Evidence on the role of social media in the illegal trade of Iranian wildlife

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Abstract
The combination of increasing trade across an ever more globalized world and the ubiquity of social media access has led to unprecedented levels of wildlife exploitation. In this study, we opportunistically surveyed Instagram and Telegram from 2019 to 2020, two of Iran’s most prominent social media platforms, for advertisements of illegally captured wildlife in Iran. In total we documented 305 advertisements for 63 species, including birds (29%), amphibians (27%), reptiles (26%), and mammals (17%). Trade was most active in June, which may be due to increased availability of young animals, following spring births. The majority of the species advertised for sale (65%) were classified by the IUCN Red List of Threatened Species as Least Concern, and 5% of the species we documented as being traded are Endangered. Some Endangered species advertised for sale were Caspian seal and Saker falcon. While the sale of all species is illegal in Iran, 25% of species were also listed on CITES as being prohibited for international trade. However, these domestic and international laws are not well-enforced within Iran, in light of the scale of open trade we observed. We recommend that authorities devote more time to monitoring these online platforms, and that resources are provided to in-country enforcement efforts during the spring and summer, the observed peak of capture and trade. We also suggest that further research be conducted into the sources of wildlife, motivations for selling wildlife, and motivations for purchasing wildlife.

Keywords
e-markets, illegal wildlife trade, Instagram, Iran wildlife, online trade, telegram

1 INTRODUCTION

Global innovations in communication technology and transportation have led to an increasingly globalized world, allowing new markets to emerge, aid international trade, and boost the global economy (Zagorchev et al., 2011). However, globalization has also accelerated legal and illegal trade of wildlife around the world (Esmail et al., 2020). Illegal trade of wildlife is a growing threat to global biodiversity and has significantly
hampered conservation efforts (Challender et al., 2015; Sung & Fong, 2018; Esmail et al., 2020; Sung et al., 2021). Besides being a staple of food markets, luxury goods, and traditional medicine, a key factor of illegal wildlife trade worldwide is the demand for pets (Baker et al., 2013). Illegal wildlife trade creates not only immediate problems such as population loss and habitat degradation (Bush et al., 2014), but can also lead to unintended consequences such as collapse of food chains (Stirmann et al., 2018), introduction of non-native species (Fong & Chen, 2010; Ikeda et al., 2004), and increased zoonotic risks and the spread of emerging infectious diseases (Jones et al., 2008; Pavlin et al., 2009; Shivaparakash et al., 2021).

With the advent of social media, illegal wildlife trade is becoming easier than ever (La Laina et al., 2021). Social media can act as a marketplace, opening gateways for online trade of animals (Harrison et al., 2016; Esmail et al., 2020; Sung et al., 2021). The lack of control over the new trade media in developing economies may perpetuate threats to endangered species by facilitating access to these wildlife (La Laina et al., 2021; Martin et al., 2018; Nijman, 2020; Siriwat et al., 2019).

There are a number of different challenges with monitoring the trades that take place through social media. Unlike the traditional marketplace, the trades happen in private settings between mostly anonymous individuals that circumnavigate the banking infrastructure through the use of third-party platforms, which makes tracking and enforcement difficult, 2018; Hinsley, Lee, et al., 2016; Hinsley, Nuno, et al., 2016). Despite social media having been identified as a priority in conservation research and monitoring of wildlife trade (Yu & Jia, 2015), literature on the topic is limited. This is particularly so for the taxonomic groups that are at high risk of overexploitation due to unsustainable and illegal capture (Martin et al., 2018). However, in the past few years some publications have explored the role of social media on the illegal trade of wildlife in different parts of the globe (Sung et al., 2021; White, 2020).

Our motivation in documenting the extent of online trafficking of native wildlife in Iran is to add to the limited body of literature regarding illegal wildlife trade in Iran and across Southwest Asia, and to provide recommendations for Iranian authorities and conservation organizations working in Iran. Although trading native fauna in Iran is restricted (IPRC, 2022), enforcing the law against it is often neglected by the authorities. This could be due to difficulties in implementing effective enforcement, which requires manpower and major financial resources (Holden et al., 2019). With the spread of broadband internet and cellular network coverage for smartphones (Wansink, 2019), online trade is increasingly accessible in Iran.

