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Perspective

Trafficking of Galápagos iguanas as an example of a global problem: CITES permits, laundering and the role of transit countries in Europe and Africa

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ABSTRACT

International cooperation is widely considered necessary to prevent the over-exploitation of threatened species in trade. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is the principal intergovernmental agreement for member states to address both legal and illegal trade in animals and plants. However, some CITES Parties in both the Global North and South issue export permits for illegally acquired animals or plants, which encourages trafficking, undermines the effectiveness and integrity of the Convention' provisions, and puts endangered species at greater risk from international trade. Herein we review the illegal trade of live iguanas, endemic to Ecuador's Galápagos Islands, through the issuance of CITES permits by non-range states without consulting the range state to determine specimens' legal provenance. We underscore the importance for CITES member states to be diligent, strictly enforce the provisions of the Convention, refrain from issuing export permits for illegally traded animals or their offspring, particularly endangered species with high commercial values. Specifically, we highlight the roles of the national CITES authorities in Mali, Switzerland, and Uganda and demonstrate that the issuance of CITES export permits for trafficked animals and their offspring is a persistent problem that creates a dangerous loophole, enabling illegal activities.

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1. Introduction

Species decline and damage to critical ecosystems commonly result from a combination of threats. According to the International Union for Conservation of Nature (IUCN), 10 out of 11 known threats are considered anthropogenic as defined by "the proximate human activities or processes that have impacted, are impacting, or may impact the status of the taxon being assessed" (Salafsky et al., 2008; IUCN, 2024). Habitat loss and degradation, expansion of agricultural areas, invasive species, climate change, and illegal and unsustainable trade of species imposes burdens on populations and impairs the resilience of previously healthy ecosystems (IPBES, 2019; Hogue and Breon, 2022). The unsustainable exploitation of wild species is known to be a major threat to their continued survival, and further efforts are clearly needed to prevent subsequent population declines because of this trade (Hughes et al., 2023).

By the 1970s international cooperation was considered "essential for the protection of certain species of wild fauna and flora against over-exploitation through international trade" (Wijnstekers, 2011), resulting in the adoption in 1973 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The increasing commercialization of the international wildlife trade and the rising demand for species and their products inevitably fuelled illegal activities, with consumer countries benefitting from poor governance of origin countries, porous borders, bribery and corruption, and complex and dynamic trade networks (King, 1978; t Sas-Rolfes, 2015; Phelps et al., 2016; van Uhm and Moreto, 2017; Wyatt et al., 2018; Outhwaite, 2020; Tittensor et al., 2020).

Due to its elusive characteristics, it is not possible to reliably assess the volume of the Illegal Wildlife Trade (IWT). Annual estimates suggest that IWT could be valued between USD 7–23 billion (Nellemann et al., 2016), however, these amounts may be largely underestimated (Tow et al., 2021), particularly if illegal trade in timber and fisheries products are included. High monetary value and profit margins for some species have boosted international illegal trade, resulting in a situation where economic interests often take precedence over a responsible and ethical approach to conserve species and protect critical ecosystems (Courchamp et al., 2006; TRAFFIC, 2008; Stoner and Nijman, 2015). The demand for exotic species in the commercial hobbyist and collectors' markets further fuels this trade. Today, numerous examples exist across a wide range of animal species, in which IWT has led to severe population declines, including fish (Feitosa et al., 2018), birds (Kupferschmidt, 2022; van Balen et al., 2000), reptiles (Perälä, 2022), and mammals (Omifolaji et al., 2022; Wittemyer et al., 2014); (see Hinsley et al., 2023 for a general overview).

