



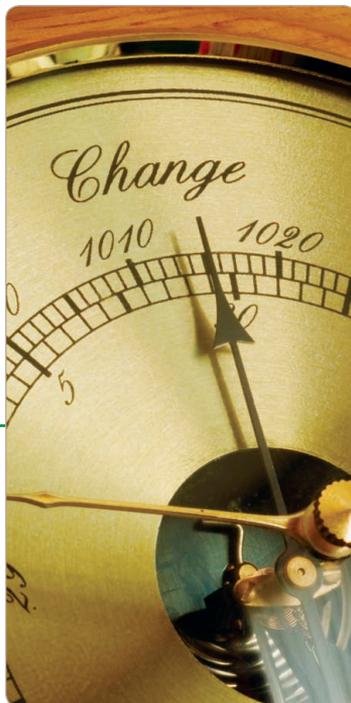
## LETTERS

edited by Jennifer Sills

### Barometer of Life: Sampling

IN THEIR POLICY FORUM “THE BAROMETER OF LIFE” (9 APRIL, P. 177), S. N. Stuart and coauthors report that 160,000 species are required to approach a meaningful indicator of the health of species. Assuming a linear projection, at the current rate of increase and level of investment, this goal will take until 2040. For the barometer to provide trend information (change in status), the 160,000 species assessments will have to be repeated on a regular basis, increasing the time frame for delivery. It is hoped that increased investment and commitment will help accelerate this process, but this will inevitably take many years; the health of the planet’s species needs urgently to be better understood.

Conducting conservation assessments of a representative sample of a set of species (1) can produce robust,



### Barometer of Life: National Red Lists

IN THEIR POLICY FORUM, S. N. Stuart *et al.* propose “The Barometer of Life” (9 April, p. 177), which would track the conservation status of the global fauna and flora on the basis of the Red List of Threatened Species (1). However, restricted knowledge of large sets of organism groups challenges the possibility of true representativeness. To address this problem, Stuart *et al.* argue for investing more resources in global Red List assessment and in accelerating taxonomy and scientific natural history.

In addition to their recommendations, I suggest other ways of speeding up the process. Several national red lists already have a very broad taxonomic scope. For instance, in Nordic countries, more than 40% of all known

multicellular species are being assessed every 5 or 10 years, representing all biomes and all major organism groups (2–4). A number of much more species-rich countries have produced extensive national red lists, such as China, The Philippines, South Africa, Brazil, Venezuela, and Colombia (5, 6). Assessments at a national level could not only complement the Barometer of Life but also serve to explore the extent to which particular organism groups are representative of the biodiversity overall.

With emerging endeavors, such as the Swedish (7–9) and the Norwegian Taxonomy Initiatives (10), aiming at finding and describing every species, we even see the possibility of assessing the conservation status for all species in particular regions. **ULF GÄRDENFORS**

meaningful results in a shorter time frame [e.g., (2)], setting a baseline from which future change can be measured and indentifying a suite of species whose fate can be tracked over time. By the end of 2010, this new approach will reveal the status of all vertebrates, a large group of plants, and a number of invertebrate groups (3).

This technique has important advantages. (i) It enables rapid assessment of groups of species, even those that are comparatively poorly known. (ii) It will add groups of species to the barometer that are more important to ecosystem function (e.g., pollination, water filtration, carbon sequestration) than those that are currently assessed. By using the sampled approach and creating a barometer that is truly representative of biodiversity, we will better equip ourselves to make the right decisions about maintaining life on Earth.

**BEN COLLEN\* AND JONATHAN E. M. BAILLIE**

Zoological Society of London, Regent’s Park, London NW1 4RY, UK.