While understanding the lack of information on the illegal wildlife trade in Iran is important, there are broader benefits to this research from a global perspective. Illegal wildlife trade is often highly globalized, with, for example, wildlife taken from Africa sold thousands of miles away in Asia (e.g., t Sas-Rolfes et al., 2019). In this globalized context, Iran occupies a unique place between European, African, and Asian markets, all of which may place divergent pressures on wildlife within Iran. Understanding the scale of trade at a basic level is important for identifying global research gaps, as well as international strategies.

For the purpose of this study, we aim to address the following questions: (A) What kind of native amphibian, reptile, bird, and mammal species are mostly traded in Iran? (B) on what social media platform are most of the trades occurring? (C) What is the distribution of threatened species rank among the traded species in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species? And (D) What is the distribution of the traded species rank in the Convention on International Trade in Endangered Species (CITES)?

We collected data from advertisement posts on Instagram and Telegram, and analyzed our data to show the taxonomic and conservation characteristics of the different taxa native to Iran that are exploited. We also identified the most popular months of the year that potential trades were taking place and the platform through which these trades took place. Creating this base of information enables authorities to deploy counter-measures in a focused manner during intense periods of advertisement.

2 | MATERIALS AND METHODS

2.1 | Study platforms

To study the role of social media on the illegal wildlife trade of native species in Iran, Instagram and Telegram, two of the most popular social media platforms in the country were surveyed over the course of 1 year (2019–2020).

2.2 | Data acquisition

Data gathering was started on April 16, 2019 and stopped on April 16, 2020, so that the data were gathered consistently during the year. We opportunistically browsed through posts posted on Telegram group chats, channels and Instagram pages, every day until we reached saturation on each platform (i.e., we were seeing the same ads). This process usually took approximately an hour for each
platform. It is worth mentioning that our data collection was done between 12 and 1 pm, Iran time zone. We spent a total of approximately 720 h on both platforms to collect our data (see Opportunistic sampling for ads in the section below). We used relative keywords in Farsi (Iran’s national language) to find posts that were selling Iranian native wildlife. Finally, we collected date of post, name of the species advertised, IUCN Red List of Threatened Species rank, IUCN Red List of Threatened Species population trend, and CITES status of the species from all posts that sold wildlife. For the purposes of this study, we narrowed our search to Iranian mammals, birds, reptiles, and amphibians. We focused solely on the publicly available sources as collecting data on private accounts is beyond the scope of this study. We captured trade for both live and dead wildlife, as both types of trade are restricted in Iran.

Since some species posted in the advertisements were misidentified or not identified at all by the sellers, the authors, with the help of experts in herpetology, ornithology, and mammalogy, identified the species from the screen shots that were taken during the 1-year survey. It should be noted that, all the animals in the advertisements were identified to the species level.

It is important to know what species are traded for further research and close monitoring of their population dynamics. For context, we have also provided the global population trends and IUCN Red List of Threatened Species status of the traded species (Table S1). Given the lack of sufficient data on the regional scale (i.e., across Eastern Europe and Central Asia) for both population trends and IUCN status, we do not have access to the full perspective. However, there has been an assessment on the mammals of Iran which we used for the mammal species of this study (Yusefi et al., 2019).

On Telegram, advertisements are spread through two lines of communication with potential clients. The first format is open groups whereby multiple persons interact, create, and share content with one another. Anyone interested in selling or buying animals can join these groups through another person’s invitation or the group’s special joining link. The second avenue are channels on Telegram wherein one or more administrators can post and spread content. Usually, such operations are created by people who trade animals full-time and on large scales. Furthermore, they can spread the word about their channels in the group chats or ask other channel administrators to spread their advertisements.

On Instagram, pages are controlled by a single or multiple administrator who posts content that could be tagged with the relevant hashtags. Users can filter through the immense volume of content posted on Instagram by searching their hashtags of interest. The perpetrators appeal to potential clients by using particular hashtags on their posts. It is worth mentioning that we did not account for the daily temporal pattern of the data as due to the dynamic mechanisms of social media it was impossible.

2.3 | Opportunistic sampling for ads

In our quest to find and monitor these sources, we used relevant keywords in Farsi to find posts on Instagram and Telegram that advertised wildlife. It should be noted that we did not look into a specific taxon and we searched the same number of hashtags for each taxon. We used 32 keywords that consisted of a combination of the word “sell” and different families of each order (amphibians, reptiles, birds, mammals) (Table S1). It should be noted that some keywords we used were the common names of the most popular animal in each taxon. For instance, fox, eagle, turtle, and salamander.