While most countries have legislative and regulatory measures in place designed to prevent IWT, the economic incentives (e.g., Busilacchi et al., 2022), coupled with the low priority often placed on enforcement of wildlife crime, means that illegal trade may continue unabated (Laws, 2017; Price, 2017). Additionally, offspring produced by trafficked animals frequently move internationally with CITES export permits in which the "legal acquisition" of the specimens and/or their founder stock have not been properly examined by permit-issuing authorities – despite CITES requirements (Lyons and Natusch, 2011; Shepherd and Sy, 2017; Hogg et al., 2018; Nijman, 2021; Boyle, 2024, also see below). In this way, wild-caught animals, and their offspring, are essentially "laundered" as "captive-bred," thereby creating a dangerous loophole for sustained illicit activities. In response to the issuance of export permits for legally questionable specimens, the CITES Parties adopted Resolution Conf. 18.7 (Rev. CoP19), *Legal acquisition findings* (CITES, 2022). This directive of the CITES Conference of the Parties recommends that Parties should consider the "legal acquisition of founder stock of specimens" before issuing permits, although some Parties had been routinely examining the legality of founders and breeders when issuing CITES export permits before adoption of this Resolution (Weissgold, *pers. obs.*).

In this paper we investigate historical and recent developments of Galápagos iguana trafficking and reveal the involvement of transnational criminal networks. We also describe existing legislation affecting Galápagos iguanas, consumer demand in international IWT. Finally, the credibility of declared captive breeding and the legal origin of animals in facilities outside the Galápagos are examined along with the legality of recent international shipments.

1.1. Galápagos Islands and Galápagos iguanas

The following section describes the importance of the archipelago in terms of its biodiversity and the relevant conservation legislation of the Galápagos Islands, with particular reference to the iguanas, their threats and endangered status.

In 1936, the Galápagos archipelago obtained protected status under Ecuadorian law (Ministry of Environment, 2024), and in 1959 was declared Ecuador's first national park, with ca. 97 % of the terrestrial surface of the archipelago strictly protected (Government of Ecuador, 2024). In 1978, the archipelago was declared a World Heritage Site (UNESCO, 1978). Since then, further national and international measures have been implemented to protect the archipelagos' endemic biodiversity. Among the unique terrestrial fauna of the islands, the Galápagos Giant Tortoises (*Chelonoidis niger* ssp.) (TTWG, 2021) were probably the first species group from the region to be targeted for illegal international trade (Anon, 2015; Gentile et al., 2013; Quinzin et al., 2023; Rueda et al., 2023).

According to Ecuador's legislation, specifically the "Law of the Special Regime for the Province of Galápagos, Official Supplementary Register 520" (as of 11 June 2015), the removal of wildlife from the Galápagos is considered a serious environmental crime, punishable under Articles of Ecuador's Criminal Code (Gentile et al., 2013; Ecuador, 2022). While the archipelago's reptile fauna is threatened by multiple factors, e.g., climate change and invasive species (Dueñas et al., 2021; Collins et al., 2020), the illegal offtake and trade of live individuals would have a detrimental impact to these species and wild populations (Gentile et al., 2013; Vega, 2022; Vega Barrera et al., 2023).

The Galápagos archipelago is within Ecuador's Tumbes-Chocó-Magdalena biodiversity hotspot (Conservation International, 2024), and Ecuador is one of the 17 megadiverse countries in the world (IPBES, n. d.). However, among the threats impacting the biodiversity of the Galápagos, such as habitat alteration, introduction of invasive species, over-fishing, pollution, and unsustainable tourism, poaching and trafficking are an immediate threat to the islands' charismatic iguanas (Escobar-Camacho et al., 2021, and refs therein). As an inevitable consequence of the growing international, commercial trade in high-end, live reptiles (Marshall et al., 2020), Galápagos iguanas are increasingly exposed to the threat of IWT, yet monitoring and enforcement remain at a standstill.

Four species of iguanas are endemic to the Galápagos: the Galápagos land iguana (*Conolophus subcristatus*), Galápagos pink land iguana (*C. marthae*), Barrington land iguana (*C. pallidus*), and the Marine iguana (*Amblyrhynchus cristatus*) with eleven subspecies (Buckley et al., 2016; Miralles et al., 2017; Uetz et al., 2023). The conservation status of all taxa has been evaluated under the criteria of the IUCN Red List of Threatened Species (Table 1). Since 1975, due to the threat of commercial trade, they have been listed on Appendix II of CITES, which allows international trade in wild-caught specimens if they are accompanied by a CITES export permit (or re-export certificate) issued by the exporting country's official CITES Management Authority. Even with existing national and international regulations, and the strong commitment of Galápagos' governmental institutions in combatting wildlife trafficking, iguanas have been poached and smuggled from the islands and can be found in commercial trade conducted by commercial hobbyists and wildlife dealers (IUCN SSC ISG, 2014; Ecuador, 2022).