\*To whom correspondence should be addressed. E-mail: ben.collen@ioz.ac.uk

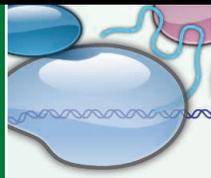
#### References

1. J. E. M. Baillie *et al.*, *Conserv. Lett.* **1**, 18 (2008).
2. V. Clausnitzer *et al.*, *Biol. Conserv.* **142**, 1864 (2009).
3. B. Collen *et al.*, in *Wildlife in a Changing World: An Analysis of the 2008 IUCN Red List of Threatened Species*, J.-C. Vié, C. Hilton-Taylor, S. N. Stuart, Eds. (IUCN, Gland, Switzerland, 2009), pp. 67–76.

Swedish Species Information Centre (ArtDatabanken), Swedish University of Agricultural Sciences, Uppsala, 750 07, Sweden. E-mail: Ulf.Gardenfors@artdata.slu.se

**References and Notes**

1. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species ([www.iucnredlist.org](http://www.iucnredlist.org)).
2. U. Gärdenfors, Ed., *The 2010 Red List of Swedish Species* (ArtDatabanken, Uppsala, Sweden, 2010).
3. J. A. Kålås, Å. Viken, T. Bakken, *2006 Norwegian Red List* (Artsdatabanken, Trondheim, Norway, 2006). A 2010 edition is scheduled for the end of 2010.
4. P. Rassi, A. Alanen, T. Kanerva, I. Mannerkoski, Eds., *The 2000 Red List of Finnish Species* (The Ministry of the Environment and the Finnish Environment Institute, Helsinki, Finland, 2001). A 2010 edition is scheduled for the end of 2010.
5. R. M. Miller *et al.*, *Conserv. Biol.* **21**, 684 (2007).
6. T. J. Zamin *et al.*, *Conserv. Biol.*, 10.1111/j.1523-1739.2010.01492.x (2010).
7. F. Ronquist, U. Gärdenfors, *Trends Ecol. Evol.* **18**, 269 (2003).
8. G. Miller, *Science* **307**, 1038 (2005).
9. ArtDatabanken, The Swedish Species Information Centre ([www.artdata.slu.se/english/](http://www.artdata.slu.se/english/)).
10. Artsdatabanken, The Norwegian Biodiversity Information Centre ([www.artsdatabanken.no](http://www.artsdatabanken.no)).



Chromatin repression

150



Stimulating destruction

154

## Barometer of Life: More Action, Not More Data

IN THEIR POLICY FORUM, S. N. STUART *ET AL.* called for “The Barometer of Life” (9 April, p. 177) to expand the scope of the IUCN Red List. The barometer would provide more detailed information on the threats, distribution, and extinction risks of 160,000 species considered more representative of the millions of species likely to exist than the 48,000 assessed to date.

We agree that identifying conservation actions to save species depends on knowledge of threats, distribution, and extinction risk, but the conservation benefit of continuing to accumulate such information must be traded off against the benefits of spending the proposed funds on alternative conservation activities, and the return on investment evaluated. Conservation initiatives fail with disturbing regularity (1), usually due to a suite of interacting social, economic, and political factors rather than an absence of data (2). Conservation plans are unlikely to be significantly improved by increasing the number of taxa upon which they are based, due to the rapidly diminishing returns of biological surveys and the extreme heterogeneity in economic and social influences on decision-making (3–6).

Although the IUCN Red List has been instrumental in raising global public awareness by documenting the status of threatened species, we question whether its expansion represents a sound return on investment. The US\$60 million investment proposed by Stuart *et al.* to expand the Red List could be better spent improving local-scale decision-making and implementing action. For

example, the Wildlife Conservation Society spends around US\$25 million annually on 1100 staff in 12 countries for its Africa field program, and the New Zealand government plans to spend NZ\$30 million a year for the next 50 years on saving 559 threatened species. We have sufficient data to confirm the current unprecedented Anthropocene extinction event. We need to market this fact better and implement action, not add weight to it with more data.