Using Telegram and Instagram search algorithms, we were able to follow a whole network of pages, channels, and group chats. As we searched more, similar pages were offered to us by Instagram as “aligning with our interests.” We also found more channels on the Telegram platform because some pages on Instagram advertised their Telegram channels. Similarly, we were able to follow an ever-larger network of channels and groups on Telegram as we become more exposed to these sources. With the addition of every group or channel to our network, we would routinely notice talks of other sources, which we would then track down and follow. We tracked down sources and recorded their advertisements even if they posted a few posts about selling wildlife.

To prevent double counting and overlaps between the platforms, we checked each record with our dataset and if it was already collected, we did not take the additional record into account. In terms of overlaps between Instagram and Telegram, priority was given to the platform which we collected first after our searches. In addition, when we reached saturation on a day, we stopped our search for that day. The next day we would look again and each time, new ads would be available to collect.

2.4 | Statistical analyses

Based on the Shapiro–Wilk normality test advertisement data were normally distributed ($W = 0.91306$, $p$-value $= .2335$). Also, Levene’s test showed that the variances for advertisement in different seasons were equal, $F(3, 8) = 4.58, p = .319$. We compared the number of advertisements
between the two platforms (Instagram and Telegram) using paired t-tests. One-way ANOVA test and post-hoc Tukey test were used to compare the number of advertisements in different seasons. All statistical analyses were performed in R Studio version 2.1.1 (R Core Team, 2021).

2.5 | Ethical clearance

Although posts were public, we ensured that the identity of group members and online dealers stayed anonymous during our data collection. Therefore, we will release no record of our sources. In order to preserve the respondents’ confidentiality, we diligently followed the guidelines set forth by the University of Jiroft ethical committee under the code 128/243. Nonetheless, the majority of online sellers still used anonymous accounts and third parties to sell or deliver their merchandise.

3 | RESULTS

There are different groups, channels, and pages which each specialize on only one taxon (e.g., groups on Telegram dedicated only to reptiles). Other groups, however, are more general and people can sell or buy mammals, birds, reptiles, amphibians, fish, and sometimes invertebrates such as scorpions with relative ease.

In total we were able to find 305 relevant advertisements, with 111 found on Telegram and 194 posted on Instagram in the 12-month period, some advertisement samples from both platforms are presented in Figure 1. Of the 124 accounts that posted these advertisements,
68 of them were on Instagram and 56 on Telegram. The frequency of advertisements across birds, amphibians, reptiles, and mammals were 29.5%, 27.5%, 26.2%, and 16.7% respectively.

Birds had the highest number of advertisements across both platforms, with a total of 90 posts, 65 of which were on Instagram and 25 found on Telegram (Table 1). We did not find a significant difference between the number of advertisements on Instagram and Telegram ($t = -2.563$, df = 3, $p = .083$).

Reptiles had the highest species diversity within the advertisements, constituting 43% of the total number of species, followed by birds at 36%. Mammals and amphibians both made up 11% and 9%, respectively, of the total species promoted on Instagram and Telegram (Table S2).

### 3.1 Temporal patterns of the traded species

There was a significant seasonal pattern in the timing of advertising wildlife on Telegram and Instagram. We noticed that the majority of advertisements were posted during spring and summer; 62% of the advertisements found during the year were posted across the months of March, April, May, June, and July (Figure 2). There is a significant difference between the seasons of the year and advertisements when performing a one-way ANOVA test ($F_{3.8} = 11.179$, $p = .003$). The post-hoc Tukey test showed a significant difference between spring and autumn ($p = .036$), spring and winter ($p = .036$) but no significant difference was observed between spring and summer ($p = .673$).

