Essay

The perils of flawed science in wildlife trade literature

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Abstract: Despite broad scientific consensus that sustainable use of wildlife can enhance conservation efforts, ethical concerns have led some community groups to oppose use of wild animals. Voicing those concerns is legitimate, but underlying philosophical bias should not influence science-based analysis and interpretation. We argue that philosophical biases are common in the scientific literature on trade in wildlife. The critically important case of bias surrounding the use of reptile leathers for luxury fashion illustrates the problem. Based on analysis of official seizures of fashion products made from wildlife, a recent study inferred that criminal activity (as inferred by noncompliance with regulations) was common and increasing and, hence, that authorities needed to adopt more stringent restrictions on the trade. In fact, the conclusions of that study are artifacts of pseudoreplication (e.g., multiple counts of single violations) and biased sampling (e.g., focus on companies with high rates of error) and run directly opposite to actual patterns in the data. As a proportion of overall trade, rates of noncompliance are exceptionally low (<0.4%), are declining, and result primarily from paper-work errors rather than criminal intent (e.g., such errors are more frequent for goods shipped by government authorities than by the commercial fashion industry). The recommendation by the study authors to prohibit the international trade in wildlife-based fashion products is imperiling a sustainable trade that can benefit biodiversity and people's livelihoods by providing financial incentives for conservation of species and habitats. This example offers a warning of the dangers of basing research on the wildlife trade on ethical or philosophical positions rather than objective evaluations of evidence.

Keywords: animal rights, CITES, evidence, illegal LEMIS, philosophical bias, reptile, sustainable harvesting

Los Peligros de la Ciencia Errada en la Literatura sobre el Comercio de Fauna

Resumen: A pesar del amplio consenso científico de que el uso sustentable de la fauna puede mejorar los esfuerzos de conservación, las preocupaciones éticas han llevado a algunos grupos comunitarios a oponerse al uso de fauna silvestre. Es legítimo otorgarles una voz a estas preocupaciones, pero el sesgo filosófico subyacente no debería influenciar el análisis basado en la ciencia y su interpretación. Discutimos que los sesgos filosóficos son comunes en la literatura científica sobre la fauna. El caso críticamente importante del sesgo alrededor del uso de pieles de reptiles para artículos lujosos de moda ilustra este problema. Con base en el análisis de incautaciones oficiales de productos de moda hechos de fauna, Sosnowski y Petrossian (2020) infirieron que la actividad criminal (deducida como el no cumplimiento de las regulaciones) era común y se encontraba en crecimiento y por lo tanto, que las autoridades necesitaban adoptar restricciones más estrictas para el mercado. De hecho, las conclusiones de Sosnowski y Petrossian (2020) son artefactos de pseudoreplicación (es decir, conteos múltiples de violaciones únicas) y un muestreo sesgado (es decir, enfocado en compañías con tasas altas de error) y van directamente en contra de los patrones actuales en los datos. Como una proporción del mercado en general, las tasas de no cumplimiento son excepcionalmente bajas (<0.4%), están declinando y son el resultado principal de los errores cometidos en el papeleo y no de la intención criminal (es decir, dichos errores son más frecuentes para los bienes enviados por las autoridades del gobierno que para los envíos realizados por la industria de la moda comercial).

La recomendación hecha por Sosnowski y Petrossian (2020) de prohibir el mercado internacional de productos de moda hechos con productos animales está poniendo en peligro al mercado sustentable que puede beneficiar a la biodiversidad y al sustento de las personas al proporcionar incentivos financieros para la conservación de especies y hábitats. Este ejemplo ofrece una advertencia sobre los peligros de basar la investigación del mercado de fauna en posiciones éticas o filosóficas en lugar de evaluaciones objetivas de la evidencia.

