CONSERVATION

Boosting CITES

To protect biodiversity, more, improved biological and trade data and analyses are needed.

Jacob Phelps,[1]*† Edward L. Webb,[1]* David Bickford,[1]† Vincent Nijman,[2] Navjot S. Sodhi[1]

International wildlife trade remains a leading threat to biodiversity conservation (1) and is a common vector for infectious diseases (2, 3) and invasive species (4) that also affect agriculture, livestock, and public health. With 175 member countries, the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) is the most important global initiative to monitor and regulate international trade of plants and animals (5). CITES regulates trade of nearly 34,000 species and has reduced threats associated with overharvest of imperiled species for international trade.

Credible biological and trade data are core to informing decisions and garnering political will and consensus among CITES parties (6). This does not preclude party bargaining, as occurred during the March 2010 Conference of Parties (CoP) debate over bluefin tuna [e.g., (7)]. Nevertheless, CITES decisions are also frequently hindered by a lack of basic data [e.g., (8–10)]. We highlight CITES limitations and describe potential solutions related to systematic data collection, rigorous data analysis, flexible research methods, and peer review.

Systematic, Standardized Data Collection

The CITES secretariat, Animals and Plant Committees (APCs), and external agencies [e.g., International Union for Conservation of Nature (IUCN) Specialist Groups] depend on national agencies to regulate trade. Yet many CITES parties fail to systematically monitor and report international wildlife trade [e.g., (11–13)]. Some of the largest exporters and importers of wildlife products are not fully compliant: Brazil, a significant source country for illegal fauna (14), lacks a functioning central mechanism for reporting wildlife confiscations (15). The United States, a leading importer of wildlife, lacks a coordinated national authority for monitoring wildlife imports (3).

Many CITES parties fail to collect domestic population and harvest data, and CITES lacks a standard international reporting mechanism for species-level information (16). Yet this information is central to CITES function (9, 15), as exporters must complete nondetriment finding (NDF) reports to prove that international trade is not harming populations of regulated species (17). Such baseline data are also fundamental to listing species for CITES protection; commercially high-value species have been listed on the basis of robust, empirical population data [e.g., (6, 18)]. However, most taxa are understudied, and there is a lack of coordinated, systematic data collection within and among parties [supporting online material (SOM)].

Data collection at all levels depends on proper species identification (19), which

	Genera identified	Count* for each genus
CITES Trade Database	*Ascocentrum*	5
	Dendrobium	5
	Rhynchostylis	10
Total count		**20**
Market observations	*Aerides*	60
	Arundina	14
	Ascocentrum	7
	Bulbophyllum (including *Cirrhopetalum*)	50
	Dendrobium	10
	Eria	5
	Vanda	6
	Vanilla	16
Total count		**168**

Orchid trade between Lao PDR and Thailand. Comparing CITES Trade Database (2000–09) and a 1-day survey of a single market trader along the Mekong River (February 2010). *The CITES count is based on the number reported, method unreported. Observed count is based on the number of plant bundles (potentially including multiple individuals) plus the number of individuals (potentially divisions of larger plants), both recorded as single counts. This is conservative relative to traditional customs recording, but not necessarily representative of the number of genetically distinct individuals. (See SOM for details.)

remains a leading challenge. For example, more than 50% of documented live-animal imports into the United States from 2000 to 2006 were identified only by class; only about 14% were identified to species (3). Weak data sets overlook species introductions, substitutions, and exporter misidentifications [e.g., (20)]. Traditional identification protocols and methods are proving inadequate (3, 15) and require revision and innovation (19, 21).

Rigorous Analysis

When data are available, analyses under the Secretariat, APCs, and their collaborators often remain insufficient to identify species threatened by trade and to detect trade inaccuracies and loop-holes. For instance, ~20% of species threatened in four mega-diversity countries (Brazil, China, Colombia, and the Philippines) have not been assessed at the international level (22). Similarly, the IUCN holds "no information" about the status of most of the Orchidaceae (23); only three species were added to the Red List of Threatened Species from 2007 to 2009, although sufficient information exists to list many others (24). A handful of studies have highlighted the need for enhanced, rigorous analysis (SOM), yet critical trade linkages often remain undetected when CITES relies on the interest, resources, and often informal or irregular input of independent researchers and organizations (25). Encouragingly, CITES partners are developing tools to enhance analysis capacity, such as the Trade Data Dashboard (26).

Flexible Methods

Wildlife trade occurs openly at public border markets (27) and discrete black markets (28). Trade activity shifts and cycles among countries as wild populations are depleted (12, 29), and innovative smuggling techniques are adopted in response to enforcement pressures (28). However, trade data are collected using conventional techniques implemented along easily accessed trade routes (e.g., airports), which cannot capture the true dynamics. For example, CITES reports an insignificant fraction of CITES-regulated wild orchid trade into Thailand from Lao People's Democratic Republic (see the chart), Myanmar, Cambodia, and Vietnam. A single small-scale trader at an informal border market on the Mekong can sell

[1]Department of Biological Sciences, National University of Singapore, Singapore, 117543, Singapore. [2]School of Social Sciences and Law, Oxford Brookes University, Oxford, OX3 0BP, UK.