### 3.2 Conservation status of the traded species

Most of the species ($n = 39, 62\%$) up for sale were classified as least concern (LC) according to IUCN’s Red List. However, according to IUCN’s Red List of Threatened Species some of their populations have decreased over the past few years due to identified threats. For 15% of the species advertised on social media, their status was either Endangered (5%), Vulnerable (8%) or Near Threatened (2%) according to IUCN’s Red List of Threatened Species, for instance, Caspian seal (*Pusa capsica*, EN), Saker falcon (*Falco cherrug*, EN), Steppe eagle (*Aquila nipalensis*, EN), Spur-thighed Tortoise (*Testudo graeca*, VU), and Lorestan Newt (*Neurergus kaiseri*, VU). In addition, 20% of the species had no IUCN Red List of Threatened Species assessment. Also, 3% of the species had deficient data. Some species in our study ($n = 22, 35\%$) had not undergone a population assessment by IUCN, and 32% of them had a decreasing population trend. Only 28% had a stable population trend and only 5% had an increasing population trend (Figure 3). Also, when assessing all the identified mammal species ($n = 6$) according to their regional IUCN Red List of Threatened Species assessment (Yusefi et al., 2019), 67% ($n = 4$) were listed as LC. Only one species (Caucasian squirrel) was listed as NT, which is classified as LC with a decreasing population in the global IUCN Red List of Threatened Species assessment. One species, the Caspian seal was not listed in the regional assessment.

In addition, when assessing all identified species according to CITES 25% ($n = 16$) of the species were listed on CITES while 75% of the remaining species were not listed (Figure 3). Within our list, 0%, 4%, 33%, 57% of the amphibian, reptile, mammal and bird species were listed by CITES, respectively (Figure 3). Among all species listed by CITES, only Peregrine Falcon (*Falco peregrinus*) was (6%, $n = 1$) on CITES appendix I which is a strict prohibition of international trading, 75% ($n = 12$)
were listed as CITES appendix II which is a closely monitored species for international trade. Also, 19% \((n = 3)\) of CITES-listed species were listed on CITES appendix III which is where species are listed at the request of a party that regulates the trade of certain species and needs international aid to prevent unsustainable or illegal exploitation.

4 | DISCUSSION

This study is the first of its kind on addressing illegal wildlife trade of Iranian wildlife, using social media in Iran. In our study we noticed that birds were the most popular taxa advertised online whereas mammals were lowest. This is in line with the global trend of illegal wildlife trade all around the world, where birds are widely traded and highly demanded (Sánchez-Mercado et al., 2020; Spee et al., 2019; Sykes, 2017). Birds of prey are especially highly demanded among the wealthy residents of the Persian Gulf states for falconry (Nijman et al., 2009; Panter et al., 2019; Wyatt, 2009). For songbirds, illegal trade is their greatest threat globally, known as the “songbird crisis” (Sykes, 2017). This general pattern is also observed in other Middle-Eastern countries (Eid et al., 2011; Aloufi & Eid, 2014; Soorae et al., 2008; Abi-Said et al., 2018). Our results are consistent with a study in Lebanon that found that 97% of the illegally traded animals were birds (Abi-Said et al., 2018). This relatively robust literature around trade in birds could support and guide “next step” research, such as consumer research to design bird-trade demand reduction interventions in Iran.

While birds were most frequently traded, we documented a variety of taxa being traded at potentially unsustainable levels. In addition, we noted that reptiles had the highest diversity of individual species traded. The nuances of this overall picture may by extension indicate a difference in relative impact to native biodiversity, and also point to the importance of identifying and addressing threats to understudied species such as reptiles and amphibians (Morton et al., 2021). This diverse trade in wildlife also illustrates the diverse potential for zoonotic transmission, and gives some indication of the relative risk of such transmission (Booth et al., 2021).

Instagram is a platform designed for content discovery (Hutchinson, 2018) and its algorithms learn the preference of its users, it will tailor the discover page to serve them more of the same content (Giannoulakis & Tsapatsoulis, 2015; Ye et al., 2017). So, in effect, the platform helps traders perpetuate their content. This ease of discovery, coupled with the popularity of Instagram as a multirole platform probably allows illegal traders to get their merchandise to markets much more efficiently. The Telegram channels and groups are more difficult to find, and usually have a smaller audience base compared to similar Instagram pages. But they are nearly as popular as Instagram for traders, we speculate that is probably

**FIGURE 3** CITES and IUCN designations for taxa identified on social media advertisements

![CITES and IUCN Designations for Iranian Animals Identified on Social Media Ads](chart)
because Telegram group chats and channels are less public.