Table 1
Threats and IUCN Red List status of Galápagos iguanas (Gentile, 2012; Gentile and Grant, 2020; Kumar et al., 2020; MacLeod et al., 2020). CR = Critically Endangered, VU = Vulnerable, year of last assessment in brackets; AOO = Estimated Area of Occupancy; * = Introduced populations; ** = *A. cristatus* includes 11 subspecies, of which four are classified as Critically Endangered, six as Endangered and one as Vulnerable (Gentile and Grant, 2020; Kumar et al., 2020; MacLeod et al., 2020; Gentile, 2012). ENSO = El Niño/Southern Oscillation.

Scientific name	Common name	Distribution range	Threats	IUCN Red List status
Conolophus subcristatus	Galápagos land iguana	Islands: Isabela, Fernandina, Santa Cruz, Plaza Sur, Baltra, Seymour Norte, Santiago* & Venecia*	Invasive predators, illegal pet trade	VU (2020)
Conolophus marthae	Galápagos pink iguana	Endemic to Volcán Wolf, a single location on Isabela Island; AOO 9–11 km^2	Invasive predators, illegal pet trade, volcanic eruptions	CR (2012)
Conolophus pallidus	Barrington land iguana	Endemic to uninhabited Santa Fe (Barrington) Island; AOO 40 km^2	Genetic bottleneck	VU (2020)
*Amblyrhynchus cristatus***	marine iguana	Islands: Española, Fernandina, Floreana, Genovesa, Isabela, Marchena, Pinta, San Cristobál, Santa Cruz, Santa Fe, and Santiago, the mid-sized islands Baltra, Bartolomé, Pinzón, Plaza Norte, Plaza Sur, Rábida, and Seymour Norte; smaller key populations on Darwin, Roca Redonda, and Wolf Islands	Increased ENSO variability, climate change, invasive predators, pollution	VU (2020) **

2. Methods

This study relies on a comprehensive review of background material on trade and trafficking of Galápagos iguanas generated by the interdisciplinary authorship (experts in herpetology, conservation science, and wildlife trade, crime, and enforcement) as well as CITES documents, archival records, and data from the IUCN Red List of Threatened Species (IUCN, 2024).

2.1. Historical and recent data on keeping Galápagos iguanas

To verify the legal origin of Galápagos iguanas in trade, we reviewed the history of keeping and breeding these animals in reputable zoos. We extracted data from the Species360 Zoological Information Management Software database (ZIMS, 2024) and the online database "Zootierliste" (2024). On both platforms, registered users can enter data on past and present facilities holding a distinct species. In addition, information on current holding records in European zoos was requested from the European Association of Zoos and Aquaria (EAZA).

2.2. CITES trade data

To obtain an overview of reported international trade data in Galápagos iguanas, we analysed the official CITES trade database (maintained by UNEP's World Conservation Monitoring Centre, WCMC) including trade data for live individuals of both "*Conolophus*" and "*Amblyrhynchus*" from 1975 to 2022 (UNEP-WCMC, 2025). Together these sources provide information on the conservation status and threats of each species, known captive populations, and documented international trade records and their routes. We hereby explicitly point out that it is often not possible to establish the accuracy of official CITES trade data (Weissgold, 2024).

2.3. News articles and social media that indicate illegal trade

Due to the clandestine nature of the illegal trade, it was also vital to collect anecdotal information from news, and web articles and social media posts (see Suppl. Mat.). Therefore, news articles were collected by combining the keywords "Galápagos", "iguanas", and "seizure" in English and Spanish using the search engine Google. Similarly, from October 2023 to April 2024, we systematically searched the social media platforms, Facebook and Instagram for posts of Galápagos marine and land iguanas, also using "*Conolophus*" and "*Amblyrhynchus*" search terms. Some authors have been monitoring selected Facebook pages since 2013, and relevant screenshots of posts with Galápagos land and marine iguanas and related individual comments were also reviewed. While often insufficient for enforcement officials or prosecutors to launch investigations, content found in social media posts can alert officials and provides a window on the extent, timeline, and nature of the illegal trade in these and other species. It was therefore essential to highlight social media communications that provided evidence of illegal activities.