Palabras Clave: CITES, colecta sustentable, derechos animales, evidencia, LEMIS ilegal, reptil, sesgo filosófico

摘要: 尽管野生生物的可持续利用有助于保护已广泛成为科学共识, 但伦理方面的担忧仍导致一些社会群体反对野生生物利用。表达这些担忧是合理的, 但潜在的哲学偏见不应影响基于科学的分析和解读。我们认为, 哲学偏见在野生生物贸易的科学文献中很常见, 围绕奢侈品时尚中使用爬行动物皮革的偏见就可以作为一个重要案例来说明这个问题。根据官方没收野生生物制成的时尚产品的分析, Sosnowski 和 Petrossian (2020) 推断, 犯罪活动 (由违反规定推断) 很常见且越来越多, 因此当局需要对贸易采取更严格的限制。实际上, Sosnowski 和 Petrossian (2020) 的结论是基于伪重复 (如对单次违规的重复统计) 和有偏抽样 (如关注出错率高的公司) 得到的假象, 与数据的实际情况完全相反。在所有贸易中, 违规的比率非常低 (<0.4%) 还正在下降, 并且主要是由于文书工作错误而不是存在犯罪意图 (例如, 政府部门装运的货物比商业时尚产业中更常出现这些错误) 。Sosnowski和Petrossian (2020) 提出的禁止以野生生物为基础的时尚产品国际贸易的建议正在危及通过为物种和栖息地保护提供财政激励而有益于生物多样性和人们生计的可持续贸易。这个例子警示我们, 将野生生物贸易的研究建立在伦理或哲学立场上, 而非客观地评估证据, 是很危险的。【翻译: 胡怡思; 审校: 聂永刚 】

关键词: 动物权利, 《濒危野生动植物种国际贸易公约》 (CITES), 证据, 《美国执法管理信息系统 (LEMIS)》中的非法贸易, 哲学偏见, 可持续收获, 爬行动物

Introduction

Conservation science, like many scientific fields, involves substantial controversy and disagreement (Robinson, 2011). Some of the resultant debates are due to differences in approach among practitioners within the discipline about how to ask questions and how to gather, analyze, and interpret data. Such divergences are the lifeblood of scientific progress and potentially can be reconciled by academic debate because all of the people involved broadly agree on the ground rules. That is, scientists embrace the paradigm that in testing among alternative answers for any given question, one prefers the explanation that is most compatible with empirically verifiable observations (Gauch, 2003). Although scientists tend to take that approach for granted, many people (including scientists in their personal life) use a wide range of other criteria for interpreting information. For example, many strongly held views are based on ethical, spiritual, or philosophical doctrines rather than evidence (Noss, 2007; Nelson & Vucetich, 2009).

That wider range of criteria for interpreting the results of scientific research is especially relevant in debates about the sustainability of wildlife use and trade. Whether or not wildlife trade is sustainable depends on a complex interplay among biological, economic, and social parameters (Challender et al., 2015; Cooney et al., 2015). Consequently, accurate analysis and interpretations about the sustainability of wildlife trade require an understanding of these diverse parameters. However, the expense of conducting in situ wildlife trade fieldwork and the inherent wariness of some industries utilizing wildlife are barriers to entry for aspiring conservation scientists trying to attain this knowledge. As a result, the analysis of data from open-access sources of digital information has become an increasingly accessible and affordable alternative way to examine issues associated with sustainability of that trade. For example, researchers have used online platforms and wildlife trade databases to examine issues, such as trade volumes and trends (Luiselli et al., 2012), taxonomic representation and threat status (Scheffers et al., 2019), and illegal trade (D'Cruze & Macdonald, 2016; Petrossian et al., 2016).

