Biodiversity
A public engagement literature review

Audience Research and Insight Team,
Natural History Museum
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</table>
The purpose of this paper is to inform Natural History Museum (NHM) colleagues about research on the public’s awareness, knowledge, understanding and attitudes towards biodiversity and successful ways of engaging the public with biodiversity.
Executive Summary

The term ‘biodiversity’ is problematic because:

• it doesn’t explicitly refer to all the concepts it incorporates (e.g. interconnectivity, ecosystems)
• it involves processes that operate at different geographical and temporal scales so needs to be contextualised
• it is value laden and the subject of socio-scientific debate as society values biodiversity to different extents and in different ways.

The public seems to be aware that nature is interconnected and is under threat. However, they are confused about the impact that any loss of biodiversity will have. Although they claim to be concerned about biodiversity loss when asked, in reality, it seems that they do not give the issue much thought. This confusion and lack of concern seems to be because they:

• attribute it to the natural background extinction rate and the process of evolution
• are unable to reconcile the fact that, although extinction has occurred throughout Earth’s long history, it is now happening at an accelerated rate
• haven’t experienced any negative effects of extinction personally
• are aware that nature operates within a state of dynamic equilibrium and feel that taking action could potentially have negative repercussions
• deem other issues, such as terrorism and access to healthcare, as more important
• do not understand what effect the loss of a species has on the rest of the ecosystem
• have become disconnected from nature as processes of industrialisation and urbanisation mask the fact that humans rely on natural processes
• perceive biodiversity loss as something that happens in other parts of the world, not in Britain.
• Feel overwhelmed by the amount of information about the environment and feel any action they take is futile

Before the public can engage with the importance of biodiversity, how it is threatened or what conservation actions are taking place, they need to value biodiversity. This means we need to engage them emotionally through positive experiences with nature.

Biodiversity education should help learners:

• develop a personal connection to nature,
• understand the scientific concepts involved
• be aware of the socio-scientific debate
• form their own values and views about the issues surrounding biodiversity.
Introduction

Biodiversity loss is at the heart of the Museum’s new strategy. Launched in 2020, the Museum’s new strategy seeks to create a future where both people and the planet thrive by creating advocates for the planet. The NHM has responded to the current planetary emergency by highlighting the destructive impact our actions have had on the planet in order to spark an unprecedented response.

“We face a planetary emergency. Humanity’s future depends on the natural world, but we are not taking effective action to combat our destructive impact on the planet’s survival systems. Climate change, biodiversity loss and extinctions, habitat destruction, environmental pollution, soil erosion and loss, deforestation, desertification, ocean acidification and many other crises all flow from unsustainable human activity.”
(NHM Strategy, 2020, p3).
Definitions

Scientists use the term ‘biodiversity’ to refer to the concepts of variation, ecosystems and the interconnectedness of nature.

The term ‘biodiversity’ was coined by W. J. Rosen during a series of conferences in 1986 and first published in 1988 (Novacek, 2008). A decade later, the term was in common usage in schools, the media and museums. Definitions usually refer to the two concepts of variation and ecosystems explicitly and the concept of interconnectedness of nature implicitly.

<table>
<thead>
<tr>
<th>Definition</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity: the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.</td>
<td>(IUCN, 2010)</td>
</tr>
<tr>
<td>Biodiversity is the variety of all life on Earth. It includes all species of animals and plants – everything that is alive on our planet.</td>
<td>(DEFRA, 2011a, p4)</td>
</tr>
<tr>
<td>“it embraces all species of plants, animals and micro-organisms, the ecosystems and ecological processes of which they are part; this includes three levels: genetic diversity (intra-species diversity), species diversity (richness) and ecosystem diversity”</td>
<td>(Kassas, 2002, p347)</td>
</tr>
</tbody>
</table>

Figure 1: Example Definitions of ‘Biodiversity’

However, from an educational perspective, the term is considered ‘ill-defined’.

According to the educational literature, there is “no universally agreed upon definition” of biodiversity because the term is open to multiple interpretations (Dreyfus, Wals and van Weelie, 1999, p160). This is because it:

• incorporates many concepts and ideas within it
For example, the concept of diversity refers to variability within and between species and ecosystems as well as ‘richness’ (i.e. the number of species in a unit) and ‘abundance’ (i.e. the amount of members of that species) (Kassas, 2002, van Weelie and Wals, 2002 and Dreyfus, Wals and van Weelie, 1999).

• is value laden
People value biodiversity in different ways and for different reasons (e.g. aesthetically, politically, morally, spiritually etc.).

• needs to be contextualised.
References to biodiversity need to include geographical and temporal dimensions, therefore, we should consider the term as representing “variability in biological entities in a specific space at a specific moment in time” (van Weelie and Wals, 2002 p1148).
The term ‘biodiversity’ has both scientific meaning and symbolic or political meaning which leaves it open to socio-scientific dispute.

Its scientific meaning refers to the past, present and future state of biodiversity based on empirical evidence whereas its symbolic meaning refers to value statement that society should try to protect biodiversity which is based on value judgement (Dreyfus, Wals and van Weelie, 1999).

Due to misconceptions about the nature of science and scientific inquiry, where the public perceive contradictions in scientific findings or a lack of consensus amongst scientists in relation to the evidence, they tend to dismiss scientific claims (Dreyfus, Wals and van Weelie, 1999). The fact that biodiversity lacks a common definition that is uniformly interpreted means it is open to socio-scientific dispute (ibid).
Public Understanding of Biodiversity

3

3.1

Knowledge

A significant number of people are unaware of the term ‘biodiversity’.

According to the Special Eurobarometer 481 (Kantar Public Brussels, 2019), a survey designed to explore European’s citizens awareness of and views on biodiversity and nature, 37% of the UK population have never heard of the term ‘biodiversity’.

