GC Insights: Nature stripes for raising engagement with biodiversity loss

Miles Richardson

School of Psychology, University of Derby, Derby, DE22 1GB, UK

5 *Correspondence to*: Miles Richardson (m.richardson@derby.ac.uk)

Abstract. Globally there has also been a stark decline in biodiversity since 1970 yet climate change receives far greater attention. The 'warming stripes' have shown the power of very simple graphical visualisations of data for communicating with broad audiences. The 'nature stripes' show how biodiversity data can also be presented in a similar way to positive effect.

1 Introduction

10 The climate and biodiversity crises are interlinked, with transformational change required. However, biodiversity loss receives up to eight times less media coverage than climate change (Legagneux et al., 2018). The public need to be aware of the problems and be willing participants in enacting the solutions. Intergovernmental science-policy initiatives to resolve these two environmental crises are insufficient without public awareness, because policy decisions are closely related to awareness of the issues by the public (McCombs & Shaw 1972). There is therefore a clear need to inform a wider audience about

15 biodiversity loss.

The imbalance between attention given to climate warming and biodiversity loss is potentially surprising as there is a sense that many people love the natural world. In the UK and beyond people enjoy art and poetry that considers nature, many cherish naturalists and enjoy nature documentaries and millions of people are members of nature conservation organisations. Yet

20 nature is in decline.

Climate change differs through being structurally global, whereas global data for biodiversity loss must be aggregated across many species and populations (Moran, 2017) and there are differences in how climate and biodiversity are monitored (O'Conner et al., 2020). Emergent data suggests the Earth is entering a mass extinction (Ceballos et al., 2016), with others

25 noting population declines, rather than species loss, above natural variations (Briggs, 2017). It is perhaps the case that the costs and effect of climate are more visible through the impact on local weather patterns. Whereas, the loss of wildlife, even when local, can be imperceptible, with baselines shifting such that each generation has a new norm (Soga & Gaston, 2018). It has also been suggested that biodiversity researchers have invested less effort in promoting their findings (Legagneux et al., 2018), although the comparative lack of media interest also makes this more difficult.

Professor Ed Hawkins at the University of Reading created the 'warming stripes' in 2018. A series of vertical-coloured bars shows how the planet has warmed over 200 years. In the first week alone, warming stripes were downloaded by over a million people from the website (www.ShowYourStripes.info). The warming stripes have been shared widely, increasing the awareness of climate change by being simple and adaptable.

35

Effective communication of geoscience issues such as biodiversity loss present an enormous challenge and there is a need to create and share ideas (Hawkins et al., 2019). In that spirit and responding to Legagneux's call to focus on public and media awareness of biodiversity through conveying accurate and well-structured information, this short paper shares the 'nature stripes' as a communication engagement tool and considers some reasons for their emerging success.

40 **2 The data and approach**

Conveying accurate information on biodiversity over time requires a suitable dataset. Biodiversity is widely understood at the species level, and the Living Planet Index (LPI) is a multi-species indicator based on mean levels of vertebrate species population abundance around the world for 1970-2016. The LPI links closely to ecosystem function and ecological process and measures trends in species abundance. The LPI is constructed from time-series population indicators and the global data 45 is aggregated from over 20,000 populations of over 4000 species. The LPI reveals an average drop of 68% in the population of mammals, birds, fish, amphibians and reptiles since 1970. Given the complexities of biodiversity measurement, the LPI can be misrepresented by the popular media, however it provides an important tool in communicating biodiversity trends, such as in the high-profile Living Planet Report (WWF, 2020) and associated communications (WWF, 2022). Combined with powerful graphical representations the data can capture attention and drive action around biodiversity loss.

50

To create the stripes conditional formatting of the LPI data allows each data point to be assigned a colour. Choice of colours is critical to ensure that the graphic is as intuitive as possible, as with the blues and reds used in the warming stripes. As biodiversity and nature is commonly depicted by the colour green, the 1970 LPI of '1' was represented by a vibrant green. As the decline of wildlife can be seen as a loss of colour, the lowest LPI figure was represented by grey. A mid-point value in the 55 data was represented by yellow, the most eye-catching colour (Crameri et al., 2020) which is harmonious with green and a combination preferred by users (Weingerl & Javoršek, 2018). The colour selection also avoids the problematic red-green and rainbow colourmaps (Crameri et al., 2020). The declining trend in the LPI was therefore captured by a transition from green to yellow and then from yellow to grey, as depicted in the striped bars in Figure 1.