However, depending on online data repositories rather than obtaining direct empirical evidence entails a substantial risk of misunderstanding the impacts of harvesting on dynamic populations of wild species (especially across many taxonomic groups or species, which meta-analyses typically cover). Although steps can be taken to improve the relevance of conclusions (e.g., Robinson & Sinovas, 2018), a lack of firsthand information can lead to ambiguity—which frequently results in researchers applying their personal views to help inform their conclusions and interpretations (Wallington & Moore, 2005; Noss, 2007). Thus, such analyses often include statements that superficially sound like conclusions based on results of scientific research (i.e., are based on objective evaluation of evidence) but in fact are derived primarily from philosophical considerations (Wallington & Moore, 2005; Robinson, 2011; Martin, 2012; Challender et al., 2015).

Some level of personal bias is inevitable and is generally benign—certainly, it is not intended to cause harm. Most such biases likely are subconscious (Wallington & Moore, 2005; Noss, 2007). However, our experience over the last decade is that philosophical attitudes toward wildlife trade are often negative, are applied indiscriminately, and are increasingly influential. For

example, a study published in the journal *Biological Conservation* examining the impact of the commercial pet trade on reptile populations concluded that "the legal and illegal trade in various reptile species … should be considered detrimental to their survival" (Auliya et al., 2016). Although the study usefully highlights several instances of illegal or unsustainable trade, generalizing the conclusion so broadly goes beyond the available data and is, in our view, misleading. (In reality, relatively few species are threatened by trade [Marsh et al., 2021].) One could have reviewed a few select cases in which the harvest is demonstrably sustainable and concluded from these examples that the worldwide pet trade poses no threat to population viability of reptiles. Neither of those broad conclusions would be accurate. Numerous other studies are similarly misleading. For example, Marshall et al. (2021) conclude that 79% of traded reptile species are not subject to international regulation, which jeopardizes their conservation. The article received widespread media coverage, with titles such as "Online Reptile Trade Is a Free-For-All that Threatens Thousands of Species" (Alberts, 2020; Nuwer, 2020a). However, many species are not subject to international regulation because they do not meet well-defined criteria; that is, the conservation status and trade levels of many species do not warrant further action (i.e., listing) because the species involved are not threatened with extinction by international trade. Of the reptile species likely to be threatened by commercial use, > 95% are under international trade control (Marsh et al., 2021). So although the statement about trade in many species not being subject to international regulation is technically correct, it is embellished to infer a serious oversight and failure of conservation assessment. Many articles on wildlife trade imply that all commercial trade in wildlife is negative for biodiversity conservation, yet do not provide evidence to support this broad implication (Auliya et al., 2016; D'Cruze & Macdonald, 2016; Petrossian et al., 2016; Scheffers et al., 2019; Marshall et al., 2021).

Broad statements made by authors analyzing wildlife trade are important because such statements can misinform and misdirect time-strapped policy makers. The mainstream media often embellishes underlying philosophical biases inherent in scientific wildlife trade literature, exacerbating the problem (e.g., Alberts, 2020; Nuwer, 2020a, 2020b). Although wildlife trade is a threat to some species (e.g., tigers [Dinerstein et al., 2006]), for others trade is demonstrably sustainable and generates considerable benefits for people, species, and ecosystems (Hutton & Leader-Williams, 2003; Roe et al., 2020). Indeed, analyses of the sustainability of wildlife trade reveal declining population trends for some species, but positive population trends for many species subject to trade-related management (McRae et al., 2020). Portraying all wildlife trade in a negative light can jeopardize

these success stories and the conservation and management programs that underpin them.

We consider underlying philosophical biases in wildlife trade research to be a growing problem. Although this difficulty is well known to seasoned conservation scientists, the issue is rarely discussed in the conservation literature and has become an elephant in the room, partly because identifying underlying biases can be challenging. Wildlife trade undoubtedly threatens the viability of some species, but it contributes significantly to the viability of others. That diversity in impacts means that one needs to evaluate carefully any study that lumps all species and trade types together (i.e., vulnerable and nonvulnerable species) and then generates broad conclusions about the sustainability and value of wildlife trade. To illustrate the threat of philosophical bias in research on the wildlife trade, we examined a key example: Sosnowski and Petrossian (2020). We chose this study because it is timely; involves a taxonomic group and trade type for which the evidence overwhelming supports trade legality and sustainability; has already affected policy with implications for species conservation; and contains flaws and bias in analysis and interpretation that falsify the main conclusions of the work.