Have you ever heard of the term ‘biodiversity’?

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>You have heard of it and you know what it means</td>
<td>5</td>
</tr>
<tr>
<td>You have heard of it but you do not know what it means</td>
<td>22</td>
</tr>
<tr>
<td>You have never heard of it</td>
<td>73</td>
</tr>
<tr>
<td>Don’t know</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 2: The Special Eurobarometer 481, Attitudes of Europeans toward Biodiversity (May 2019).

Similarly, in focus groups conducted with parents and independent adults at the Natural History Museum, in 2019, almost half of the participants had not heard of the term ‘biodiversity’ before (Davidson, 2019). At the beginning of this focus group, participants were asked to write or draw anything they associated with the term ‘biodiversity’. Their responses included:

“I put ‘what’?, I have no clue”
(Independent adult)

totally unfamiliar
(Independent adult)

“I put a big question-mark”
(Parent)

“never heard of it before”
(Parent)
The public feel that they do not know a lot about ‘biodiversity’.  

Whilst a sizeable proportion of people had heard the term ‘biodiversity’ only 18% of participants in a DEFRA (2011) survey felt they had “a lot/fair amount” of knowledge about biodiversity.

Those of higher socio-economic status are more likely to think they know a lot about biodiversity than those of lower socio-economic status. 29% of AB participants declared they knew a lot or a fair amount about biodiversity in comparison to 10% of DE participants (DEFRA, 2011).

According to Figure 2, 61% of those surveyed were either unaware of the term ‘biodiversity’ (37%) or were aware of the term ‘biodiversity’ but were not confident in its meaning (24%).

Although 39% of those surveyed felt they were confident in understanding the meaning of the term ‘biodiversity’, it is unclear if their understanding of the term is correct.
The public tend to associate the term ‘biodiversity’ with variation and nature in general not specifically with ecosystems or interconnectedness.

Most of the public seem to simply associate the term with nature in general (Davidson 2019, Smit, 2014 and Fischer and Young, 2007). When focus group participants were asked what they associated with the term ‘biodiversity’, the overwhelming majority of answers revolved around ‘all of nature’ or ‘life’ (Davidson, 2019). For these participants, the term ‘biodiversity’ was synonymous with nature. Some participants seemed quite unsure of the term as they felt the term ‘biodiversity’ was interchangeable with nature; these participants found the task difficult as they were unable to give much detail about it, other than it related to nature.

“Obviously plants and animals”
(Independent adult)

“biodiversity is the natural environment”
(Independent adult)

“There are a lot of items to fit into (biodiversity) because you end up saying the whole planet”
(Independent adult)

“when I think about it I started thinking of all living life”
(Independent adult)

“different types of life”
(Parent)

“I put different types of species, diverse, lots of different things, different species” (Parent)
When NHM survey participants were asked ‘What comes to mind when I say ‘biodiversity’?’, answers included:

Fischer and Young’s (2007) focus group participants criticised the use of the term because it is “just a fancy name for nature” (p274).

When NHM survey participants were asked to provide their own definition of ‘biodiversity’, only 8 out of 35 referred more than variation (Smit, 2014). Most, 21, gave a definition that only mentioned diversity. 2 got it wrong, despite one of those visitors claiming he had heard of the term. 4 others, who had not heard of the term, said they had absolutely no idea what it could mean beyond “something to do with nature / biology”. Unsurprisingly, those who had heard of the term ‘biodiversity’ before were more likely to give a correct or partially correct definition than those who had not.

<table>
<thead>
<tr>
<th>Level of accuracy</th>
<th>Example of types of answers given</th>
<th>Number of respondents</th>
<th>Heard of the term ‘biodiversity’?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>“The diversity in all of nature, and how they work together”</td>
<td>8</td>
<td>All YES</td>
</tr>
<tr>
<td>Incomplete</td>
<td>“Different forms of life in nature”</td>
<td>21</td>
<td>18 YES 3 NO</td>
</tr>
<tr>
<td>Incorrect</td>
<td>“Bio fuel? No! Diversity is not fuel, hahaha!”</td>
<td>2</td>
<td>1 YES 1 NO</td>
</tr>
<tr>
<td>No Idea</td>
<td>“Something to do with biology?”</td>
<td>4</td>
<td>All NO</td>
</tr>
</tbody>
</table>
The public do seem aware that everything in nature is connected but do not understand what the implications of that are for biodiversity loss. Although participants rarely mention the idea that everything in nature is connected when asked what is meant by biodiversity directly, their responses to other research questions suggests they do realise that nature is connected to some degree (Davidson 2019, Fischer and Young, 2007). This seems to be due to their awareness and knowledge of food chains (Davidson 2019, Fischer and Young, 2007 and Christmas et al, 2013). For example:

“I think there is a connection but I also think there is a food chain as well which is part of that connectivity.”
(Participant quotation, Davidson 2019).

“We still need living things to help us live, we need food to eat, we need vegetables and fruit, so all these other things are needed, like the worms to turn the soil. It is like the food chain isn’t it”
(Participant quotation in Christmas et al, 2013, p70).

Where the interconnectedness of species is known, “there seemed to be a general feeling that loss of a particular species would have knock-on effects on other species including humans, but the exact effects were unclear” (Fischer and Young, 2007, p277). The fact that species, such as the Dodo or the T-Rex, have become extinct without any perceivable negative impact on the rest of life is used to argue that, despite these interrelationships, nature will recover so we do not need to worry (Davidson, 2019; Christmas et al, 2013). The fact that participants have not felt any negative impacts of extinction of species personally exacerbates this line of argument. It is difficult for the public to reconcile the two apparently contradictory messages that nature is in dynamic equilibrium but humans are having a damaging effect on nature (ibid). They do not appear to realise that these messages refer to processes that operate over different time frames and at different scales (ibid). The attitude of “Well we do lose species over years anyway” coupled with “they will always find new species” leads to a lack of concern over biodiversity loss (Davidson 2019).