60 However, given the LPI is a single value representing many species globally, the decline since 1970 is smooth, the colour changes are too subtle for clear stripes to emerge, as depicted by the smooth bar in Figure 1. In order to capture the trend and

produce stripes the high and low confidence intervals for each year were used to calculate a random point using the following formula in MS Excel, Stripe Value = LPI_Value + ((LPI_Value_Upper_CI - LPI_Value Lower CI)/2)*(RANDBETWEEN(-10,10))/10. To allow differing levels of decline to be represented a protocol and colourmap are used to ensure higher levels of decline use a darker grey, with low levels of decline only reaching yellow (see Figure 1).

The creation of artificial variability within the confidence intervals is openly acknowledged. However, it is reiterated that the nature stripes are intended to be a communication and public engagement tool to motivate action on the acknowledged, yet underreported issue of biodiversity loss, rather than a visualization of the data for further analysis. The stripes engage people with the overall declining trend in biodiversity over time. The random variability also means stripes for the same data can differ, however, once again as a communication rather than analysis tool replication is not a significant issue.

Although such stripe graphics alone have proven successful, science communication must also make people care. To do so there is a need to go beyond facts to creating emotional connections by telling stories (Joubert et al., 2019), which can be seen as facts wrapped in emotions (Olson, 2009). Stories provide a powerful way to engage people with science and help them understand it (Dahstrom, 2014; ElShafie, 2018). Within this context, imagery can be combined with the stripes to add meaning, emotion and help tell a story. Or, as shown in Figure 1, the stripes can be combined with iconic and colourful species, such as the Toucan or flocks of birds. There are many opportunities to use the nature stripes to prompt emotions, trigger meaning and tell a story (see biodiversitystripes.info). This opportunity was soon spotted by Greenpeace (2022), as shown in Figure 1, and Nature4Climate (2022). Nature4Climate, comprising sixteen international environmental and civil society groups, used the stripes to announce a global effort to raise the profile of protecting and restoring ecosystems in the Nature Zones at both COP27 and COP15.

3 Discussion

Sadly, climate warming and biodiversity loss face a battle for attention against well-funded opposition. This takes place in a modern world of decreasing attention spans combined with a myriad of fast paced options (van de Sand et al., 2020). Several high-profile users of the warming stripes have reported that the graphic stopped them 'scrolling' through their social media feeds. Environmental scientists and nature conservation organisations must learn the power of meaning and emotion that those engaging consumers have been using for decades (Holbrook & Hirschman, 1982), often contributing to the environmental challenges we face today.

The original warming stripes, biodiversity stripes, or nature stripes (using more familiar terminology), meet many of the principles of effective data visualisation (Midway, 2020). The core information to be conveyed was identified and represented

in a different form, using colour which always add meaning, while retaining simplicity. Collaboration with artists, adds an opportunity for sharing further stories about nature and the human relationship with it.

95

The use of the stripes concepts with alternative datasets also allows messages to be modified for particular audiences. The LPI database includes several continental regions and groups of species, for example freshwater species where the stripes can be coloured from blue to grey. Alternative data sources should allow stripes that focus on the biodiversity of specific nations, regions and stripes for a variety of species, from insects to birds. The stripes concept can also be used to represent the declining

100   use of nature words in cultural products (Kesebir & Kesebir, 2017).

The story told by the nature stripes engages people and can help them care about the loss of wildlife, and loss of colour in the world. This matters since organisations such as the UN and IPBES recognise that the failing human relationship with nature is an underlying cause of the environmental crises. Compassion and care for nature, is a pathway to rebuild the human-nature

105   relationship (Lumber et al., 2017; Richardson et al., 2020). The nature stripes can potentially connect people with these issues so they start to care for nature and begin to green the grey.

Data Availability

Living Planet Index is available from http://stats.livingplanetindex.org/. Note that products derived from LPI data for financial gain are prohibited without written permission of ZSL and WWF

110   ### Ethical Statement

Ethical clearance not required for data visualisation using publicly available data.

Acknowledgements

The author would like to thank Professor Ed Hawkins for support in creating the nature stripes and comments on a draft version of the manuscript.