The Case Study

Sosnowski and Petrossian's (2020:94) article in *EcoHealth* asserts that "the fashion industry is one of the largest markets for illegal wildlife products." Their primary conclusions are that criminal activity in this trade is not only rife, but also increasing and, hence, that this international trade poses a significant conservation threat that should be addressed by more stringent enforcement or corporate bans on wildlife use.

Sosnowski and Petrossian (2020) based their analyses on a data set (in the United States Law Enforcement Management Information System [LEMIS]) of import seizures made by the United States Fish and Wildlife Service (USFWS) from 2003 to 2013. Small leather products, especially those made from reptile skins, were the most commonly seized articles. These items were confiscated because of regulatory infractions, most commonly those related to CITES (99% of cases).

Sosnowski and Petrossian (2020:108) call for an end to the trade in wildlife-based fashion products by saying, "If species are beautiful enough to carry as a handbag, they should be beautiful enough to let live sustainably and fulfil their ecological roles in the wild." We used their data set to evaluate the validity of their conclusions. We contend that Sosnowski and Petrossian (2020) is an example of an analysis biased by a philosophical position. We used only their data on reptiles because products made from reptile skins comprise 84% of seizures cited in Sosnowski and Petrossian (2020); their focus

was on reptiles; trade in reptile skins relates directly to the conservation of wild populations; and other wildlife products seized involve species for which lethal harvest cannot be assumed, making determination of conservation impact challenging (e.g., shell, cloth, horn, and coral).

Errors in Methodology

In legal supply chains, the extent of interventions designed to address noncompliance depends upon the proportion of shipments that contravene legal requirements. If that proportion is high, serious interventions that may affect the entire supply chain and all its actors may be warranted (e.g., trade suspensions). If that proportion is small, especially if noncompliance is concentrated in a small subset of firms, then nuanced improvements rather than blanket bans or more rigorous overall enforcement are needed.

Sosnowski and Petrossian (2020) do not specifically address the issue of how commonly authorities detect infringements. The only information they provide on this topic is at the beginning of their Results section, where they note 474 seizures over a period (2003–2013) when 2930 legal permits were issued. These numbers suggest a very high rate of noncompliance (474/2930 = 16.2%). But, the number of permits issued is incorrect and appears to have been taken from the CITES Trade database rather than from LEMIS [Appendices S1 & S4]). A better comparison would be the proportion of all shipments seized or the proportion of all shipped items seized. Before we could make that calculation, however, we needed to address the pseudoreplication and sampling bias in Sosnowski and Petrossian (2020).

Sosnowski and Petrossian (2020) treated each row in the LEMIS spreadsheet as an independent data point, even though many shipments of fashion items include material from multiple wildlife species. Thus, for example, a single shipment might include 1 python handbag, 1 pair of alligator shoes, 1 pair of python shoes, and 1 alligator handbag. If a single CITES permit is omitted from the shipping manifest accompanying the shipment, then all of the shipment's CITES-listed wildlife content is seized, and each product is recorded in LEMIS as a unique seizure entry (i.e., 4 rows in the data sheet). A bag made of several different reptile species (e.g., made of alligator with a lizard and python skin handle) may be seized because the CITES permits record only 2 of the 3 species. This bag might be entered into the database as 3 rows of unique data (to reflect the 3 species seized) even if the other 2 species have legal documentation. Ultimately, the decision about how to treat the shipment is at the discretion of the wildlife inspector, causing ambiguities in data entry (Eskew et al., 2020). Seizure of a single shipment may, therefore, translate into multiple entries (rows) in the LEMIS database, depending on the number of species, origins, sources, and types of items in the shipment.