Therefore, it seems there is a disconnection between the term ‘biodiversity’ and the concepts it is used to represent.

Indeed, “understanding biodiversity is not the same as knowing the word ‘biodiversity’” (Fischer et al, 2009 cited in Christmas et al (2013). This is because “the word biodiversity suggests only that there is a great variety of life forms: it does not lead one to recognise the interconnectedness of those forms in ecosystems” (Novacek, 2008, p11572). The problem has been exacerbated by single species conservation projects which prioritise one, popular species over a range of less visible, less attractive, yet crucial species, such as microbes (ibid).

Equally, focus group participants struggled to understand the importance of genetic variation within species.
“I’m not really bothered (about biodiversity loss), as long as there is some left. I mean there is like a million types of mushroom, isn’t there, or something stupid. You could afford to lose a few of them, they are not that important.”
(Participant quotation, Davidson 2019).

As a result, there are calls to replace the term ‘biodiversity’ with ‘ecosystem services’.

IUCN (2010) define an ecosystem service as: “a service people obtain from the environment. Ecosystem services are the transformation of natural assets (soil, plants and animals, air and water) into things that we value. They can be viewed as provisioning such as food and water; regulating, for example, flood and disease control; cultural such as spiritual, recreational, and cultural benefits; or supporting like nutrient cycling that maintain the conditions for life on Earth. Ecosystem ‘goods’ include food, medicinal plants, construction materials, tourism and recreation, and wild genes for domestic plants and animals” (their emphasis).

Christmas et al (2013) argues that ‘ecosystem services’ should be used to frame biodiversity because it “seeks to draw attention to the enormous value of the benefits we obtain from nature” (p70). Emphasis on the role that nature plays in “provisioning, regulating and supporting” life is needed because the public seem to lack a personal connection to nature and do not recognise the fundamental role that nature plays in their day-to-day lives (ibid, p70 and Define Research and Insight, 2007).

Other authors urge caution due to the public’s lack of understanding of the concept of ecosystems (Define Research and Insight, 2007). Novacek (2008) states “that species are the fabric of ecosystems, which in turn provide essential services, is a powerful concept, but one that may escape many of those unfamiliar with biological principles” (p11574). Define Research and Insight (2007) claim the term “is meaningless and confusing and is likely to distance people from the concept” (p40). However, DEFRA (2011) found that the public’s declared knowledge about the term ‘ecosystem services’ is comparable with that of the term ‘biodiversity’ (see Figure 7):

<table>
<thead>
<tr>
<th>Respondents declared knowledge</th>
<th>Climate change</th>
<th>Ecosystem services</th>
<th>Biodiversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot/fair amount</td>
<td>61%</td>
<td>44%</td>
<td>18%</td>
</tr>
<tr>
<td>Just a little</td>
<td>33%</td>
<td>44%</td>
<td>33%</td>
</tr>
<tr>
<td>Nothing, have only heard of the name</td>
<td>4%</td>
<td>8%</td>
<td>18%</td>
</tr>
<tr>
<td>Nothing, have never heard of it</td>
<td>1%</td>
<td>2%</td>
<td>28%</td>
</tr>
</tbody>
</table>

Note: The term ‘ecosystem services’ was not included in the 2009 survey.

Figure 7: The Public’s Declared Knowledge about Biodiversity (DEFRA, 2011)
The public is aware that biodiversity is under threat.

The biodiversity segmentation study conducted by Christmas et al (2013) suggested that 70% of the population is aware that biodiversity is under threat. Almost the same proportion (two thirds) of visitors taking part in the NHM survey about biodiversity had heard of biodiversity loss and most participants in front end focus groups for the Coral Reefs exhibition knew that coral reefs are under threat (Smit, 2014 and Fenyoe, 2014).

Although some focus group participants had heard of the term ‘biodiversity’, none had heard of the term ‘biodiversity loss’. They explained that this was a term they were unfamiliar with. However, all of the participants were able to correctly define biodiversity loss, with most of them referring to the decline in the number of species (Davidson 2019).

“The reduction in the number and type of species.”
(Independent adult)

“There is a clue in the title.”
(Parent)

When asked what loss of biodiversity meant, all NHM survey respondents gave a correct or partially correct answer (Smit, 2014). Most of them (30/35) thought it just meant extinction and losing species. 5 gave a full explanation that included an idea of how everything is connected and how it influences the environment. No one gave an incorrect answer.

<table>
<thead>
<tr>
<th>Level of Accuracy</th>
<th>Example of types of answers given</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>“That species will disappear, which means other species will disappear because they no longer have food and in the end they all affect each other.”</td>
<td>5</td>
</tr>
<tr>
<td>Partially correct</td>
<td>“Extinction”</td>
<td>30</td>
</tr>
</tbody>
</table>

Figure B: Definitions of Biodiversity Loss according to NHM Visitors (Smit, 2014)
3.2 Level of concern

People claim to be concerned about biodiversity loss

**Awareness and concern at biodiversity loss** (% of adults 2014/15 to 2018/19)

How important is it for you to personally contribute to conserving biodiversity?

![Bar chart showing percentage of adults aware and concerned about biodiversity loss from 2014/15 to 2018/19]

Figure 9: Monitor Engagement with the Natural Environment (MENE) 2019.

Monitor Engagement with the Natural World (MENE) is a national survey conducted by Nature England, a governmental adviser on the environment in England. The results of this survey are used by DEFRA to understand more about how the UK connect with nature. Approximately half a million people participated in this survey. As seen in Figure 9, in 2018-19, 62% of those surveyed claimed they were either concerned or extremely concerned about biodiversity loss.