*These authors contributed equally to this work. †Authors for correspondence. E-mail: jacob.phelps@gmail.com (J.P.), dbsbdp@nus.edu.sg (D.B.)

more plants in a single day than reported by CITES over a 9-year period (SOM, see the charts on page 1752). Similar trade inaccuracies are evident across taxa (bears, edible tubers, medicinal plants, seahorses, bushmeat, and frogs) and regions (*12*, *20*, *27*, *30*–*33*). Some efforts have been made to integrate alternative, investigative approaches into CITES (e.g., the Lusaka Agreement and CITES-INTERPOL collaborations), but the overall CITES "airport bias" fails to detect the majority of illicit trade.

CITES shortcomings may be overlooked because the convention lacks internal and external checks and balances. CITES relies exclusively on country self-reporting, although incentives are high for biased analyses and misreporting (*34*), and most CITES-listed species occur in the tropics where governance is often weak and corruption high (*35*). This is especially problematic when CITES National Management Authorities lack independence from their advisory Scientific Authorities (SOM) and because parties' submissions to CITES are not publically available (*36*).

Critical, independent peer-review offers a legitimate means of party validation, particularly when addressing contentious issues such as harvest quotas, approvals of NDFs, proof of captive breeding, and national management procedures for protected species (*8*). These reviews may meet with party resistance that could hamper future investigative efforts, especially if they are followed by legal action. However, the recent pilot CITES Policy Review Project in four exporting countries provides an encouraging precedent for future external reviews (*37*) (SOM).

Solutions in Context

CITES credibility, effectiveness, and success at catalyzing consensus depend heavily on punctilious data collection, analysis, and synthesis. Yet the convention is bound by political and economic realities. General strategies through which to improve CITES (table S1) must recognize that some measures may overlap, prioritization depends on party needs and resources, and recommendations may vary in their political feasibility.

CITES has improved party compliance and science-based decision-making despite political sensitivities, through provision of technical support; mission visits and recommendations; simplified reporting procedures; and legal strategies, such as warnings and threats of trade suspensions (*5*, *36*). Such progress demonstrates CITES recognition of the importance of enhanced enforcement and data collection. Further increasing the demands on CITES parties and secretariat is necessary, but remains administratively demanding, costly, and politically challenging.

Some of the most urgent solutions (table S1) require the greatest coordination among parties and institutions. For example, collection of baseline biological data on traded species will require coordinated activities among diverse stakeholders, ranging from rural harvesters to multilateral agencies. CITES has already enhanced data-sharing and analysis through collaborations with nongovernmental organizations and partnerships, such as the Wildlife Enforcement Monitoring System. At the March 2010 CoP, CITES instituted an illegal-trade database working group to enhance data collection and analysis (*38*). The majority of proposed solutions depends on enhanced active, sustained, and reciprocal engagement of CITES parties with external partners.

Funding remains a principal limitation to CITES, especially for on-the-ground execution of mandates and for proposed enhancements (table S1) (*25*). The secretariat operates on meager party donations (*25*, *36*) of U.S. $5.2M per year for 2009–11 (*39*). National-level funding for CITES enforcement is similarly restricted, especially in many tropical exporting countries. There is a need for parties, particularly importing nations, to increase contributions dramatically. CITES costs should also be extended to participating industries and consumers, consistent with the "polluter pays" principle, while doing no harm to poor harvesters (*40*). This can be accomplished through trade levies on CITES-listed wildlife (*9*), increased infraction penalties (*19*), and wildlife certification schemes (*41*). Only through increased resources can CITES move toward proactive, real-time monitoring and regulation to strengthen enforcement and data quality.

After 35 years, the CITES framework remains highly relevant, and the secretariat and CoP should continue to facilitate progress among noncompliant countries and should exercise legal tools to create consensus. However, current rigors are inadequate, and meaningful improvements will require greater financial and political commitments. We propose targeted CITES negotiations to establish new partnerships; to review financial commitments; and to develop clear rules and progressive standards for data collection, analysis, and review. A strengthened convention is essential to protecting imperiled biodiversity.