One of the fundamental assumptions of any statistical analysis is that each data point be independent from the others. If this is not possible, then nonindependence needs to be accommodated by methods, such as nesting data points within broader categories (that are themselves independent). Pseudoreplication leads to incorrect conclusions because it can massively inflate sample sizes (Hulbert, 1984). Sosnowski and Petrossian's (2020) decision to treat all items within a shipment as independent means that a single paper-work error can translate into multiple entries in the LEMIS database and give the impression that multiple illicit events occurred. To illustrate the significance of this error, the second-worst-offending fashion brand in Sosnowski and Petrossian's (2020) study received 32 of its total 38 seizure entries from a single shipment (seized on 14 November 2012; incident number 2012182917). Our inspection of the raw data in LEMIS revealed that at least 35% of all seized shipments involving reptiles for luxury fashion included multiple items (i.e., were pseudoreplicated in the data set). By counting a single seizure event multiple times, Sosnowski and Petrossian (2020) increased the actual number of shipments seized by more than one-third.

The inclusion of some firms in Sosnowski and Petrossian's (2020) study, and the exclusion of others, also created a sampling bias. Sosnowski and Petrossian (2020) explain that they filtered the LEMIS data to restrict their analysis to luxury fashion imports. They did so by including importers of fashion goods and shoes and by omitting jewelry companies. They specifically note that they included brands of the LVMH and Kering groups, "as well as other brands with similar profiles based on products, popularity, prices and sales" (p. 97). Problematically, their sampling was biased toward fashion brands with high rates of noncompliance. Their study relies on data from 50 "luxury fashion" companies, but they do not explain how they selected those companies. They omitted many large and well-known luxury fashion brands, including most of the Richemont Group (the world's third largest luxury conglomerate). Conversely, several more obscure companies (fewer than 5 shipments over the course of the study) were selected, including some that would not typically be classified in the same league as the larger international luxury brands undertaking regular shipments of wildlife products. Many of the obscure companies were small, infrequent importers that contributed high rates of noncompliance in the LEMIS database (e.g., Isaac Mizrahi and Henri Bendel) (Appendix S4 and "Errors in Interpretation" below).

It is unclear why Sosnowski and Petrossian (2020) chose the brands they did. A more suitable source would be the Deloitte annual list of the largest 100 luxury goods companies (Deloitte, 2019). A comparison between

Sosnowski and Petrossian's (2020) selected companies and the Deloitte Top 100 list reveals that companies included in Sosnowski and Petrossian (2020) had double the seizure rate of those that were omitted, although the difference was not statistically significant. Sosnowski and Petrossian's (2020) inference of high rates of seizure is a direct result of biased sampling.

The most meaningful way to calculate the rate of noncompliance for products involving reptiles is to divide the number of shipments of reptile products that were seized ($n = 253$) by the total number of shipments involving reptiles ($n = 56,930$). For these data, this calculation yielded a noncompliance rate of 0.4% (i.e., 99.6% compliance). When instead we ignored pseudoreplication, as did Sosnowski and Petrossian (2020), and divided the number of rows of data for seizures ($n = 391$) by the total number of reptile-related rows of data in LEMIS ($n = 156,678$, including legal trade by the 50 companies Sosnowski and Petrossian [2020] included), the noncompliance rate was $391/156,678 = 0.2\%$ (i.e., 99.8% compliance). Even with the statistically flawed approach of Sosnowski and Petrossian (2020), rates of noncompliance were so low, as a proportion of total trade volume, that Sosnowski and Petrossian's (2020) recommendation to stop the trade on the basis of this result is extreme.

Some might argue, however, that even a 99.8% compliance rate is unacceptable. To put the noncompliance rate for luxury wildlife-based products into perspective, we compared the rate at which reptiles (imported in all forms, including tissue, live, skins, etc.) are seized as a function of the importing agency. Over the same period as in the Sosnowski and Petrossian (2020) study, LEMIS contains records of 55 seizure incidents from 2202 shipments of reptiles imported for educational, biomedical, scientific, and law enforcement or forensic purposes. This seizure rate (2.5%) was 5 times greater than that reported for commercial fashion.