In a Union for Ethical Biotrade (UEBT) (2014) survey, 78% of respondents agreed that they “worry about the changes to the countryside in the UK and loss of native animals and plants”, and 79% agreed that they “worry about the loss of species of animals and plants in the world”. People aged 45-54 were most likely to agree with these statements (UEBT, 2014). Additionally, 84% felt it was essential or important for them to personally contribute to conserving biodiversity (ibid).
Consumer engagement

How important is it for you to personally contribute to conserving biodiversity?

<table>
<thead>
<tr>
<th>Contribution to biodiversity conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumers are increasingly aware about biodiversity, but is it important to them to personally contribute to biodiversity conservation? For the first time UEBT asks this question, and finds that a large majority of respondents agrees:</td>
</tr>
<tr>
<td>48% of respondents say it is essential to personally contribute to diversity</td>
</tr>
<tr>
<td>84% say it is either essential or important</td>
</tr>
</tbody>
</table>

Figure 10: The Public’s Attitude towards Personally Contributing to Conserving Biodiversity (UEBT, 2014)

However, it seems the public do not really give the loss of biodiversity much thought.

When discussing how often the focus group participants thought about biodiversity loss, it seemed that they did not give the topic much thought. (Davidson 2019).

“If I hadn’t been here today I don’t think I would be discussing biodiversity loss.” (Independent adult)

Similarly, although almost all NHM survey participants rated biodiversity as “very” or “quite important to the world”, when probed, they did not seem particularly concerned about its loss (Smit, 2014). Indeed, in 2011, fewer than a quarter of DEFRA (2011) survey respondents (23%) had given biodiversity loss “a great deal” or “a fair amount” of thought. This has decreased from almost a third in 2007 (see Figure 11).

<table>
<thead>
<tr>
<th>A great deal</th>
<th>2007</th>
<th>2009</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>A fair amount</td>
<td>25%</td>
<td>14%</td>
<td>17%</td>
</tr>
<tr>
<td>A little</td>
<td>36%</td>
<td>25%</td>
<td>40%</td>
</tr>
<tr>
<td>None at all</td>
<td>32%</td>
<td>49%</td>
<td>33%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>n/a</td>
<td>6%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Figure 11: The Public’s Declared Level of Concern about Biodiversity Loss (DEFRA, 2011)

Only 4 / 35 NHM visitors were active in trying to combat biodiversity loss when surveyed (Smit, 2014). Any concern expressed seemed to be the result of conforming to societal expectations, rather than an accurate expression of their true feelings. For coral reefs specifically, focus group participants were only concerned about the loss of coral reefs if they had a personal connection to them (e.g. they had seen one while diving) or understood their environmental importance (Fenyoe, 2014).
3.2 Reasons why people are not more concerned

Reasons why people are not more actively concerned about biodiversity loss include:

**Perceptions based on knowledge of related concepts**

According to NHM research, this is because the public are either passive (i.e. just don’t give the issue much thought) or optimistic (i.e. believe it will be all right in the end). This optimism seems to be founded on:

- the misconception that current biodiversity loss is due to the natural background extinction rate and is part of the process of evolution (Novacek, 2008).
- the idea that “nature finds a way” to maintain its equilibrium i.e. it adapts and regenerates after it’s been harmed (Christmas et al, 2010 and Fischer and Young, 2007).
- The idea that the public are unable to reconcile the fact that loss of biodiversity, while having occurred naturally, is now currently happening at an unprecedented rate.

These messages suggest there is no cause for concern nor a sense of urgency about dealing with the issue (Novacek, 2008).

**Other issues are deemed more important**

Some participants stated that there are other things in life which bid for their time and attention, which are deemed more of a priority than the prevention of biodiversity loss. The participants were asked how often they think about biodiversity loss. The overwhelming response was that they do not; when they do, it is around distant examples.

“As much as life kind of allows time for; there is so much of other things going on as well.”
(Independent adult)

“If I hadn’t been here today I don’t think I would be discussing biodiversity loss.” (Independent adult)

“there are so many things that just bids your attention all the time, like bills and mortgages”.
(Independent adult).

“Public interest in most aspects of the environment is sharply declining relative to other subjects, as measured by internet searches performed on Google” (Mccallum and Bury, 2013, p1355). Google Insights for Search has become an accepted means of assessing the public’s curiosity for subjects as it monitors actual behaviour rather than self-reported behaviour (ibid). According to recent opinion polls in the US
(Novacek, 2008) and the UK (Downing and Ballantyne, 2007), it seems the public are more concerned with terrorism, healthcare and the economy than environmental issues (see Figure 12 below).

January 2020
What do you see as the most/other important issues facing Britain today?

<table>
<thead>
<tr>
<th>Top mentions %</th>
<th>Most/Other important issues</th>
<th>Most important issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Market/Brexit/EU/Europe</td>
<td>47%</td>
<td>31%</td>
</tr>
<tr>
<td>NHS/Hospitals/Healthcare</td>
<td>31%</td>
<td>44%</td>
</tr>
<tr>
<td>Pollution/Environment/Climate change</td>
<td>23%</td>
<td>15%</td>
</tr>
<tr>
<td>Poverty/Inequality</td>
<td>22%</td>
<td>9%</td>
</tr>
<tr>
<td>Crime/Law and Order/ASB</td>
<td>20%</td>
<td>5%</td>
</tr>
<tr>
<td>Education/Schools</td>
<td>18%</td>
<td>3%</td>
</tr>
<tr>
<td>Immigration/Immigrants</td>
<td>16%</td>
<td>5%</td>
</tr>
<tr>
<td>Housing</td>
<td>14%</td>
<td>3%</td>
</tr>
<tr>
<td>Economy</td>
<td>13%</td>
<td>3%</td>
</tr>
<tr>
<td>Ageing population/Social care</td>
<td>10%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Figure 12: What the UK public regard as the most important issues facing Britain (Ipsos Mori Jan 2020).