ANDREW T. KNIGHT,<sup>1\*</sup> MICHAEL BODE,<sup>2</sup>  
RICHARD A. FULLER,<sup>3</sup> HEDLEY S. GRANTHAM,<sup>3</sup>  
HUGH P. POSSINGHAM,<sup>3</sup> JAMES E. M. WATSON,<sup>3</sup>  
KERRIE A. WILSON<sup>3</sup>

<sup>1</sup>Department of Conservation Ecology and Entomology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa. <sup>2</sup>Applied Environmental Decision Analysis Group, School of Botany, The University of Melbourne, Melbourne, VIC 3010, Australia. <sup>3</sup>The Ecology Centre and Centre for Applied Environmental Decision Analysis, University of Queensland, St. Lucia, QLD 4072, Australia.

\*To whom correspondence should be addressed. E-mail: tawnyfrogmouth@gmail.com

### References

1. K. H. Redford, A. Taber, *Conserv. Biol.* **14**, 1567 (2000).
2. A. Jaramillo-Legorreta *et al.*, *Conserv. Biol.* **21**, 1653 (2007).
3. M. Bode *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **105**, 6498 (2008).
4. H. Grantam *et al.*, *Conserv. Lett.* **1**, 190 (2008).
5. K. Perhans *et al.*, *Conserv. Biol.* **22**, 1331 (2008).
6. R. M. Cowling, A. T. Knight, S. D. J. Privett, G. P. Sharma, *Conserv. Biol.* **24**, 633 (2010).

### Response

COLLEN AND BAILLIE ARGUE THAT EXPANDING the IUCN Red List into a broader Barometer of Life will sometimes require making use of representative samples of sets of species (1, 2). We agree, and indeed the numbers we proposed assumed sampled assessments for many nonchordate taxa, for which assessments of every species are simply not possible in the foreseeable future.

We also agree with Gärdenfors that the barometer must operate at national as well as global levels, and we refer to the importance of national lists (3). Increasingly, national and global listing are conducted simultaneously (4, 5), particularly in countries with high levels of endemism. Furthermore, the development of a network of national Red List assessors would increase information availability on the world’s

species, and strengthen local scientific capacity for generating and using these data to support conservation (6).

Our call to invest in the barometer is not an alternative to the good examples of investment in conservation action given by Knight *et al.* The amount spent on data gathering and monitoring should always be a small fraction of the overall conservation budget (noting that donors specialize, some focusing solely on field action, others on research and assessments; funding is often not transferable). What we are calling for is small compared to what must be spent if we are to stop global biodiversity loss. The failure to stem biodiversity loss (7) is explained by a widening gap between the mounting pressures on biodiversity and the insufficient responses to those pressures. Consequently, the Organization for Economic Cooperation and Development governments are considering a 10-fold increase by 2020 in international biodiversity assistance [currently US\$2 billion annually (8)], and IUCN is calling for wealthy countries to invest 0.3% of annual GDP on biodiversity internationally (about US\$120 billion) (9), making our call for a US\$60 million investment in the barometer look small.

Knight *et al.* make the valid point that conservation initiatives do not usually fail because of lack of data. However, they neglect to mention that many essential conservation actions do not happen at all in the absence of data. For example, conservation of globally threatened amphibians was scarcely taking place in 2004 when IUCN first assessed and published the status of nearly 6000 species (10), thus stimulating new conservation efforts that otherwise would not have happened [the work of the Amphibian Specialist Group is one example (11)]. Thanks to this information, amphibians have joined mammals and birds as species that are considered when evaluating, mitigating, and offsetting the environmental impacts of development projects.

Unfortunately, most of the world’s taxa are wholly off the conservation radar, particularly hyperdiverse groups such as plants, fungi, and invertebrates in biodiversity-rich regions where human and financial resources are lacking. Some will be protected by chance through investment in already identified conservation targets, but this will not always be the case. In Madagascar, for example, priorities for expanding the protected area network are very different when considering vertebrates or when integrating data on plants or invertebrates (12). And the size and allocation of New Zealand’s NZ\$30 million yearly budget on threatened species (mentioned by Knight *et al.*) has certainly been influenced

### Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 3 months or issues of general interest. They can be submitted through the Web ([www.submit2science.org](http://www.submit2science.org)) or by regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.