Furthermore, there is a whole different category of offenders that use the deep web, private groups, channels and pages in order to limit their footprint and evade authorities (Stringham et al., 2021). Gaining access to these sellers is usually more difficult and can only be done by accepting their invitation to join their online clan (Stringham et al., 2021).

### 4.1 Temporal patterns of the traded species

Spring and summer were the most active seasons for the illegal traders (62% of the advertisements). During these seasons, we saw a higher portion of advertisements being posted online which we attribute to a combination of reasons. Spring is the time of the year when due to the warmer weather wild animals native to Iran are more active due to the climate conditions, mating and/or producing offspring and looking for resources (Grace et al., 2017; Krebs, 2008). We suspect this provides poachers with the opportunity to set traps and capture the wildlife, especially the infants since they are easier to take captive. Seasonality has also been found in other areas with high levels of illegal wildlife trade, such as Indonesia (Nijman et al., 2021). Similarly, to our study, a suggested reason for this seasonality was the amount of young available to take (in their case, eggs of Javan crocias \(\textit{Laniellus albonotatus}\)). However, this seasonality was also suggested to be related to the ease with which poachers could enter the forest (the wet season being prohibitive to movement) (Nijman et al., 2021). For our results, it is also possible that spring/summer is when poachers have greater ability to go into the wild to capture wildlife, if poaching is a secondary form of income/vocation, and/or related to seasonal effects such as storms/snow. In general, this noted temporal pattern represents an opportunity for intervention and identifies where an increase in enforcement investment and/or monitoring may have the most impact.

### 4.2 Conservation and CITES status of the traded species

Threatened species (Vulnerable and Endangered) are at risk of extinction in the future if decisive action is not taken to both understand population trends, and if necessary protect and conserve them. Extensive poaching of species with stable or increasing populations can eventually result in population declines, and the sustainability of such activities may need to be considered (Abensperg-Traun, 2009). The majority of our list of species (75%) were not listed on any of the CITES appendices. In a similar study in Lebanon, most traded species were also not listed in CITES (64%) (Abi-Said et al., 2018). Among listed species by CITES, birds had the highest number \(n = 13\) and none of the amphibians were listed by CITES. This lack of attention can be due to prior assessments that international trade in some species is sustainable, but could also be due to unavailability of data and assessments by scientists in the region. However, as all trade in Iranian wildlife is restricted within Iran, trade in any species without monitoring and/or governance is clearly viewed as a conservation and/or national concern.

### 4.3 Implications for illegal wildlife trade management

The response to the growing problem of illegal wildlife trade should come from both the public and private sectors (Duffy & Brockington, 2022). This means that regulatory agencies must have the authority and resources to track and shutdown these illegal operations, and create mandates that would require the implementation of reporting systems through these private social media (Vaglica et al., 2017). Nevertheless, transparent legislations will allow public authorities to surgically target such operations without triggering unintended consequences. Finally, governmental and non-governmental agencies should invest in public education and awareness toward the illegal wildlife trade to curb the demand of capturing wildlife for the pet trade (Fukushima et al., 2021).

In addition, the increase in posts during the spring indicate a temporal opportunity for when resources should be expended to enact enforcement efforts, as well as conservation marketing strategies to reduce acceptability of buying and selling wildlife. While our study was preliminary in nature, we found that unequivocally, illegal wildlife trade is active in Iran and numerous future research opportunities into mitigation exist. For instance, research into the motivations driving poachers, middlemen, and the buyers themselves can provide important foundational knowledge for consumer-focused efforts.

Since this study was completed, the Iranian Department of Environment (DoE) in collaboration with Iran’s cyber police have developed a task force dedicated to tracking and shutting down online illegal wildlife trading in the country (Mehr News, 2020). The task force is authorized to track down and report perpetrators to the court for further investigation. However, due to the extent and development of the illegal trade on social media, more restrictions and extensive monitoring is
needed. Monitoring what is on offer in markets (whether virtual or physical) is beneficial for establishing evidence bases to compare future trade patterns against, as well illustrating which species need the most conservation investment, and even how this investment can best be spent (e.g., Sung & Fong, 2018). As an example, we noted in this study that birds were the most actively traded species, which is evidence towards prioritizing demand for those species in Iran and surrounding countries.