Lack of understanding about the importance of biodiversity

It seems that the public’s lack of understanding about the genetic variation of species and of the interconnectedness of species and ecosystems may also account for their lack of concern about biodiversity loss. Although the majority of NHM survey participants (30/35) equated biodiversity loss with the extinction of species, only a minority (5/35) talked about the knock on effect the extinction of one species can have on another (Smit, 2014). According to Novacek (2008) “the basic message, that biodiversity is enormously important to the sustainability of the environment and the quality of our own lives is at serious risk, is not getting across” (p11573).

The participants were asked how concerned they were about losing some species. Some participants explained that they were not concerned about biodiversity loss, particularly with regard to variation within species, as they were unable to recognise the importance of genetic variation. This is mainly due to the fact that these participants could not see a benefit or relevance of these species to their own lives.

“there is a million types of flies, million types of bees but I can’t think of anyone that had an affect or is likely to have an effect.”

(Parent)
“not really bothered (about biodiversity loss), as long as there is some left. I mean there is like a million types of mushroom, isn’t there, or something stupid. You could afford to lose a few of them, they are not that important.”
(Parent)

“I can’t think was use a millipede is”
(Independent adult)

“Some things out of the food chain you can lose.”
(Parent)

The participants struggled to understand the importance or necessity of genetic variation among species. This was due, in part, to the lack of impact they personally felt from the extinction of a particular species. This has been identified as a major barrier in terms of connecting the participants with biodiversity and the implications of biodiversity loss, and their levels of concern.

The participants were asked if they felt having a variety of species was important, in general. Some participants were limited to thinking about variety among species, rather than variety within species. As explained, the participants understood that having a variety of species is crucial, particularly for food chains. However, the majority did not deem the variety within species as crucial to ecosystems or themselves in general.

“Some creatures depend entirely on others for their food.”
(Parent)

“We humans eat a variety of food.”
(Independent adult)

However, it should be mentioned that a few participants were concerned about biodiversity loss and understood that genetic variation among species is important, although no participants were able to give examples as to why variation within species is important.

“We think we are not going to miss something but there is a purpose for everything.”
(Parent)

“The loss might only be ten square metres but then when you multiply that by ten million, you know, it is constant.”
(Parent)

Lack of relevance to people’s lives

There is a perception that biodiversity does not impact on and, therefore, is not relevant to people’s everyday lives (Davidson 2019, Smit, 2014; Fenyoë, 2014 and Christmas et al, 2013). When asked how biodiversity affects them, NHM survey participants struggled to provide links (Smit, 2014). Instead, they referred to how
nature affects their lives in general, through producing food and being present in outdoor spaces. Although these can be regarded as effects of biodiversity, it was not clear whether participants actually understood how the two elements related to each other just that there is an association. This view was shared by focus group participants taking part in the Biodiversity Segmentation Scoping Study (Christmas et al. 2013).

As a result of industrialisation and urbanisation, the public experience fewer natural processes at work first hand and perceive that the manmade environment and human behaviour “checks or excludes natural processes” e.g. lawns are tarmacked over so homeowners can park their cars (ibid, p71 and Kassas, 2002). Instead, “nature has become just another subject, rather than the immanent context for our lives. It is about them, separated from us physically and spiritually, as if nature could be fully understood outside of a connected, living context” (Gilliam and Lane-Zucker in Sobel, 1996, pvii). The idea that humans are not dependent on nature has led to some people thinking that humans can solve problems through ingenuity and technology and without relying on natural processes at all.

Lack of personal connection to biodiversity and its loss

The British and European public seem to think that biodiversity occurs in other countries so are more concerned about biodiversity loss at a global rather than a local level (Fischer and Young, 2007). For example, Christmas et al (2013) found that 26% of UK participants in the Biodiversity Segmentation Study thought that biodiversity was decreasing a lot in the world but only 14% thought it was decreasing a lot in the UK. This seems to be because UK citizens feel they have not experienced any negative effects of biodiversity loss despite approximately 500 native species becoming extinct in England since 1800 (Davidson, 2019; Fischer et al, 2007 and Natural England, 2010).

Similarly, the 2019 focus group participants were asked where they thought biodiversity loss and extinction of species is occurring (Davidson, 2019). They immediately associated biodiversity loss with distant examples, such as deforestation of the Amazon Rainforest, the Ivory Trade in Africa and plastics in the oceans. When asked for any UK examples, the participants struggled to think of any examples of biodiversity loss.

“we are not living, breathing and seeing all these species in front of us dying out… you kind of push it to the back of your mind.”
( Participant quote, Davidson 2019).

“I can’t think what has gone extinct lately in the UK.”
( Participant quote, Davidson 2019).

The participants explained that they have not felt the effects of biodiversity loss on their own lives, and so struggled to be concerned about it. Some participants even mentioned that the fact that they could not immediately see biodiversity loss directly in front of them prevented them from being concerned about it. Although these
participants could appreciate and acknowledge that biodiversity is under threat, the fact they felt this had no effect on their lives allowed them to push any concern out of their minds.

“it doesn’t affect me in my day to day.”
(Independent adult)

“the fact there are fewer really hasn’t changed by lifestyle.”
(Independent adult)

“we are not living, breathing and seeing all these species in front of us dying out... you kind of push it to the back of your mind.”
(Independent adult)

“If it is a far away place I can’t make myself care.”
(Independent adult)

Prevention of biodiversity loss is futile and feelings of helplessness
Some participants were not concerned by biodiversity loss as they felt helpless to prevent it. These participants believed that small actions would not help, and that change is reliant on larger organisations. These participants were not concerned with preventing biodiversity loss as they believed that individual action is futile.