Call for  
Papers

# Science Translational Medicine

Integrating Medicine  
and Science

The new journal from the publisher of *Science* stands at the forefront of the unprecedented and vital collaboration between basic scientists and clinical researchers.

- Cardiovascular Disease
- Neuroscience/Neurology/  
Psychiatry
- Infectious Diseases
- Cancer
- Health Policy
- Bioengineering
- Chemical Genomics/  
Drug Discovery
- Other Interdisciplinary  
Approaches to Medicine

Submit your research at  
[www.submit2scitransmed.org](http://www.submit2scitransmed.org)



Chief Scientific Adviser  
**Elias A. Zerhouni, M.D.**  
Former Director,  
National Institutes of Health



[ScienceTranslationalMedicine.org](http://ScienceTranslationalMedicine.org)

## LETTERS

by data on the 92% of their threatened species that are either plants or invertebrates (13).

The data in the Red List do much more than confirm the current Anthropocene extinction event, as implied by Knight *et al.*; they are increasingly important in guiding efforts to reduce the severity of biodiversity losses (14). For this reason, we believe that a substantial expansion in the taxonomic base of the IUCN Red List would be an excellent conservation investment.

S. N. STUART,<sup>1\*</sup> E. O. WILSON,<sup>2</sup> J. A. MCNEELY,<sup>3</sup>  
R. A. MITTERMEIER,<sup>4</sup> J. P. RODRÍGUEZ<sup>5</sup>

<sup>1</sup>International Union for Conservation of Nature (IUCN) Species Survival Commission, 1196 Gland, Switzerland; United Nations Environmental Programme World Conservation Monitoring Centre, Al Ain Wildlife Park and Resort, Al Ain, United Arab Emirates; and Department of Biology and Biochemistry, University of Bath, Bath BA2 7AY, UK. <sup>2</sup>Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138, USA. <sup>3</sup>IUCN, 1196 Gland, Switzerland. <sup>4</sup>Conservation International, Arlington, VA 22202, USA. <sup>5</sup>Centro de Ecología, Instituto Venezolano de Investigaciones Científicas, Apartado 20632, Caracas 1020-A, Venezuela, and Pro-vita, Apartado 47552, Caracas 1041-A, Venezuela.

\*To whom correspondence should be addressed. E-mail: [simon.stuart@iucn.org](mailto:simon.stuart@iucn.org)