References and Notes

1. W. Sutherland *et al.*, *Conserv. Biol.* **23**, 557 (2009).
2. P. Daszak, A. A. Cunningham, A. D. Hyatt, *Science* **287**, 443 (2000).
3. K. F. Smith *et al.*, *Science* **324**, 594 (2009).
4. P. M. Vitousek, C. M. D'Antonio, L. L. Loope, R. Westbrooks, *Am. Sci.* **84**, 468 (1996).
5. P. H. Sand, *Eur. J. Int. Law* **8**, 29 (1997).
6. T. Gehring, E. Ruffing, *Glob. Environ. Polit.* **8**, 123 (2008).
7. S. Milius, *Sci. News*, 26 March 2010, Web edition; www.sciencenews.org/view/generic/id/57679.
8. V. Nijman, C. R. Shepherd, *Wildlife Trade from ASEAN to the EU: Issues with the Trade in Captive-Bred Reptiles from Indonesia* (TRAFFIC Europe Report for the EC, Brussels, 2010); www.traffic.org/species-reports/traffic_species_reptiles26.pdf.
9. V. Nijman, *Biodivers. Conserv.* **19**, 1101 (2010).
10. E. C. M. Parsons, N. A. Rose, T. M. Telecky, *Mar. Policy* **34**, 384 (2010).
11. L. Yi-Ming, L. Dianmo, *Biodivers. Conserv.* **7**, 895 (1998).
12. B. G. Giles, T. S. Ky, D. H. Hoang, C. J. Vincent, *Biodivers. Conserv.* **15**, 2497 (2006).
13. O. G. Amir, *Wildlife Trade in Somalia* (Antelope Specialist Group, Northeast African Subgroup, IUCN Species Survival Commission, Geneva, 2006).
14. RENCTAS, *Primer Relatorio Nacional Sobre o Trafico de Fauna Silvestre* [RENCTAS (Brazilian National Network to Fight the Trafficking of Wild Animals), Brazília, 2001]; www.renctas.com.br/files/REL_RENCTAS_pt_final.pdf.
15. J. Pistoni, L. F. Toledo, *Braz. Soc. Herpetol.* **5**, 51 (2010).
16. H. Gerson *et al.*, *Conserv. Biol.* **22**, 4 (2008).
17. CITES, "Non-detriment findings"; www.cites.org/eng/prog/ndf/index.shtml.
18. A. G. Blundell, *Oryx* **38**, 84 (2004).
19. G. E. Rosen, K. F. Smith, *EcoHealth* **7**, 24 (2010).
20. M. Veith, J. Kosuch, R. Feldmann, H. Martens, A. Seitz, *Biodivers. Conserv.* **9**, 333 (2000).
21. E. P. Green, H. Hendry, *Coral Reefs* **18**, 403 (1999).
22. D. Brito *et al.*, *Biol. Conserv.* **143**, 1154 (2010).
23. United Nations Environment Programme–World Conservation Monitoring Centre (UNEP-WCMC), Threatened Species Database (UNEP-WCMC, Cambridge, 2010); www.unep-wcmc.org.
24. IUCN Species Survival Commission, Orchid Specialist Group General Meeting, Quito, Ecuador, 7 February 2009; www.orchidconservation.org/osg/Docs/OSG%20Quito%20minutes.pdf.
25. L. Wilson-Wilde, *Forensic Sci. Med. Pathol.* **6**, 221 (2010).
26. CITES, Trade Data Dashboards, http://cites-dashboards.unep-wcmc.org/about.
27. N. Van Song, *J. Environ. Dev.* **17**, 145 (2008).
28. B. Moyle, *Global Crime* **10**, 124 (2009).
29. A. I. Carpenter, J. M. Rowcliffe, A. R. Watkinson, *Biol. Conserv.* **120**, 291 (2004).
30. C. R. Shepherd, V. Nijman, *Biodivers. Conserv.* **17**, 35 (2008).
31. T. R. B. Davenport, H. J. Ndangalasi, *Oryx* **37**, 55 (2003).
32. C. S. Olsen, N. Bhattarai, *Mt. Res. Dev.* **25**, 37 (2005).
33. M. Mohneke, A. B. Onadeko, M. Hirschfeld, M. O. Rodel, *TRAFFIC Bull.* **22**, 117 (2010).
34. F. Courchamp *et al.*, *PLoS Biol.* **4**, e415 (2006).
35. N. S. Sodhi, B. W. Brook, C. J. A. Bradshaw, *Tropical Conservation Biology* (Blackwell Publishing, Oxford, 2007).
36. R. Reeve, *Int. Aff.* **82**, 881 (2006).
37. Wildlife Trade Policy Reviews, www.cites.org/eng/prog/policy/index.shtml.
38. Gathering and analysis of data on illegal trade, www.cites.org/eng/dec/valid15/15_42-43.shtml.
39. Resolution on financing, www.cites.org/eng/res/14/14-01.shtml.
40. B. Dickson, *Oryx* **42**, 548 (2008).
41. I. G. Warkentin, D. Bickford, N. S. Sodhi, C. J. Bradshaw, *Conserv. Biol.* **23**, 1056 (2009).
42. Funding for J.P. provided by the Harry S. Truman Foundation, for E.L.W. from the Singapore Ministry of Education grant no. R-154-000-400-133.