism, use of natural areas, relative urbanization) on the value for endemism, we found no clear patterns.

Comparison of our results with current federal COSEWIC listings revealed that public opinion and national science-based designations were, in this case, congruent. Species endemic to British Columbia (either completely or within Canadian jurisdiction) were overall more likely to be officially listed than other British Columbian species, and COSEWIC listing is a first step toward effective conservation management. That COSEWIC listings are biased toward endemic species is not unexpected, given that endemic species have restricted ranges and that small range size is a predictor of current and future threat (McKinney 1997; Purvis et al. 2000). This pattern is not universal, however. Bunnell et al. (2004) found that fewer than half the species unique to British Columbia are listed on official provincial lists of at-risk species. Recent work by Findlay et al. (2009)

indicates the opposite pattern is true for species listed under Canada's Species at Risk Act. Species occurring either wholly or mostly in Canada were less likely to be listed under the act. This indicates there is a disconnect between species recommended for legal listing by COSEWIC and those that are actually listed (Mooers et al. 2007).

There are several aspects of endemism value that require further investigation. Among them is the possible difference in public valuation between true endemics and sociopolitical endemics (in the Canadian context, "peripheral species" occurring in Canada at the edge of their geographic range). Jurisdictions might prioritize species for which they have global responsibility (true endemics) over imperiled biota that is at less risk elsewhere (Bunnell et al. 2004; Mooers 2007). The information available to us in our data set did not allow us to disentangle these two concepts. In addition, because our survey was restricted to residents of British Columbia, it was not possible with our sample to determine whether this was a local British Columbian phenomenon or whether people from other jurisdictions would value British Columbian endemics over nonendemics, value their own endemic species, or value endemic species over nonendemic species wherever they occur. Exploring this question would help to determine whether the value expressed for endemism is associated with a particular place or whether endemism itself is valuable.

We suggest that surveys of public conservation preferences can contribute to the ongoing debate on how to allocate scarce resources to conservation. To make public policy for the common good, authorities need to know what the public values and why, and we suggest it would be most efficient if authorities gathered information based on species attributes rather than on specific species because such information could be applied more broadly.

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