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Modest levels of interpretability of the term ‘biodiversity’, mediated by educational level, among the Australian public

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Abstract Effective worldwide efforts to conserve flora and fauna rely on engaging the public, and thus on public appreciation of the object of conservation activities (most commonly, ‘biodiversity’). We examined alignment of interpretation of the term ‘biodiversity’ with generally accepted definitions in a representative sample (n = 499) of the public from the state of Victoria in Australia, a country with an explicit biodiversity conservation strategy (which defines the term) and the capacity to invest heavily in conservation. However, almost half of respondents did not know what ‘biodiversity’ meant, 32\% and 18\% expressed an ecological and conceptual interpretation, respectively. The probability of having at least some interpretation of the term was higher among university-educated respondents, but otherwise did not
vary with gender or income. Broadening the base of conservation efforts would likely
be facilitated by better aligning interpretations of the term ‘biodiversity’ among the
public or by adopting more intuitive language when engaging with the public.

Additional Keywords awareness, biological diversity, conservation, gender, income,
interpretation, survey
Introduction

Engaging with the general public in conservation efforts is a critical aspect of successful conservation of flora and fauna (Ainsworth et al. 2016). Given that developed countries may invest more in conservation and theoretically may be able to reduce environmental impacts (Bradshaw et al. 2010), it might be expected that engagement of citizens would be highest amongst these countries. One such country is Australia, a continent with a history of vertebrate extinctions and environmental challenges, and with a high standard of living and capacity to invest in conservation solutions (Common and Norton 1992).

Key to any broad-based conservation efforts is a common interpretation of the objectives and, specifically, the entity to be conserved (Wilson et al. 2009). ‘Biodiversity’ is a term used commonly to describe and argue for the conservation of biological diversity (Bugter et al. 2018). However, defining the term is problematic and usage of the term varies widely among conservation decision-makers, such that people exhibit different ‘interpretations’ of the word (DeLong 1996; Hamilton 2005; Habib 2015). The Australian Government’s ‘Biodiversity Conservation Strategy 2010-2030’ identifies ‘engaging all Australians’ in biodiversity conservation as a priority, and proposes that the concept of biodiversity protection needs to be ‘mainstreamed’ but acknowledges that biodiversity is ‘poorly understood and communicated’ (Natural Resource Management Ministerial Council [NRMMC] 2010). Its own definition of ‘biodiversity, or biological diversity, is the variety of all life forms’, and includes three levels: genetic, species and ecosystem diversity (NRMMC 2010; p12). Public interpretations of biodiversity are commonly evaluated based on scientific definitions, but people express a variety of social representations of biodiversity regarding conservation objectives (Fischer and Young 2007; Buijs et
Therefore, greater insight into the interpretations (meanings and ideas) the public currently assigns to biodiversity is likely to be an important step towards increasing public awareness and engagement in biodiversity conservation goals (Bright and Stinchfield 2005). While a body of literature deals with clarifying definitions of biodiversity, and how to share these interpretations in educational settings (e.g., Lindemann-Matthies et al. 2009; Moss et al. 2017), little research goes directly to interpretations held by the general public, an aspect which may help identify opportunities to better engage the public around conceptions of biodiversity (Meinard and Quétier 2013).

We examine what the term ‘biodiversity’ means to the general public using data collected as part of a larger study on public perceptions and attitudes towards different ecosystems in the Australian State of Victoria (Kiley et al. 2017). We also examine whether having some interpretation was associated with respondent gender, education or income, factors which influence various measures of environmental awareness and concern (Miller 2000; Zelezny et al. 2000; Franklin 2007).

Methods
This social science research used an online survey delivered to a representative sample of 503 members of the Victorian general public (see Kiley et al. 2017). Respondents registered with a professional survey company which delivers surveys to a demographically representative sample of Victorians from a database of over 550,000 Australians (PermissionCorp. 2015). As 86% of Australians have broadband access (ABS 2018), any sampling bias in that regard would be limited. Participants were invited to answer (in their own words) the question “What does the term ‘biodiversity’ mean to you?” Responses that were nonsensical were excluded from the analysis leaving 499 respondents. To examine associations with gender, income
and education, we removed respondents who did not provide specific responses to the relevant questions (thus, n = 439). Income was coded as: 1. I am not a paid worker, 2. Up to $40,000 per year, 3. $41,000 to $80,000 per year or 4. $81,000 or more per year. The highest level of education attained was coded as: 1. non-university (e.g. secondary school or trade certificate), or 2. university. A binary logistic model of interpretation (none versus at least some, i.e. ecological or conceptual interpretation) against gender, income and education was run in SPSS.