3. Results

3.1. History of keeping Galapágos iguanas

All removals of marine iguanas from 1936 onward were performed without permits and thus, illegal (Ministry of Environment, 2024). Additionally, offtake of animals from 1959 onward occurred from land assigned to the Galápagos National Park (see above; Government of Ecuador, 2024). Notably, Ecuador has been a CITES Party since February 1975. No Galápagos land or marine iguanas are currently known to exist in European zoos (EAZA *in litt.* 2024) and none are known by the authors in the United States.

Three zoos in the United States (Philadelphia, Los Angeles, Chicago) held a total of 21 Galápagos marine iguanas from 1925 to 1965. Most of these animals survived only a few days to 11 months (ZIMS, 2024). The Brookfield Zoo in Chicago, however, received four animals from a wildlife dealer in Florida, which were kept for several years (Pawley, 1966; Murphy, 2015, also see below). In Europe, only the Frankfurt Zoo housed individuals (four) in the 1960s (Peaker, 2019).

Zoos in the United States also had challenges caring for Galápagos land iguanas (*Conolophus subcristatus*) from 1929 to 1966, with 16 of 25 individuals perishing within days to months (land iguanas were kept by zoos in Chicago, Oklahoma, and Philadelphia). Only nine individuals survived from one to seven years. The only Barrington land iguana (*C. pallidus*) kept by the Brookfield Zoo in Chicago in 1941 died after 1.5 years (ZIMS, 2024). In Europe, there is a record from London Zoo for seven Galápagos land iguanas received in 1902 and from Frankfurt Zoo for three individuals in 1960, with both records lacking information over the entire period in which the animals were housed at the zoo. More individuals were reportedly held by the Zurich Zoo in the 1960s, without any indication of the number of individuals held (Zootierliste, 2024).

3.2. Recent international trade in Galapágos iguanas under CITES

International trade of CITES Appendix II taxa requires lawfully issued export permits or re-export certificates and international trade must be reported by the Parties to the CITES Secretariat; from there the data is entered in the UNEP-WCMC (World Conservation Monitoring Centre) CITES trade database. The Galápagos National Park Directorate and the Ecuadorian Ministry of Environment never issued CITES export permits for live Galápagos pink land iguanas or their eggs (Rueda et al., 2023). Since 1975, when CITES came into force and Ecuador became a Party (it was the 7th country to ratify the treaty), Ecuador has not reported any legal export of live Galápagos land or marine iguana species to the CITES Secretariat (Tables 2,3). Nevertheless, a few shipments from non-range states were reported in the 1980s and 1990s, most of them only recorded to the genus level "*Conolophus* spp." (Table 2, Fig. 2). These older records, however, may not be accurate, considering the number of individuals and the fact that no corresponding entries by exporters are recorded.