Finally, we looked at the rate of seizures overall and at how that rate has changed through time. Sosnowski and Petrossian (2020) present a trend line that suggests increasing numbers of seizures (actually, seizure entries in LEMIS) over the study period. They report that increase as a major finding (i.e., it is reported in the abstract of their article). However, no statistical test is provided to support this finding, and the pattern shown is not statistically significant ($r^2 = 0.09$; $p = 0.35$) (Appendix S5). Reanalysis of the data on seizures relative to gross volume of trade shows a nonsignificant declining trend over time ($r^2 = 0.21$; $p = 0.16$) (Appendix S5). Expansion of the analysis to all reptile-derived fashion items imported into the United States by all companies showed a significant declining trend over time ($r^2 = 0.43$; $p = 0.028$) (Appendix S5). Sosnowski and Petrossian's (2020) conclusion about increasing noncompliance thus is the opposite of the empirical pattern in the data (i.e., no significant change in absolute numbers of seizures, but a decrease in the rate of seizures as a proportion of total trade volume).

In sum, analysis errors in Sosnowski and Petrossian (2020) invalidate their suggestions that noncompliance is common and increasing. In fact, rates of noncompliance are low and decreasing.

Errors in Interpretation

Sosnowski and Petrossian (2020) interpret seizures in the fashion sector as evidence of criminal intent; they dwell at length on their criminology approach. We suggest instead that most seizures are due to errors in documentation, such as accidentally failing to include permits within a shipment, identification errors, or omission of original export details in re-export paper work. These are easy mistakes to make, given that the CITES permit system is paper-based and its complexities offer numerous opportunities for human error (Wijnstekers, 1995).

How can one distinguish between criminal intent versus simple mistakes in paper work? We suggest that errors in paper work should generate 2 patterns in the data: noncompliance should be evident even for groups with no profit motive (such as museums and government wildlife agencies) and noncompliance should occur mostly in firms with little experience in the permitting system. Our analysis supports both those patterns.

As noted above, the rate of seizure incidents from shipments of reptiles imported for educational, biomedical, scientific, and law enforcement or forensic purposes was 5 times greater than that reported for commercial fashion. The logic Sosnowski and Petrossian (2020) used would thereby suggest that national museums, universities, and government agencies (including USFWS itself) are 5 times more likely to be involved in wildlife crime than the fashion industry (Appendix S6).

If most seizures are the result of error rather than criminal intent, one would expect noncompliance rates to be highest for people unfamiliar with this complex system, that is, small firms that export very few items. We tested this prediction by regressing seizure rates per company against the number of shipments made by those same companies over the study period. We used all imports of reptile-derived fashion products by all companies. As predicted, companies with greater numbers of shipments had lower seizure rates (trade volume vs. percentage of seizures, Spearman rho = 0.13; $p = 0.0001$) (Figure 1 & Appendix S7). In other words, the less experience companies had in trading wildlife items, the greater the chance that they made mistakes.

These results invalidate Sosnowski and Petrossian's (2020) fundamental premise that seizures reflect criminal conduct. This fallacy also is clear from closer inspection of the fashion supply chain. For example, the reptile taxon most commonly seized entering the United States
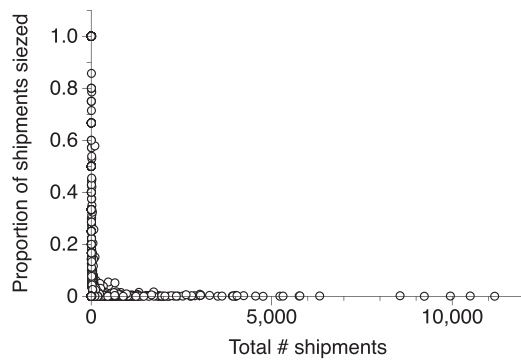
Figure 1. Rates of seizure by management authorities of wildlife-based luxury goods imported into the United States as a function of the number of shipments made by those firms over 10 years

