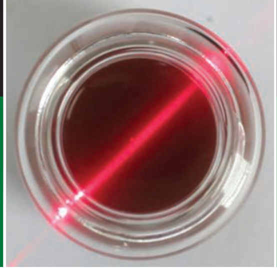

LETTERS

edited by Jennifer Sills

The Scientific Whaling Loophole

AT THE RECENT INTERNATIONAL WHALING COMMISSION'S ANNUAL meeting in Panama, South Korean officials announced their plan to initiate a "scientific whaling" program (*1*). This announcement came as a surprise given the general sentiment that the global demand for whale meat is declining. After weeks of international outcry, on 17 July, South Korea reversed their decision to hunt whales for research, but the issue is not dead (*2*).

South Korea claimed that the goal of the scientific whaling program is to study the types and amounts of fish whales eat, given conflict with fisheries. Yet, it is well established in the scientific literature that there are many ways to study whale diet without killing them (*3*).

Decades of fruitless negotiation between pro- and anti-whaling nations suggests a broken system, wrought with loopholes that allow unsustainable whaling to continue. Within this broken system, there is no incentive to reduce whaling, as the recent announcement by South Korea shows. Whaling groups are unwilling to compromise by allowing a sustainable harvest of whales, so unsustainable (scientific) whaling continues.

To ensure a future of both whales and whalers, we must harness the passion and value that people place on living whales, without telling people what to do or force one set of values on others. We need novel, out-of-the-box approaches to effective management and conservation of whales. We must compromise to ensure reductions in whales being killed, better oversight of countries that harvest them, and limited whaling that does not threaten the persistence of whales.

For those who believe that whaling is unethical, I challenge you to put forward alternative ideas to a global moratorium that fosters the "loophole" of scientific whaling. With new plans to develop scientific whaling programs (*4*), the current global moratorium is clearly broken. Scientists, conservation advocates, resource managers, and the public must work together to develop new approaches to ensure the persistence of whales in our oceans.

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Iconic CO_2 Time Series at Risk

THE STEADY RISE IN ATMOSPHERIC LONG-lived greenhouse gas concentrations is the main driver of contemporary climate change. The Mauna Loa CO_2 time series (*1*, *2*), started by C. D. Keeling in 1958 and maintained today by the Scripps Institution of Oceanography and the Earth System Research Laboratory (ESRL) of NOAA, is iconic evidence of the effect of human-caused fossil fuel and land-use change emissions on the atmospheric increase of CO_2. The continuity of such records depends critically on having stable funding, which is challenging to maintain in the context of 3- to 4-year research grant funding cycles (*3*), and is currently threatened by the financial crisis.

The ESRL Global Monitoring Division maintains a network of about 100 surface and aircraft sites worldwide at which whole air samples are collected approximately every week for analysis of CO_2, CH_4, CO, halocarbons, and many other chemical species (*4*). This is complemented by high-frequency measurements at the Mauna Loa, Barrow, American Samoa, and South Pole observatories, and about 10 North American tall towers. The success of the NOAA program has inspired similar efforts in Europe (*5*), China (*6*), India (*7*), and Brazil (*8*), with the United Nations World Meteorological Organization providing guidance and precision requirements through the Global Atmosphere Watch program (*9*), but no funding.

The data collected by NOAA and its worldwide partners have been used not only to demonstrate the unassailable rise of atmospheric greenhouse gas concentrations, but also to infer the magnitudes, locations, and times of surface-atmosphere exchange of those gases based on small concentration gradients between sites (*10*). Important findings from analysis of these records include the detection of a significant terrestrial carbon sink at northern mid-latitudes (*11*) and subsequent research aimed at identifying the mechanisms by which that sink must operate. Long-term, high-quality, atmospheric measurements are crucial for quantifying trends in greenhouse gas fluxes and attributing them to fossil fuel emissions, changes in land-use and management, or the response of natural

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land and ocean ecosystems to climate change and elevated CO_2 concentrations.

Greenhouse gas measurements along tall towers in the interior continents allow quantification of regional sources and sinks, which has a very high relevance for measuring the effectiveness of climate policy. NOAA ESRL provides measurements that are critical for the U.S. national security in that they provide independent verification and early warning of changing greenhouse gas emissions from countries involved in efforts to mitigate greenhouse gases.

Dedicated carbon-observing satellites such as GOSAT and OCO-2 are needed to fill in the missing geographical information required for verification of carbon flux mitigation efforts. However, satellite retrievals do not yet provide sufficient information to deliver new constraints on surface fluxes, although quick progress is being made in this direction. In situ observations are crucial for anchoring space-borne measurements, for detecting potential biases of remote sensing techniques, and for providing continuity given the finite lifetime of satellites.

Despite the growing importance of greenhouse gas observations to humanity, substantial budget cuts at NOAA have resulted in curtailment of our ability to observe and understand changes to the global carbon cycle. Already, a dozen surface flask-sampling sites have been removed from NOAA's operational network and aircraft profiling sites have been eliminated and reduced in frequency at the remaining NOAA sites. The planned growth in the tall tower program has stopped, and plans for closing some towers are being developed. The U.S. budget process in this election year, with the added risk of mandatory across-the-board cuts due to the 2011 Budget Control Act, foretells more bleak news for greenhouse gas monitoring at NOAA and could cause further retreat from the goal of recording ongoing changes in atmospheric composition. As scientists, we believe that preserving the continuity of these vital time series must remain a priority for U.S. carbon cycle research.