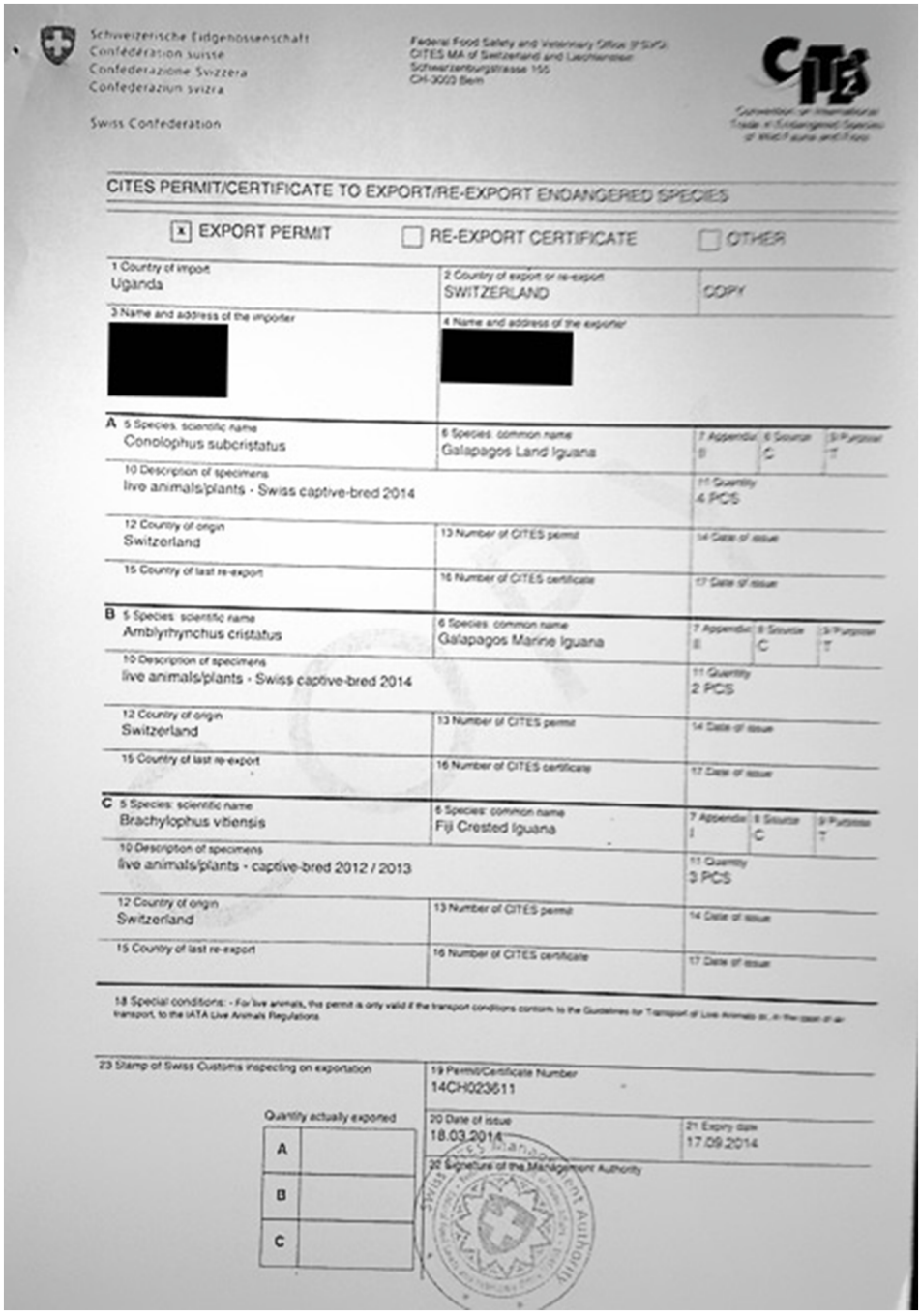
In the early 2010s, the Galápagos National Park Directorate uncovered a complex network of people involved in trafficking Galápagos iguanas (Angermeyer, 2014). To the best of our knowledge, the first complete description of the existence of a trafficking network was reported to the IUCN SSC Iguana Specialist Group (ISG) at its, 2014 meeting in the Galápagos (IUCN SSC ISG, 2014), covering intelligence work conducted by the National Park. Dubious international commercial trade in Galápagos iguanas may have commenced in 2010 with the illegal export of Galápagos land and pink land iguanas (two individuals of each) from Mali to Switzerland for commercial purposes – although the CITES trade database indicates that Switzerland only reported the import of two Galápagos land iguanas (UNEP-WCMC, 2025). In addition, Switzerland reported the import of three additional marine iguanas from Mali in 2012 (a shipment that Mali as the exporter did not report to the CITES Secretariat, Table 3, Fig. 2). All seven animals were labelled as "captive-bred", although Mali has never reported any imports of Galápagos iguanas. Hence, it appears that these animals may have been smuggled out of Ecuador, eventually to Mali, where they were "laundered" by declaring them as "captive-bred" for export to Switzerland (IUCN SSC ISG, 2015).