Conservation organizations and government authorities can also develop better conservation marketing strategies towards online wildlife trade. Our study is a springboard into next steps. For example, future studies could focus on the prospective buyers of these illegally traded wildlife, to gather foundational consumer research that can be applied to demand reduction campaigns.

5 | CONCLUSIONS

Mitigating the wildlife trade is challenging, especially given the rise of online trade platforms. Based on our results, we found that illegal trade is prevalent on social media platforms in Iran. Our hope is that studies like this open the way for discussion on online trade of wildlife. Furthermore, despite the bureaucratic inertia of regulatory agencies, positive measures have been taken to crack down on these online black markets. Nonetheless, more needs to be done. We believe that monitoring should be done to enhance our understanding of the illegal wildlife trade markets and facilitate stronger trade enforcement. More research on the other aspects of illegal wildlife trade should be done to assess the movement of trafficked species into and out of Iran, which would link with our study and on-going efforts to monitor online trade, providing a real time picture of the trades.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

AUTHORS CONTRIBUTIONS

All authors contributed to manuscript writing, revision and responded to reviewers’ comments. In addition, the first author collected the data for the study and assisted with data analysis. The third and fourth authors conducted the data analysis, and the fifth author supervised and drew the graphics for the data of this study.

DATA ACCESSIBILITY STATEMENT

The data that support the findings of this study are available upon reasonable request from the corresponding author.

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REFERENCES

Abensperg-Traun, M. (2009). CITES, sustainable use of wild species and incentive-driven conservation in developing countries, with an emphasis on southern Africa. Biological Conservation, 142(5), 948–963.

Abi-Said, M. R., Outa, N. T., Makhlouf, H., Amr, Z. S., & Eid, E. (2018). Illegal trade in wildlife species in Beirut, Lebanon. Vertibrate Zoology, 68(1), 1–4.

Aloufi, A., & Eid, E. (2014). Conservation perspectives of illegal animal trade at markets in Tabuk. Saudi Arabia. – Traffic Bulletin, 26, 77–80.

Baker, S. E., Cain, R., van Kesteren, F., Zommers, Z. A., D’Cruze, N., & Macdonald, D. W. (2013). Rough trade. Bioscience, 63(12), 928–938.

Booth, H., Arias, M., Brittain, S., Challender, D. W., Khanyari, M., Kuiper, T., Li, Y., Olmedo, A., Oyanedel, R., Pieknowski, T., & Milner-Gulland, E. J. (2021). “Saving lives, protecting livelihoods, and safeguarding nature”: Risk-based wildlife trade policy for sustainable development outcomes post-COVID-19. Frontiers in Ecology and Evolution, 9, 99.

Bush, E. R., Baker, S. E., & Macdonald, D. W. (2014). Global trade in exotic pets 2006–2012. Conservation Biology, 28(3), 663–676.

Challender, D. W. S., Harrop, S. R., & MacMillan, D. C. (2015). Towards informed and multi-faceted wildlife trade interventions. Global Ecology and Conservation, 3, 129–148.

Di Minin, E., Fink, C., Hiippala, T., & Tenkanen, H. (2018). A framework for investigating illegal wildlife trade on social media with machine learning. Conservation Biology, 32(1), 210–213.

Di Minin, E., Fink, C., Tenkanen, H., & Hiippala, T. (2018). Machine learning for tracking illegal wildlife trade on social media. Nature Ecology &Evolution, 2(3), 406–407.

Duffy, R. V., & Brockington, D. (2022). Political ecology of security: Tackling the illegal wildlife trade. Journal of Political Ecology, 29(1), 21–35.

Eid, E., Al Hasani, I., Al Share, T., Abed, O., & Amr, Z. (2011). Animal trade in Amman local market, Jordan. – Jordan. Journal of Biological Sciences, 4, 101–108.

Esmail, N., Wintle, B. C., Sas-Roffes, M., Athanas, A., Beale, C. M., Bending, Z., Dai, R., Fabinyi, M., Gluszek, S., Haenlein, C.,...
et al., (2020). Emerging illegal wildlife trade issues: A global horizon scan. Conservation Letters, 13, e12715.

Fong, J. J., & Chen, T.-H. (2010). DNA evidence for the hybridization of wild turtles in Taiwan: Possible genetic pollution from trade animals. Conservation Genetics, 11(5), 2061–2066.