“it is too big a topic so what can I do about it?”
(Independent adult)

“you as an individual sitting there...you are not going to have an much effect, like big industries far outweigh what you are.”
(Parent)

These participants were also not concerned with preventing biodiversity loss as they felt that it would not be achievable in the modern world in which we live. For example, these participants felt that factors such as air travel was a big contributor to biodiversity loss due to the pollution this causes. However, they explained that they would not be willing to give up their lifestyle, which ultimately prevented them from being concerned over biodiversity loss.

“The thing with climate change is, the only way to reverse it is for us to revert back to what they did in the stone-age, to remove all technology basically from the face of the earth and who wants to live like that?”
(Parent)

“I’m not going to not have a TV. I am not going to sacrifice having stuff, so we are never going to go back to them days and that is the only way you are going to stop it getting worse and reversing it.”
(Parent)
“it is basically just slowing things down though, they are never going to reverse it unless they take away air travel from the world and who is going to give up that? (Parent)

Participants felt overwhelmed by the amount of information about the environment in general

Some participants felt that there are too many environmental concerns and issues that they cannot keep up with, as they feel overwhelmed and bombarded with information. As a result, they switch off from these issues all together. For these participants, they grouped environmental issues such as climate change, pollution and biodiversity loss under one ‘environment’ category. Therefore, disengagement with one sub-set of this category, for them, effects their level of engagement with another section. This was best epitomised by the fact that some participants felt so overwhelmed with information about climate change that this barred them from being concerned about biodiversity loss. They felt that there were too many ‘options’ within the environment to care about.

“And sometimes it feels like things are thrown at us and say; right, this is the law and you have got to do it or you have got to stop doing it. But there are so many of them.”
(Independent adult)

“which one do you choose?”
(Independent adult)

“Ten years ago there was a hole in the atmosphere; no-one has mentioned that in years!”
(Independent adult)

“In terms of climate change, because of how recently they have been doing the recordings, I feel like a lot of it is kind of sensational because there is not enough data in it to be able to back up.”
(Parent)

For these participants, they felt so bombarded with information that they ‘switch off’ to any environmental concern. In fact, for some, there was so much information that they felt the information surrounding these issues could potentially be unreliable, creating another barrier for engaging with not just biodiversity loss, but other issues surrounding the environment.
Novacek (2008) identifies three principles upon which to base a strategy for engaging people in biodiversity:

- “Improved understanding of the diverse public audiences we are trying to reach
- Crafting of the messages suitable for those diverse audiences
- Enhancements of the mechanism for delivering those messages and eliciting engagement” (p11572).

To care more about biodiversity loss, the public need to be:

- emotionally engaged
- intellectually engaged
- informed about threats
- informed about what’s being done.

According to Christmas et al (2013), there are four drivers of engagement in biodiversity issues: individual factors (such as, personal motivations and values); contextual factors (such as, social and physical contexts); experiences of nature; and framing (i.e. how the subject is portrayed).

Framing (or what Novacek, 2008, refers to as “crafting the messages”, p11572) is the main driver of engagement that the Museum can affect. The academic literature identifies the same 4 step process for doing so:

<table>
<thead>
<tr>
<th></th>
<th>1 Emotionally engage</th>
<th>Providing visitors with opportunities to connect to the topic emotionally. Tapping into biophilia (Wilson, 1984) i.e. the human need and love for nature</th>
<th>(Christmas, 2013; Fenyoe, 2014; Novacek, 2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Intellectually engage</td>
<td>Providing reasons for visitors to care e.g. explaining the importance of biodiversity for all life, including humans</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Inform about threats</td>
<td>Explaining how something is at risk</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Inform about what’s being done</td>
<td>Providing positive examples of what is being done to protect biodiversity – visitors switch off from depressing messages.</td>
<td>(Christmas, 2013; Fenyoe, 2014)</td>
</tr>
</tbody>
</table>

Figure 13: How to Frame Biodiversity (based on Fenyoe, 2014)
**Emotionally Engage**

The order in which the public encounters these messages is important. The public needs to emotionally engage with biodiversity to personally value it before they intellectually engage with the reasons to care about the environment, understand how it is threatened and take action to help conserve it. “Knowledge without love will not stick. But if love comes first, knowledge is sure to follow” (John Burroughs in Sobel, 1996, p10).

The importance of personal connections in engaging the public in biodiversity loss was revealed during NHM focus groups about coral reefs. These found that “the emotional connection with coral reefs is dependent on the audience’s experience of them” i.e. those who had visited a coral reef were more concerned about their loss than those who had not (Fenyoe, 2014). Providing ways for the public to experience and (re)connect with nature is, therefore, important, particularly with more recent generations spending less time playing outdoors than their predecessors (Sobel, 1996).