**Results**

Just under half the respondents (49.9%) stated that they did not know the meaning of the term ‘biodiversity’ or gave an answer that did not reflect the scientific definition given by NRMMC (2010). Answers that included mentions of multiple species, insects, genes, microorganisms or ecosystems were categorised as ‘ecological interpretation’ and were expressed by 32.1% of respondents. Responses that included either plants or animals (but not both), or that were expressions of more conceptual notions of biodiversity, such as harmony, balance and interconnectedness, were interpreted as ‘conceptual interpretation (18.0%). Some examples of responses that demonstrated a conceptual notion of biodiversity are presented in Table 1.

Regression analysis revealed that the only significant association with having at least some interpretation of ‘biodiversity’ was university education (Table 2), with 65.2% of university-educated respondents having at least some interpretation compared with 41.5% who had not attended university.
Discussion

We report modest and varying levels of interpretation of the term ‘biodiversity’ by the Victorian public, calling into question the utility of the term when engaging with the public. It seems clear that this term can have different connotations to the public than when used by specific groups, such as conservation practitioners or scientists (Dallimer et al. 2012). This is perhaps linked to the different ways that people value biodiversity, for example conservation decision-makers typically argue for the moral, intrinsic and ecological importance of biodiversity and its conservation, raising the salience of these perspectives among target groups (Berry et al. 2018).

We report no difference in whether or not respondents had some or no interpretation of the term, between genders or income. However, enhanced awareness was evident among the university educated. Many Australian Universities incorporate environmental sustainability into core curricula (see Pérez et al. 2018), so this effect is unsurprising but heartening. Evidently, formal education can effectively (but not universally) bestow greater appreciation of the use of the term biodiversity as defined by the NRMCC.

Perhaps, like commercial marketing campaigns, governments and the science community need to express the concept of biodiversity in a variety of ways to maximise engagement. Tailoring of messages to specific audiences during conservation decision-making processes is key to delivering effective arguments for biodiversity (Bugter et al. 2018).

It seems prudent for communicators to use ‘biodiversity’ cautiously. At the very least, anyone using this term should provide a definition with it. More radically, the term could be avoided when engaging with the public. The efficacy of re-framing ‘biodiversity’ and talking about it in terms that might resonate more with the ideas
people associate with biodiversity (e.g. protecting the balance of nature) warrants further research.
References


Table 1. Some examples of themes that emerged in conceptual interpretations of biodiversity.

<table>
<thead>
<tr>
<th>Harmony</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Where many animals or plants live in harmony or cooperation.</td>
<td>To me, it’s about being aware of the different types of life on this earth whether it be human, animal, vegetable or mineral and being aware of the impacts change has on this life. We need to find a way to co-exist.</td>
</tr>
<tr>
<td>In harmony with nature and all natural things.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Balance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Being aware of all forms of life and being able to mix and maintain all together whether it be human life, plants, animals etc.</td>
<td>A wide range of plants and animals co-existing in a mutually beneficial balance.</td>
</tr>
<tr>
<td>Everything coming together, living and existing peacefully.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Care for the environment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity means preserving the natural environment even though it may be diverse.</td>
<td>Essential to the health of the landscape / environment. Implies keeping different areas and types of land cover which occur naturally without human intervention ... in order to preserve flora and fauna and insects which belong there.</td>
</tr>
</tbody>
</table>
Table 2. Binary logistic regression analysis of having at least some interpretation of the term ‘biodiversity’ (conceptual or ecological) against demographic variables.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>Df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.288</td>
<td>0.203</td>
<td>2.015</td>
<td>1</td>
<td>0.156</td>
</tr>
<tr>
<td>Income</td>
<td>0.027</td>
<td>0.119</td>
<td>0.050</td>
<td>1</td>
<td>0.823</td>
</tr>
<tr>
<td>University Education</td>
<td>-1.971</td>
<td>0.214</td>
<td>20.632</td>
<td>1</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Constant</td>
<td>0.420</td>
<td>0.392</td>
<td>1.149</td>
<td>1</td>
<td>0.284</td>
</tr>
</tbody>
</table>