Table 2
CITES Trade Database records for live *Conolophus* spp. for the period 1975–2023 (UNEP WCMC, 2025). Concerns about the accuracy of quantities reported herein are discussed above. Entries marked with * may be inaccurate, as explained above. Purpose codes: T: commercial trade, P: Personal, B: Breeding in captivity, Z: Zoo. Source code: I: confiscated or seized specimen, W: wild-caught, C: bred in captivity, F: born in captivity, but not fulfilling the CITES criteria for captive-bred.

Year	Taxon	Importer	Exporter	Origin	Importer reported quantity	Exporter reported quantity	Purpose	Source
1982	Conolophus spp.*	USA	Guyana		4		T	
1983	*Conolophus* spp.*	USA	Mexico		280		T	
1984	*Conolophus subcristatus*	Italy	Peru		3			I
1995	*Conolophus* spp.*	USA	Indonesia		31		T	W
1995	*Conolophus* spp.*	USA	Solomon Islands		47		T	W
1998	*Conolophus* spp.*	USA	Indonesia		20		T	W
2002	*Conolophus* spp.	USA	Canada			1	P	C
2010	*Conolophus marthae*	Switzerland	Mali			2	T	C
2010	*Conolophus subcristatus*	Switzerland	Mali			2	T	C
2011	*Conolophus subcristatus*	Switzerland	Mali		2		P	C
2014	*Conolophus subcristatus*	Uganda	Switzerland		4		P	C
2014	*Conolophus subcristatus*	Uganda	Switzerland			4	T	C
2017	*Conolophus subcristatus*	Japan	Uganda		2	2	Z	C
2018	*Conolophus subcristatus*	Japan	Uganda		6		Z	C
2018	*Conolophus subcristatus*	Thailand	Uganda		2		B	C
2019	*Conolophus* spp.	Japan	Uganda		1		B	C
2019	*Conolophus subcristatus*	China	Sudan	Uganda	2		B	C
2019	*Conolophus subcristatus*	Japan	Uganda			2	B	C
2019	*Conolophus subcristatus*	Sudan	Uganda			2	Z	C
2019	*Conolophus subcristatus*	Thailand	Uganda		2	4	B	C
2020	*Conolophus subcristatus*	Indonesia	Uganda		2		T	C
2020	*Conolophus subcristatus*	India	Uganda			2	Z	C
2020	*Conolophus subcristatus*	Japan	Uganda		1		B	C
2020	*Conolophus subcristatus*	Sweden	Uganda			2	B	C
2020	*Conolophus subcristatus*	Thailand	Uganda		2	4	B	C
2020	*Conolophus subcristatus*	Thailand	Uganda		2		T	C
2021	*Conolophus subcristatus*	Canada	Uganda			2	B	C
2021	*Conolophus subcristatus*	Indonesia	Uganda			4	B	C
2021	*Conolophus subcristatus*	Indonesia	Uganda		8		T	C
2021	*Conolophus subcristatus*	Thailand	Uganda			10	B	C
2021	*Conolophus subcristatus*	Thailand	Uganda		6		B	C
2021	*Conolophus subcristatus*	Thailand	Uganda		4		T	C
2022	*Conolophus subcristatus*	Indonesia	Uganda			4	B	C
2022	*Conolophus subcristatus*	South Korea	Japan		2		T	C
2022	*Conolophus subcristatus*	South Korea	Japan			2	Z	C
2022	*Conolophus subcristatus*	South Korea	Uganda			2	B	F
2022	*Conolophus subcristatus*	South Korea	Uganda		2		T	F
2022	*Conolophus subcristatus*	Malaysia	Uganda			4	B	C
2022	*Conolophus subcristatus*	Taiwan	Uganda			4	B	C
2022	*Conolophus subcristatus*	Ukraine	Uganda			6	B	C
2023	*Conolophus subcristatus*	India	Togo	Uganda		2	Z	C
2023	*Conolophus subcristatus*	Japan	Uganda			4	P	C
2023	*Conolophus subcristatus*	North Korea	Uganda			2	B	C
2023	*Conolophus subcristatus*	South Korea	Uganda		1		T	C
2023	*Conolophus subcristatus*	Togo	Uganda		2		Z	C
2023	*Conolophus subcristatus*	Thailand	Uganda			4	B	C
2023	*Conolophus subcristatus*	Thailand	Uganda		4		T	C
			TOTAL		442	77		