during the course of their study was the American alligator (*Alligator mississippiensis*) (32% of all seizure rows [Appendix S8])—a species that is endemic to the United States. The vast majority of alligator skins are acquired legally and sustainably from farms in the United States controlled by the fashion brands, exported to tanneries owned by the fashion brands (e.g., in Singapore), re-exported to manufacturers owned by the fashion brands (e.g., in Italy), re-exported to a distribution warehouse owned by the fashion brands (e.g., in France), and finally re-exported back to the United States as finished products, where they are then sometimes seized. Based on this supply chain, paper-work errors are a far more plausible explanation than criminal activity.

Our results suggest that a practical way to reduce rates of noncompliance is to focus on education of people new to the trade and to simplify paper work to reduce inadvertent mistakes. Those initiatives would do far more to reduce noncompliance than would Sosnowski and Petrossian's (2020) call for more vigorous policing. Finally, in the context of seizures of luxury fashion goods, we question the validity of using LEMIS seizure data for examining impacts of illegal trade on wild populations––given that there is no link between the cause of the seizure event (i.e., they are primarily paper-work errors) and the populations of wild species.

Discussion

If conservation scientists are to influence decision making in the wildlife trade, in ways that benefit wild species, then the analysis and interpretation of wildlife trade data must be objective and rigorous. The risk of error and bias may be greater for analyses of data from online wildlife-trade repositories than for first-hand collection of field data because in the latter situation the authors' familiarity with the data can inform their decisions about how best

to analyze and interpret it. The article by Sosnowski and Petrossian (2020) offers a useful example of scientific literature containing numerous errors in analysis and interpretation that invalidate its conclusions. In addition to the main points presented above, the article includes at least 30 additional errors in statistical analysis, interpretation, literature use, conclusions, and recommendations. For the sake of brevity, explanation of these errors is in Appendix S1. These errors go beyond simple misinterpretation of the LEMIS database (only 1 of 30 errors [i.e., pseudoreplication] can be considered database misinterpretation), and all errors support the underlying position that trade is bad.

Like many emotive studies on the wildlife trade, the article by Sosnowski and Petrossian (2020) rapidly garnered attention in the popular media and has been cited in high-profile international media outlets, including *National Geographic* magazine (Katcher, 2020; Nuwer, 2020b). The consequences are substantial, given that public opinion is an increasingly important determinant of whether market-based conservation programs can deliver on their stated objectives (Lindsey et al., 2016; Natusch et al., 2019). This article has been used by advocates to lobby luxury companies to discontinue using reptile leather. Since its publication, 3 luxury fashion companies (including Calvin Klein and Tommy Hilfiger) have publicly denounced and deleted exotic skins from their merchandise.

The core issue in this debate is whether the sustainable use of biological resources is a feasible way to achieve biodiversity conservation, environmental sustainability, and socioeconomic development (CITES 2007; Abensperg-Traun, 2009; United Nations, 2015). Like climate change, the question will remain contentious in the general public long after scientists achieved broad consensus through numerous case studies over long periods (Hutton & Leader-Williams, 2003; Leader-Williams & Hutton, 2005; Abensperg-Traun, 2009; Cooney et al., 2018). Indeed, the principles that underlie sustainable use have been advocated as offering constructive solutions to complex global challenges (Cohen-Shacham et al., 2016; Maes & Jacobs, 2017). However, sustainable harvest models are inherently multidisciplinary and can be difficult to implement, and there are notable examples of failures and undesirable consequences, such as overexploitation, compromises in animal welfare standards, and outbreaks of infectious disease (Milner-Gulland & Leader-Williams, 1992; Borsky et al., 2020). Outcomes depend on complex biological, social, and economic interactions and can be difficult to predict (Cooney et al., 2015). For these reasons, policy decisions and management interventions for the wildlife trade should be based on objective evidence (and not influenced by philosophical biases, intentional or otherwise) to help ensure optimal outcomes (Roe et al., 2020; Lindsey et al., 2020).