115   ### References

Briggs, J.: Emergence of a sixth mass extinction?, Biol. J. Linn. Soc., 122, 243-248, doi:10.1093/biolinnean/blx063, 2017.

Ceballos, G., Ehrlich, P., Barnosky, A., García, A., Pringle, R. and Palmer, T.: Accelerated modern human–induced species losses: Entering the sixth mass extinction, Science Advances, 1, doi:10.1126/sciadv.1400253, 2015.

Crameri, F., Shephard, G. E., & Heron, P. J.: The misuse of colour in science communication, Nature communications, 11, 1-10, 2020.

Dahlstrom, M.: Using narratives and storytelling to communicate science with nonexpert audiences, P. Natl. Acad. Sci., 111(supplement_4), 13614-13620, doi:10.1073/pnas.1320645111, 2014.

ElShafie, S.: Making Science Meaningful for Broad Audiences through Stories, Integr. Comp. Biol., 58, 1213-1223, doi:10.1093/icb/icy103, 2018.

Greenpeace: https://greenpeaceshop.co.uk/product/toucan-t-shirt/, last access 7 September 2022.

Hawkins, E., Fæhn, T. and Fuglestvedt, J.: The Climate Spiral Demonstrates the Power of Sharing Creative Ideas, B. Am. Metrol. Soc, 100, 753-756, doi:10.1175/bams-d-18-0228.1, 2019.

Holbrook, M. and Hirschman, E.: The Experiential Aspects of Consumption: Consumer Fantasies, Feelings, and Fun, J. Consum. Res., 9, 132, doi:10.1086/208906, 1982.

Joubert, M., Davis, L. and Metcalfe, J.: Storytelling: the soul of science communication, Journal of Science Communication, 18, E, doi:10.22323/2.18050501, 2019.

Kesebir, S. and Kesebir, P.: A Growing Disconnection From Nature Is Evident in Cultural Products, Perspect. Psychol. Sci, 12, 258-269, doi:10.1177/1745691616662473, 2017.

Legagneux, P., Casajus, N., Cazelles, K., Chevallier, C., Chevrinais, M., Guéry, L., Jacquet, C., Jaffré, M., Naud, M., Noisette, F., Ropars, P., Vissault, S., Archambault, P., Bêty, J., Berteaux, D. and Gravel, D.: Our House Is Burning: Discrepancy in Climate Change vs. Biodiversity Coverage in the Media as Compared to Scientific Literature, Frontiers in Ecology and Evolution, 5, doi:10.3389/fevo.2017.00175, 2018.

LPI, Living Planet Index: http://stats.livingplanetindex.org/, downloaded 8 August 2022

Lumber, R., Richardson, M. and Sheffield, D.: Beyond knowing nature: Contact, emotion, compassion, meaning, and beauty are pathways to nature connection, PLOS ONE, 12(5), e0177186, doi:10.1371/journal.pone.0177186, 2017.

McCombs, M. and Shaw, D.: The Agenda-Setting Function of Mass Media, Public Opinion Quarterly, 36(2), 176, doi:10.1086/267990, 1972.

Midway, S.: Principles of Effective Data Visualization, Patterns, 1, 100141, doi:10.1016/j.patter.2020.100141, 2020.

Moran, D. and Kanemoto, K.: Identifying species threat hotspots from global supply chains, Nature Ecology & Evolution, 1, doi:10.1038/s41559-016-0023, 2017.

Nature4Climate: https://twitter.com/Nature4Climate/status/1573335740305530883?s=20&t=2xqWf85mSnb9BbcF0q2q5g, last access 23 September 2022.

O'Connor B., Bojinski S., Röösli C. and Schaepman M.E.: Monitoring global changes in biodiversity and climate essential as ecological crisis intensifies, Ecological Informatics, 1, 101033, 2020.

Olson, R.: Don't be such a scientist: talking substance in an age of style., Island Press, Washington, DC, U.S.A., 2009.

Richardson, M., Dobson, J., Abson, D., Lumber, R., Hunt, A., Young, R. and Moorhouse, B.: Applying the pathways to nature connectedness at a societal scale: a leverage points perspective, Ecosystems and People, 16, 387-401, doi:10.1080/26395916.2020.1844296, 2020.