Table 3
CITES Trade Database records for live *Amblyrhynchus cristatus* for the period 1975–2023 (UNEP WCMC, 2025). Concerns about the accuracy of quantities reported herein are discussed above. The entry marked with * may be inaccurate, as explained above. Purpose codes: T: commercial trade, P: Personal, B: Breeding in captivity, Z: Zoo. Source code: C: bred in captivity.

Year	Taxon	Importer	Exporter	Origin	Importer reported quantity	Exporter reported quantity	Purpose	Source
1989	*Amblyrhynchus cristatus**	Ecuador	USA	Ecuador		15		
2012	*Amblyrhynchus cristatus*	Switzerland	Mali		3		P	C
2013	*Amblyrhynchus cristatus*	Japan	Austria	Spain	2	2	T	C
2014	*Amblyrhynchus cristatus*	Uganda	Switzerland		2		P	C
2014	*Amblyrhynchus cristatus*	Uganda	Switzerland			2	T	C
2015	*Amblyrhynchus cristatus*	Japan	Mali		4		Z	C
2019	*Amblyrhynchus cristatus*	Japan	Uganda			4	B	C
			TOTAL		11	23		


Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Food Safety and Veterinary Office (FSVO)
CITES MA of Switzerland and Liechtenstein
Schwarzenburgstrasse 155
CH-3003 Bern

CITES PERMIT/CERTIFICATE TO EXPORT/RE-EXPORT ENDANGERED SPECIES

[x] EXPORT PERMIT [ ] RE-EXPORT CERTIFICATE [ ] OTHER

1 Country of import: Uganda
2 Country of export or re-export: SWITZERLAND
COPY
3 Name and address of the importer: [redacted]
4 Name and address of the exporter: [redacted]

A
5 Species: scientific name: Conolophus subcristatus
6 Species: common name: Galapagos Land Iguana
7 Appendix: II
8 Source: C
9 Purpose: T
10 Description of specimens: live animals/plants - Swiss captive-bred 2014
11 Quantity: 4 PCS
12 Country of origin: Switzerland
13 Number of CITES permit:
14 Date of issue:
15 Country of last re-export:
16 Number of CITES certificate:
17 Date of issue:

B
5 Species: scientific name: Amblyrhynchus cristatus
6 Species: common name: Galapagos Marine Iguana
7 Appendix: II
8 Source: C
9 Purpose: T
10 Description of specimens: live animals/plants - Swiss captive-bred 2014
11 Quantity: 2 PCS
12 Country of origin: Switzerland
13 Number of CITES permit:
14 Date of issue:
15 Country of last re-export:
16 Number of CITES certificate:
17 Date of issue:

C
5 Species: scientific name: Brachylophus vitiensis
6 Species: common name: Fiji Crested Iguana
7 Appendix: I
8 Source: C
9 Purpose: T
10 Description of specimens: live animals/plants - captive-bred 2012 / 2013
11 Quantity: 3 PCS
12 Country of origin: Switzerland
13 Number of CITES permit:
14 Date of issue:
15 Country of last re-export:
16 Number of CITES certificate:
17 Date of issue:

18 Special conditions: - For live animals, this permit is only valid if the transport conditions conform to the Guidelines for Transport of Live Animals or, in the case of air transport, to the IATA Live Animals Regulations

23 Stamp of Swiss Customs inspecting on exportation

Quantity actually exported
A
B
C

19 Permit/Certificate Number: 14CH023611
20 Date of issue: 18.03.2014
21 Expiry date: 17.09.2014
22 Signature of the Management Authority

Fig. 1. CITES permit for the export of four live individual of Galápagos land iguanas (*Conolophus subcristatus*) and two Galápagos marine iguanas (*Amblyrhynchus cristatus*) to Uganda, issued by Switzerland in March, 2014. All animals are declared as "Swiss captive-bred".