Numerous wildlife conservation and rural development initiatives depend on the sustainable use of wildlife resources. The commercial harvest of wild reptiles and trade in reptile leather products is a prime example. As a group, reptiles demonstrate many biological characteristics that facilitate sustained harvesting (Shine et al., 1999; Hutton & Webb, 2002; Mieres & Fitzgerald., 2006; Natusch et al., 2016; Khadiejah et al., 2019). Contrary to the claims made by Sosnowski and Petrossian (2020), 70% (18) of the reptile species seized entering the United States in their study are listed as least concern by the International Union for Conservation of Nature, 23% (6) have not been assessed, and 8% (2) are listed as threatened. Overall, there is no evidence to suggest or reason to believe that the international trade in luxury leather items threatens any species (trade is based on resilient and abundant populations or captive-bred specimens [e.g., see Natusch & Lyons, 2014]). Although unsustainable and illegal trade in wildlife does occur, empirical evidence demonstrates sustainability in many cases and often cascading conservation and environmental benefits (as in the case for reptiles used by the luxury industry [Natusch et al., 2019; Marsh et al., 2021; McRae et al., 2020]).

Despite this scientific consensus, decisions about the wildlife trade often are influenced by philosophical considerations rather than rigorously established facts (Martin, 2012; Challender & MacMillan, 2019). Policy decisions informed by flawed or emotive articles can inadvertently undermine the tenets of sustainable development and catalyze trends toward less sustainable paradigms. For example, an aversion to killing wild animals for food has resulted in the destruction of natural habitats to raise domestic livestock instead (Cawthorn & Hoffman, 2014). Scientific articles that generate antitrade recommendations based on philosophical issues rather than evidence are exploited by special-interest groups that oppose sustainable harvesting based on ideology and culture-specific ethical worldviews (Challender & MacMillan, 2019). The influence of animal rights groups has persuaded some retailers to discontinue the sale of wildlife-based products and abandon commercial support for market-based conservation models (Natusch et al., 2019). Longer-term, increasing public concerns due to misinformation can result in societal shifts and fundamental changes in trade-relevant legislation. The broader impacts of misleading research conclusions should not be underestimated.

We believe that there is a growing problem in wildlife trade literature: scientific articles with conclusions that depend on flawed analytical approaches and that ultimately are unsupported by the available evidence. There is no objective way to discern the reasons for such errors, but the overall pattern seems to be that those errors consistently bias conclusions toward embracing simplistic prohibition of commercial trade in wildlife products.

As a result, we suspect that the philosophical stance of many authors plays a regrettably large role in driving conclusions in a direction inconsistent with the data. The influence of the Sosnowski and Petrossian (2020) article since publication directly illustrates the negative impacts of such biases on policy and related management and conservation programs. The growing importance of global challenges, such as climate change, the extinction crisis, and zoonotic pandemics, makes rigorous scrutiny of the wildlife trade more important than ever. As scientists, we believe that evaluations of alternative management tactics—both for and against the sustainable use of wildlife—should be conducted as objectively as possible and be informed by quantitative assessments of the critical parameters. No one can totally eliminate philosophical biases from their work, but one should strive to minimize the influence of a priori beliefs and base conclusions on hard evidence. Given the emotive and increasingly politicized nature of the topic, scientists, journal editors, and reviewers must be made aware of the diverse agendas that are driving rapidly evolving issues in the wildlife trade.

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Supporting Information

Additional information is available online in the Supporting Information section at the end of the online article. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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