Fukushima, C. S., Tricoranche, P., Toomes, A., Stringham, O. C., Rivera-Téllez, E., Ripple, W. J., ... Cardoso, P. (2021). Challenges and perspectives on tackling illegal or unsustainable wildlife trade. Biological Conservation, 263, 109342.

Giannoulakis, S., & Tsapatsoulis, N. (2015). Instagram hashtags as image annotation metadata. In IFIP International Conference on Artificial Intelligence Applications and Innovations (pp. 206–220). Springer, Cham.

Grace, M. K., Smith, D. J., & Noss, R. F. (2017). Reducing the threat of wildlife-vehicle collisions during peak tourism periods using a roadside animal detection system. Accident Analysis & Prevention, 109, 55–61.

Harrington, J. R., Roberts, D. L., & Hernandez-Castro, J. (2016). Assessing the extent and nature of wildlife trade on the dark web. Conservation Biology, 30(4), 900–904.

Hinsley, A., Lee, T. E., Harrison, J. R., & Roberts, D. L. (2016). Estimating the extent and structure of trade in horticultural orchids via social media. Conservation Biology, 30(5), 1038–1047.

Holden, M. H., Biggs, D., Brink, H., Bal, P., Rhodes, J., & McDonald-Madden, E. (2019). Increase anti-poaching law enforcement or reduce demand for wildlife products? A framework to guide strategic conservation investments. Conservation Letters, 12(3), e12618.

Hutchinson, A. (2018, August 21). Instagram Tests a New Recommendations Feature to Boost Content Discovery. Social Media Today. https://www.socialmediatoday.com/news/instagrams-testing-a-new-recommendations-feature-to-boost-content-discovery/530550/.

Ikeda, T., Asano, M., Matoba, Y., & Abe, G. (2004). Present status of invasive alien raccoon and its impact in Japan. Global Environmental Research, 8(2), 125–131.

Islamic Parliament Research Center (IPRC). (2022). Hunting laws in Iran. https://ic.majlis.ir/fa/law/print_version/96050/

Jones, K. E., Patel, N. G., Levy, M. A., Storeygard, A., Balk, D., Gittleman, J. L., & Daszak, P. (2008). Global trends in emerging infectious diseases. Nature, 451(7181), 990–993.

Krebs, C. J. (2008). Ecology: The experimental analysis of distribution and abundance (6th ed.). Pearson.

La Laina, D. Z., Nekaris, K. A. I., Nijman, V., & Morcatty, T. Q. (2021). Illegal online pet trade in venomous snakes and the occurrence of snakebites in Brazil. Toxicon, 193, 48–54.

Martin, R. O., Senni, C., & D’Cruze, N. C. (2018). Trade in wild-sourced African grey parrots: Insights via social media. Global Ecology and Conservation, 15, e00429.

Mehr News Agency. (2020, February 4). [Signing of Cooperation memorandum between The Cyber Police and the Environmental Protection Organization], Mehr News Agency. https://www.mehrnews.com/news/4844670/.

Morton, O., Scheffers, B. R., Haugasen, T., & Edwards, D. P. (2021). Impacts of wildlife trade on terrestrial biodiversity. Nature Ecology & Evolution, 5(4), 540–548.

Nijman, V. (2020). Illegal trade in Indonesia’s National Rare Animal has moved online. Oryx, 54(1), 12–13.

Nijman, V., Ardiansyah, A., Hendrik, R., Langgeng, A., Manson, S., Hedger, K., ... Nekaris, K. A. I. (2021). Trade in a small-range songbird, the Javan crocias, gives insight into the Asian songbird crisis. Journal of Asia-Pacific Biodiversity, 14(2), 154–158.

Nijman, V., Shepherd, C. R., & Van Balen, S. (2009). Declaration of the Javan hawk eagle Spizochetus bartelsi as Indonesia’s National Rare Animal impedes conservation of the species. Oryx, 43(1), 122–128.

Panter, C. T., Atkinson, E. D., & White, R. L. (2019). Quantifying the global legal trade in live CITES-listed raptors and owls for commercial purposes over a 40-year period. Avocetta, 43(1), 23–36.

Pavlin, B. I., Schloegel, L. M., & Daszak, P. (2009). Risk of importing zoonotic diseases through wildlife trade, United States. Emerging infectious diseases, 15(11), 1721.