It seems the public value nature in three different ways:

<table>
<thead>
<tr>
<th>Value placed on nature (Futerra, 2010)</th>
<th>Who (according to Fischer and Young, 2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biocentrics</td>
<td>e.g. birdwatchers and mountaineers</td>
</tr>
<tr>
<td>Nature has intrinsic value</td>
<td>Minority</td>
</tr>
<tr>
<td>Humanists</td>
<td>e.g. tourists</td>
</tr>
<tr>
<td>Nature has value only in relation to</td>
<td>Majority</td>
</tr>
<tr>
<td>people e.g. through aesthetics and</td>
<td></td>
</tr>
<tr>
<td>economics</td>
<td></td>
</tr>
<tr>
<td>Egoists</td>
<td>e.g. farmers</td>
</tr>
<tr>
<td>Nature has value only in relation to</td>
<td></td>
</tr>
<tr>
<td>me</td>
<td></td>
</tr>
</tbody>
</table>

Figure 14: How the Public Value Nature (based on Futerra, 2010)

Consequently, different messages about conservation actions will appeal to different people. For example, ‘reducing electricity consumption will save you money’ appeals to egoists and humanists whereas ‘reducing energy consumption will be good for the environment’ appeals to biocentrics (Christmas et al, 2013). Unfortunately, biocentrics are a minority so communicators should not assume that the public values nature for its own sake (Futerra, 2010). Ways to encourage emotional attachment to nature include providing “emotionally powerful nature experiences” and emphasising the beauty and value of a local area (Futerra, 2010, p12).

**Intellectually engage**

As the public feel removed from nature and are no longer aware of the essential role that nature plays in their everyday lives, communicating the concept of ecosystem services is important to provide people with reasons to care about nature (Christmas...
et al., 2013). In NHM focus groups for the Coral Reefs exhibition, the idea that 500 million people depend on coral reefs for food and jobs was a powerful hook into the content as it demonstrated the reefs’ importance (Fenyoë, 2014).

**Inform about threats**

Although research into environmental behaviour by Bamberg and Moser (2007) suggests that awareness of an environmental issue is “a necessary first step in the route to behaviour change”, awareness that biodiversity is decreasing is not sufficient to prompt concern and action (Christmas et al., 2013, p.27). According to Value-Belief-Norm theory (Stern et al., 1999) the public must:

- value nature
- be aware that it is being threatened in a way that will have a negative impact on what they value

before they can be motivated to take action (Christmas et al., 2013).

This may explain why the public claim to be aware and concerned about biodiversity loss but do not really give the issue much thought or take action. As the public feel they have had no personal experience of the negative implications of biodiversity loss, believe that nature will recover from any losses incurred and do not understand how the loss of a species will affect the rest of an ecosystem, it seems that they do not fully understand (nor believe) what the negative consequences will be.

However, while it is important to explain how biodiversity is being threatened and what the impact of that will be, portrayals of humans as the ‘bad guys’ result in defensive attitudes and suggestions that the problem is insurmountable (e.g. through phrases, such as global mass extinction) result in defeatist attitudes, rather than in motivations to act (Futerra, 2010 and Christmas et al., 2013). Indeed, Sobel (1996) claims children are being taught about the dangers and threats to the environment at too early an age i.e. before they have the intellectual capacity to cope with the ramifications and have developed a personal connection to nature. This results in the children performing “a subtle form of dissociation” as a coping mechanism (Sobel, 1996, p.2).

Therefore, Christmas et al. (2013) suggests that risks and negative impact are framed by the messages that:

- ‘nature can’t keep up’ with the current rate of destruction i.e. it cannot rebalance itself
- while humans are making a positive contribution to biodiversity protection, it is not yet enough to solve the problem.

**Inform about what’s being done**

It seems that around 10-13% of the UK population claim to take part in some form of conservation volunteering activity each year (Christmas et al., 2013; Smit, 2014 and DEFRA, 2011). This increases substantially if more day-to-day actions, such as encouraging wildlife into their garden, are included as examples of biodiversity
action. For example, DEFRA (2011) found that 74% of their survey participants encouraged wildlife to their garden (80% of those aged 65+ claimed they did this). Christmas et al (2013) identified 5 Tiers relating to biodiversity awareness, concern and action with 28% of participants claiming they take part in conservation efforts (see Figure 15). (N.B. lower level actions are defined as those that can be taken as part of everyday life, e.g. recycle plastic carrier bags, whereas higher level actions are those which require effort beyond day-to-day life, e.g. volunteering and lobbying.)

<table>
<thead>
<tr>
<th>Tier</th>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not aware</td>
<td>30%</td>
<td>Unaware of (and do not anticipate) any loss of biodiversity, either in England or the world</td>
</tr>
<tr>
<td>Aware</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tier One</td>
<td>17%</td>
<td>Some awareness but not concerned</td>
</tr>
<tr>
<td>Tier Two</td>
<td>30%</td>
<td>Unaware of (and do not anticipate) any loss of biodiversity, either in England or the world</td>
</tr>
<tr>
<td>Tier Three</td>
<td>25%</td>
<td>Lower levels of daily life positive behavior with no higher effort behaviours</td>
</tr>
<tr>
<td>Tier Four</td>
<td>18%</td>
<td>Higher levels of daily life positive behavior with no higher effort behaviours OR Lower levels of daily life positive behaviours with 1+ higher effort behaviour</td>
</tr>
<tr>
<td>Tier Five</td>
<td>10%</td>
<td>Higher levels of daily life positive behavior with 1+ higher effort behaviour</td>
</tr>
</tbody>
</table>

Figure 15: Biodiversity Segmentation Model (Christmas et al, 2013)

According to DEFRA (2011), it seems that almost a third (30%) of the UK public feel “there is nothing I can do personally to help protect the UK’s biodiversity” suggesting that, although the majority feel there is something they could do, a substantial proportion do not (p6). This seems to be because there is a lack of understanding of the relationship between an action and its effect (Christmas et al, 2013). Indeed, Christmas et al (2013) identifies 4 types of impact – with only one of those types having a direct impact on biodiversity:

1 DEFRA (2011) define conservation volunteering as “any voluntary activity for an organisation or community undertaken to further the understanding, protection or enjoyment of the natural environment, including wildlife recording and survey; practical countryside management; providing education, training and guided walks; and administration or other office support for conservation charities.” (p6)
<table>
<thead>
<tr>
<th>Type of impact</th>
<th>Example of an action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct impacts on biodiversity</td>
<td>e.g. planting wildflowers</td>
</tr>
<tr>
<td>Impacts on other agents</td>
<td>e.g. buying sustainably-grown coffee</td>
</tr>
<tr>
<td>Impacts on environmental pressures on biodiversity</td>
<td>e.g. reducing CO2 emissions</td>
</tr>
<tr>
<td>Impacts on the person performing the action</td>
<td>e.g. increased engagement with a species as a result of taking part in a survey</td>
</tr>
</tbody>
</table>

**Table:** Types of Impact of Biodiversity Related Actions (based on Christmas et al., 2013)

Therefore, to enable people to take action, the public need to:

- know what to do (and what not to do) through a clear call to action
- understand what type of impact the action will have (e.g. what effect switching off a lightbulb will have)
- understand how the action will have that type of impact
- know how to perform the action
- believe they are able to perform the action (Christmas et al., 2013).

As there is such a wide range of actions (and inactions) that could affect biodiversity, Christmas et al. (2013) recommends actions are framed within a context or domain: either the role assumed by the agent or the location within which the action takes place.

**Table:** Biodiversity Action Roles (Futerra, 2010)

- **Activist**
  - Make yourself heard.
  - Write to MP, go on a demo, run an event because it’s vital to demonstrate political will for change.

- **Supporter**
  - Be part of a movement.
  - Join a group, sign a petition, give money, wear a badge. Visible support builds social proof for change.

- **Doer**
  - Help nature directly.
  - Put up a bird or bee box, grow wildflowers, adopt an animal. You can make a difference in your own back yard.

- **Employer**
  - Multiply your impact.
  - Raise money, join a business group, develop a strategy. Your business impact can be huge.

- **Consumer**
  - Make decisions in your daily life.
  - Buy ‘biodiversity friendly’ goods and services, avoid buying and wasting more than you need. Your credit card is powerful.
However, it might also be helpful to think about where the action is taking place, e.g. while shopping or gardening, and so frame the issues as how to do those things sustainably (Christmas et al., 2013).

In alignment with the Museum’s new strategy (2020-2031) and in light with the above findings, the Museum has created an Advocate Engagement Model to inform the Museum’s public offer. (Figure 18).

Figure 18: Advocate Engagement Model
Biodiversity is part of the wider field of Environmental Education which has been defined as “a multidisciplinary form of education that focuses on nature, environment and society as interdependent and inseparable entities” (Dreyfus, Wals and van Weelie, 1999, p156-7).

Biodiversity education should help learners develop a personal connection to nature, understand the scientific concepts involved and be aware of the socio-scientific debate.

Although Suave (2005) identified 15 ‘currents’ or discourses adopted by environmental educators, it seems there are three domains or ‘perspectives’ which biodiversity and environmental education should cover:

<table>
<thead>
<tr>
<th>Environmental education goals</th>
<th>Biodiversity education perspectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Development</td>
<td>Nature and Self</td>
</tr>
<tr>
<td></td>
<td>Intimacy with Nature</td>
</tr>
<tr>
<td></td>
<td>Enabling the learner to develop a personal connection to nature through first-hand experience which evokes a sense of wonder and enjoyment.</td>
</tr>
<tr>
<td>Scientific Knowledge</td>
<td>Ecological Literacy</td>
</tr>
<tr>
<td></td>
<td>Understand Ecology</td>
</tr>
<tr>
<td></td>
<td>Helping the learner understand the underlying concepts associated with biodiversity (e.g. genes, species, ecosystems, habitats), the relationships between species and the role of humans within that.</td>
</tr>
<tr>
<td>Social Context</td>
<td>Politics of Nature</td>
</tr>
<tr>
<td></td>
<td>Supportive society</td>
</tr>
<tr>
<td></td>
<td>Enabling the learner to understand the multiple viewpoints associated with biodiversity as well as the political processes involved in taking conservation action.</td>
</tr>
</tbody>
</table>

Figure 19: How biodiversity education goals map on to the goals of environmental education
Biodiversity education should help learners form their own values and views about the issues surrounding biodiversity.

The traditional model of teaching environmental education is based on the assumption that providing learners with information about the environment and its condition will result in them adopting environmentally-friendly behaviours (Dreyfus, Wals, and van Weelie, 1999). This premise lends itself to the knowledge-transmission teaching model typically found in schools in which scientific facts and the notion that they should take conservation action are disseminated to pupils (Stevenson, 2007). However, research shows that “providing information simply is not enough to change people’s behaviour” (Dreyfus, Wals, and van Weelie, 1999, p158). Instead, learners should be made aware of the multiple views associated with biodiversity and given the critical thinking skills to determine their own beliefs, values and actions in relation to the issue (ibid and Stevenson, 2007). In this new pedagogical model, the emphasis is on creating a literate public who can critically analyse environmental discourses to form their own opinions rather than a learned public with a shared body of knowledge. This method of teaching doesn’t fit with the current dominant school education model as it requires a holistic, interdisciplinary approach and works best where students can solve real practical problems, rather than assess abstract or theoretical ones (see Figure 20):

<table>
<thead>
<tr>
<th>School education model</th>
<th>‘Ideal’ environmental education model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomised</td>
<td>Holistic</td>
</tr>
<tr>
<td>Individual</td>
<td>Cooperative</td>
</tr>
<tr>
<td>Abstract</td>
<td>Real</td>
</tr>
<tr>
<td>Knowledge transmission</td>
<td>Critical thinking</td>
</tr>
<tr>
<td>Disciplinary</td>
<td>Interdisciplinary</td>
</tr>
</tbody>
</table>

Figure 20: Differences between the ideal environmental education model and school education approaches (Stevenson, 2007)
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