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Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the past 3 months or matters of general interest. Letters are not acknowledged upon receipt. Whether published in full or in part, Letters are subject to editing for clarity and space. Letters submitted, published, or posted elsewhere, in print or online, will be disqualified. To submit a Letter, go to www.submit2science.org.

Decoding Cryptosystems

R. STONE'S NEWS FOCUS STORY ABOUT PAN Jianwei's marvelous quantum optics experiments ("Entangled secret messages from space," 29 June, p. 1632) propagates some unfortunately common misconceptions about the uses of quantum key distribution (QKD) technology, especially its integration into a complete cryptosystem.

The confusion arises in the distinction between a cryptographic key and a communication session encrypted via the key. QKD does not carry or encrypt the message directly. Instead, QKD uses a classical communication authentication mechanism, quantum eavesdropping detection, and a healthy dose of statistics, as well as both quantum and classical randomness, to generate a random bit string that is known to be secret and shared only between two parties. This random bit string is then used as the encryption key for a standard, classical encryption system.

The ultimate success of the cryptosystem in protecting sensitive data depends on several factors. One such factor is the QKD implementation itself; no general attack against QKD is known, but various attacks have been proposed and even implemented against the photon generators, detectors, and electromechanical subsystems. Implementers respond by fixing problems in the usual thrust-and-parry of security systems implementation.

The security of the data depends on the strength of the classical encryption. The ideal use of the key would be to use it once and discard, as in a one-time pad (OTP), but current QKD key generation rates are far below desired classical communication rates, leading implementers to use the key for encryption schemes, such as Advanced Encryption Standard (AES), which encrypt many data bits with the use of fewer key bits. If used properly, OTP is perfectly secure, whereas AES could be broken by trying all possible keys, a theoretically possible but computationally impractical task.

Rather than flat statements that communication using QKD is totally unbreakable, it is more correct to say that it presents a different attack surface.

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CORRECTIONS AND CLARIFICATIONS

News Focus: "Where are the missing baryons?" by Y. Bhattacharjee (1 June, p. 1093). Oxygen VI is oxygen stripped of five electrons, not six, and Neon VIII is neon stripped of seven electrons, not eight.

This Week in Science: "Tic TOC1 plant clock" (6 April, p. 11). The editors note that the title of this summary was not intended to convey a connection between TOC1 and the plant gene *Tic*.

Reports: "The B73 maize genome: Complexity, diversity, and dynamics" by P. S. Schnable *et al*. (20 November 2009, p. 1112). Reference 27 should be C. Liang, L. Mao, D. Ware, L. Stein, *Genome Res*. **19**, 1912 (2009). The reference has been corrected in the HTML version online.

TECHNICAL COMMENT ABSTRACTS

Comment on "Intensifying Weathering and Land Use in Iron Age Central Africa"

K. Neumann, M. K. H. Eggert, R. Oslisly, B. Clist, T. Denham, P. de Maret, S. Ozainne, E. Hildebrand, K. Bostoen, U. Salzmann, D. Schwartz, B. Eichhorn, B. Tchiengué, A. Höhn

Bayon *et al*. (Reports, 9 March 2012, p. 1219) interpreted unusually high aluminum-potassium ratio values in an Atlantic sediment core as indicating anthropogenic deforestation around 2500 years before the present (B.P.). We argue that there is no terrestrial evidence for forest destruction by humans and that the third millennium B.P. rainforest crisis can be clearly attributed mostly to climatic change.

Full text at www.sciencemag.org/cgi/content/full/337/6098/1040-c

Comment on "Intensifying Weathering and Land Use in Iron Age Central Africa"

Jean Maley, Pierre Giresse, Charles Doumenge, Charly Favier

Bayon *et al*. (Reports, 9 March 2012, p. 1219) claim that the "rainforest crisis" in Central Africa centered around 2500 years before the present "was not triggered by natural climatic factors" and that it was caused by widespread deforestation resulting from the arrival of the Bantu colonists. However, there is a consensus among palaeoecologists that this landscape change and the related physical erosion it caused was due mainly to a shift to more seasonal rainfall regime.

Full text at www.sciencemag.org/cgi/content/full/337/6098/1040-d

Response to Comments on "Intensifying Weathering and Land Use in Iron Age Central Africa"

Germain Bayon, Bernard Dennielou, Joël Etoubleau, Emmanuel Ponzevera, Samuel Toucanne, Sylvain Bermell

Neumann *et al*. argue that terrestrial evidence does not support our interpretation of large-scale human land use in Central Africa about 2500 years ago and that climate was the main driver of the rainforest crisis at that time, and Maley *et al*. raise a number of concerns about our interpretation of data from chemical weathering proxies. Taking into account existing palaeoclimatic data and clarifying some misconceptions, we reassert that humans must also have contributed fundamentally to this large vegetation change.

Full text at www.sciencemag.org/cgi/content/full/337/6098/1040-e

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The Scientific Whaling Loophole

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