## References

1. J. E. M. Baillie *et al.*, *Conserv. Lett.* **1**, 18 (2008).
2. V. Clausnitzer *et al.*, *Biol. Conserv.* **142**, 1864 (2009).
3. T. J. Zamin *et al.*, *Conserv. Biol.*, 10.1111/j.1523-1739.2010.01492.x (2010).
4. L. R. Minter *et al.*, *Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland* (SI/MAB Series No. 9, Washington, DC, 2004).
5. R. Valencia, N. Pitman, S. León-Yáñez, P. M. Jørgensen, *Libro Rojo de las Plantas Endémicas del Ecuador 2000* (Publications of QCA Herbarium, Pontificia Universidad Católica del Ecuador, Quito, 2000).
6. J. P. Rodríguez, *Endangered Species Res.* **6**, 193 (2008).
7. S. H. M. Butchart *et al.*, *Science* **328**, 1164 (2010); published online 29 April 2010.
8. Convention on Biological Diversity, "Examination of the outcome-oriented goals and targets (and associated indicators) and consideration of their possible adjustment for the period beyond 2010" (2010); [www.cbd.int/doc/meetings/sbstta/sbstta-14/official/sbstta-14-10-en.pdf](http://www.cbd.int/doc/meetings/sbstta/sbstta-14/official/sbstta-14-10-en.pdf).
9. International Union for Conservation of Nature, "A new vision for biodiversity conservation" (2010); [http://cmsdata.iucn.org/downloads/iucn\\_position\\_cbd\\_strategic\\_plan\\_and\\_post\\_2010\\_targets\\_pp\\_sbsta14\\_final.pdf](http://cmsdata.iucn.org/downloads/iucn_position_cbd_strategic_plan_and_post_2010_targets_pp_sbsta14_final.pdf).
10. S. N. Stuart *et al.*, *Science* **306**, 1783 (2004).
11. Amphibian Specialist Group projects ([www.amphibians.org/ASG/Projects.html](http://www.amphibians.org/ASG/Projects.html)).
12. C. Kremen *et al.*, *Science* **320**, 222 (2008).
13. New Zealand Ministry for the Environment, Threatened Species ([www.mfe.govt.nz/environmental-reporting/biodiversity/threatened-species.html](http://www.mfe.govt.nz/environmental-reporting/biodiversity/threatened-species.html)).
14. A. S. L. Rodrigues, J. D. Pilgrim, J. F. Lamoreux, M. Hoffmann, T. M. Brooks, *Trends Ecol. Evol.* **21**, 71 (2006).

## CORRECTIONS AND CLARIFICATIONS

**Reports:** "Cross-reacting antibodies enhance dengue virus infection in humans" by W. Dejnirattisai *et al.* (7 May, p. 745). On page 747, last paragraph, the following statement was incorrect: "This is the first description, using human monoclonal antibodies, of the serological response in DENV infection." In fact, it had been shown [J. S. Schieffelin *et al.*, *Viol. J.* **7**, 28 (2010)] that human monoclonal antibodies against DENV E protein were able to recapitulate the serological ADE response of DENV infections.

## TECHNICAL COMMENT ABSTRACTS

### Comment on "Differential Sensitivity to Human Communication in Dogs, Wolves, and Human Infants"

Sylvain Fiset

Topál *et al.* (Reports, 4 September 2009, p. 1269) reported that dogs' sensitivity to reading and using human signals contributes to the emergence of a spatial perseveration error (the A-not-B error) for locating objects. Here, I argue that the authors' conclusion was biased by two confounding factors: the use of an atypical A-not-B search task and an inadequate nonsocial condition as a control.

Full text at [www.sciencemag.org/cgi/content/full/329/5988/142-b](http://www.sciencemag.org/cgi/content/full/329/5988/142-b)

### Comment on "Differential Sensitivity to Human Communication in Dogs, Wolves, and Human Infants"

S. Marshall-Pescini, C. Passalacqua, P. Valsecchi, E. Prato-Previde

Topál *et al.* (Reports, 4 September 2009, p. 1269) showed that dogs, like infants but unlike wolves, make perseverative search errors that can be explained by the use of ostensive cues from the experimenter. We suggest that a simpler learning process, local enhancement, can account for errors made by dogs.

Full text at [www.sciencemag.org/cgi/content/full/329/5988/142-c](http://www.sciencemag.org/cgi/content/full/329/5988/142-c)

### Response to Comments on "Differential Sensitivity to Human Communication in Dogs, Wolves, and Human Infants"

József Topál, Ádám Miklósi, Zsófia Sümegi, Anna Kis

The comments by Fiset and Marshall-Pescini *et al.* raise important methodological issues and propose alternative accounts for our finding of perseverative search errors in dogs. Not denying that attentional processes and local enhancement are involved in such object search tasks, we provide here new evidence and argue that dogs' behavior is affected by a combination of factors, including specific susceptibility to human communicative signals.

Full text at [www.sciencemag.org/cgi/content/full/329/5988/142-d](http://www.sciencemag.org/cgi/content/full/329/5988/142-d)