R Core Team. (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing. https://www.R-project.org/

Sánchez-Mercado, A., Cardozo-Urdaneta, A., Morlan, L., Ovalle, L., Arvelo, M. Á., Morales-Campos, J., ... Rodríguez-Clarke, K. M. (2020). Social network analysis reveals specialized trade in an endangered songbird. Animal Conservation, 23(2), 132–144.

Shivaprapaksh, K. N., Sen, S., Paul, S., Kiesecker, J. M., & Bawa, K. S. (2021). Mammals, wildlife trade, and the next global pandemic. Current Biology, 31(16), 3671–3677.

Siriwat, P., Nekaris, K. A. I., & Nijman, V. (2019). The role of the anthropogenic Allee effect in the exotic pet trade on Facebook in Thailand. Journal for Nature Conservation, 51, 125726.

Soorae, P. S., Al, H., emeri, A., Al Shamsi, A., & Al Suwaid, K. (2008). A survey of the trade in wildlife as pets in The United Arab Emirates. Traffic Bulletin, 22, 41–46.

Spee, L. B., Hazel, S. J., Dal Grande, E., Boardman, W. S., & Chaber, A. L. (2019). Endangered exotic pets on social media in the Middle East: Presence and impact. Animals, 9(8), 480.

Stirmemann, R. L., Stirmemann, I. A., Abbot, D., Biggs, D., & Heinsohn, R. (2018). Interactive impacts of by-catch take and elite consumption of illegal wildlife. Biodiversity and Conservation, 27(4), 931–946.

Stringham, O. C., Toomes, A., Kanishka, A. M., Mitchell, L., Heinrich, S., Ross, J. V., & Cassey, P. (2021). A guide to using the internet to monitor and quantify the wildlife trade. Journal of Conservation Biology, 35, 1131–1139.

Sung, Y. H., & Fong, J. J. (2018). Assessing consumer trends and illegal activity by monitoring the online wildlife trade. Biological Conservation, 227, 219–225.

Sung, Y. H., Lee, W. H., Leung, F. K. W., & Fong, J. J. (2021). Prevalence of illegal turtle trade on social media and implications for wildlife trade monitoring. Biological Conservation, 261, 109245.

Sykes, B. (2017). The elephant in the room: Addressing the Asian songbird crisis. BirdingASIA, 27, 35–41.

‘t Sas-Rolfes, M., Challender, D. W., Hinsley, A., Verissimo, D., & Milner-Gulland, E. J. (2019). Illegal wildlife trade: Scale, processes, and governance. Annual Review of Environment and Resources, 44, 201–228.

Vaglica, V., Sajeva, M., McGough, H. N., Hutchison, D., Russo, C., Gordon, A. D., ... Smith, M. J. (2017). Monitoring internet trade to inform species conservation actions. Endangered Species Research, 32, 223–235.
Wansink, K. (2019). Iran - telecoms. Mobile and Broadband - Statistics and Analyses. https://www.budde.com.au/Research/Iran-Telecoms-Mobile-and-Broadband-Statistics-and-Analyses

White, R. L. (2020). Insights from social media into the illegal trade of wild raptors in Thailand. TRAFFIC Bulletin, 32(1), 5.

Wyatt, T. (2009). Exploring the organization of Russia Far East’s illegal wildlife trade: Two case studies of the illegal fur and illegal falcon trades. Global Crime, 10(1–2), 144–154.

Ye, Z., Hashim, N. H., Baghirov, F., & Murphy, J. (2017). Gender Differences in Instagram Hashtag Use. Journal of Hospitality Marketing & Management, 27(4), 386–404.

Yu, X., & Jia, W. (2015). Moving targets: Tracking online sales of illegal wildlife products in China. TRAFFIC Briefing. Available from https://www.traffic.org/site/assets/files/2536/moving_targets_china-monitoring-report.pdf. (accessed May 2022).

Yusefi, G. H., Faizolahi, K., Darvish, J., Safi, K., & Brito, J. C. (2019). The species diversity, distribution, and conservation status of the terrestrial mammals of Iran. Journal of Mammalogy, 100(1), 55–71.

Zagorchev, A. G., Vasconcellos, G., & Bae, Y. (2011). The long-run relation among financial development, technology and GDP: A panel cointegration study. Applied Financial Economics, 21(14), 1021–1034.

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