Soga, M. and Gaston, K.: Shifting baseline syndrome: causes, consequences, and implications, Front. Ecology. Env., 16,
155 222-230, doi:10.1002/fee.1794, 2018.

van de Sand, F., Frison, A., Zotz, P., Riener, A. and Holl, K.: The Battle for Attention in: User Experience Is Brand
Experience, Springer International Publishing, Cham., 2020.

Weingerl, P., & Javoršek, D.: Theory of colour harmony and its application, Tehnički vjesnik, 25, 1243-1248, 2018.

WWF, Living Planet Report 2020 - Bending the curve of biodiversity loss, edited by: Almond, R.E.A., Grooten M. and
160 Petersen, T., WWF, Gland, Switzerland, 2020.

WWF, Living Planet Report 2020: https://livingplanet.panda.org/en-gb/, last access: 5 October 2022.
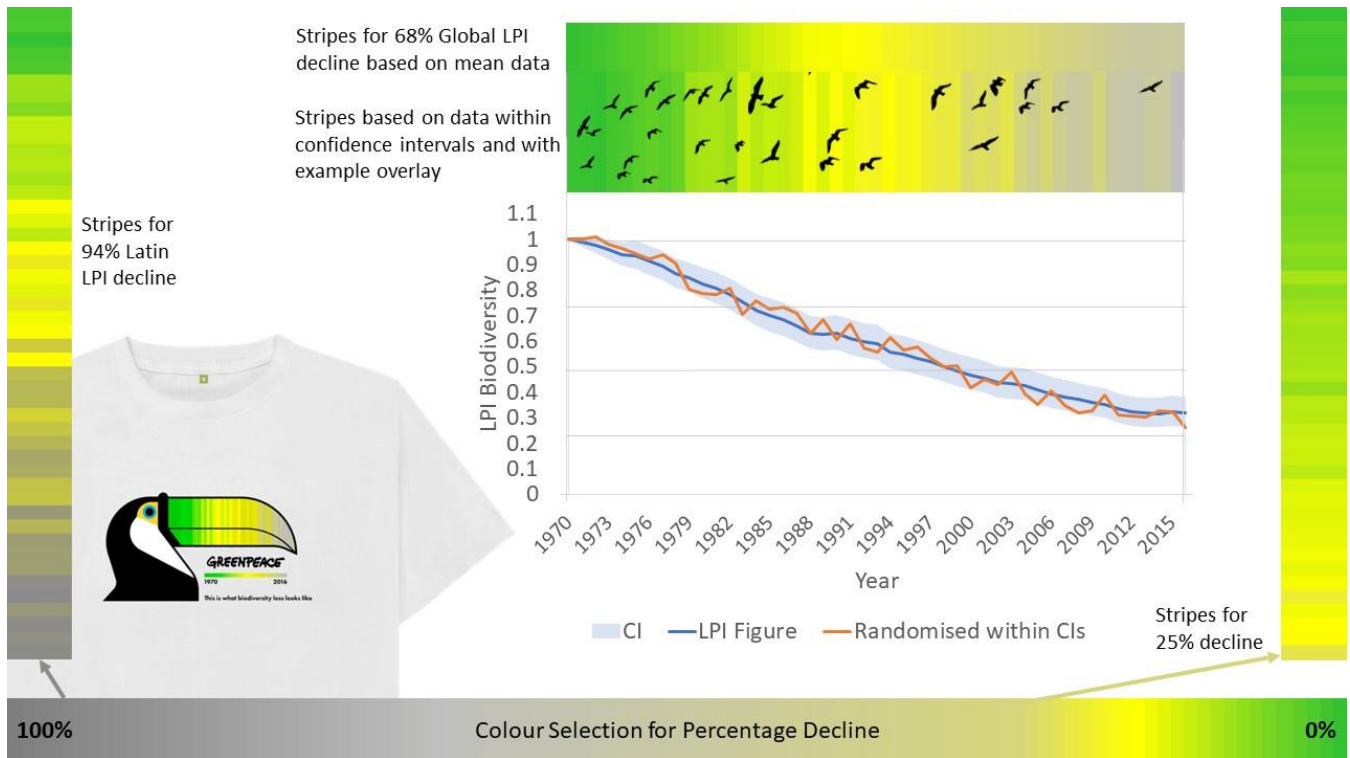
Figure 1. LPI mean and 'striped' data in traditional line chart form and represented with stripes, together with overlay, colour
165 **selection map examples and use on a Greenpeace t-shirt (Greenpeace/teemill).**