In November 2012, a man living in Switzerland at the time posted photographs on Facebook, showing two marine iguanas in his private collection (Fig. 3a) and in 2013, a photo of a Galápagos land iguana followed (Fig. 3b). In, 2014 Switzerland issued a permit for four live Galápagos land iguanas and two marine iguanas to be exported to Uganda (Fig. 1), thereby finalizing the process of "legalization" for these animals through the issuance of CITES export permits. Switzerland, as a CITES Party since the treaty entered into force in 1975, should have examined whether these animals (and their founder stock) were indeed bred in captivity and thus, acquired legally. In fact, Switzerland did not seek to determine the lawful export of the alleged founder stock. Had Swiss CITES officials examined the origins of the founder stock they would have ascertained that the movement of these animals outside of the Galápagos Islands was illegal (never authorized by the CITES authorities of Ecuador) and should have denied the issuance of a CITES export permit to Uganda. This cursory review of legal acquisition and the issuance of an export undermines the effectiveness of CITES, the integrity of its permit system, and highlights the challenges of enforcing and implementing strict standards for the authorization of international trade.

3.3. *Uganda holds the global monopoly for trade in Galapágos iguanas*

Following the successful "laundering" of these animals through Mali and Switzerland, Uganda appears to be the only country exporting Galápagos land iguanas – with one exception (see below) all of them claimed as "captive-bred" (Table 2 and Fig. 2). From 2017 to 2023, Uganda officially reported the export of 64 Galápagos land iguanas (with destinations mainly to Southeast and East Asia; Fig. 2) (Table 2). In the "Zootierliste" database (2024), the sole facility recorded housing Galápagos land iguanas is "iZoo" in Kawazu, Japan, and a video on YouTube indicates that marine iguanas were held by the zoo in 2016 (Reptil, 2016). However, an "unboxing video" posted on YouTube by an Indonesia-based reptile trader shows four juveniles arriving from Uganda in July 2021 (Fig. 3c,d). Furthermore, recent posts on Instagram (since October 2023) indicate at least two more animals are held by a facility in the city of Higashiosaka, Japan (Fig. 3h).

The UNEP WCMC records in Table 2 indicate significant inconsistencies in the reported data and the use of CITES codes: While importers reported 47 Galápagos land iguanas received from Uganda within the period 2017–2023, the exporting country, Uganda officially declared 64 individuals. It is unclear whether these data inconsistencies constitute administrative errors or are indicative of trafficking or permitting irregularities). For several shipments, which are reported by both exporter and importer, purpose codes differ, e.g. Uganda used the code "B" (= breeding in captivity), while importing countries like Indonesia or Thailand used "T" (= commercial trade).

Moreover, a shipment of two Galápagos land iguanas in 2019, declared by Sudan as a re-export originating from Uganda, was not included in Uganda's reported exports. In 2022, for a shipment of two animals from Uganda to South Korea both countries remarkably declared the source code as "F", which is used for animals that do not fulfil the CITES criteria for captive-bred animals (e.g. captive-born offspring of wild-caught animals), while all other Galápagos land iguanas were exported from Uganda under source code "C" for captive-bred (see Table 2).

In 2019, Uganda's CITES authorities reported the export of four captive-bred marine iguanas to Japan, although Japan only reported the import of four allegedly captive-bred marine iguanas from Mali in 2015. Evidence suggests that one individual is kept privately in Higashiosaka, Japan (Fig. 3g). However, marine iguanas have been officially traded in Japan since at least 2013 (e.g., Facebook, 2013).

As noted above, there is neither a population of Galápagos iguanas in reputable zoos worldwide nor are there any reliable reports on the captive breeding of lawfully acquired animals (EAZA, 2024; ZIMS, 2024), except those held by the Charles Darwin Foundation and the Galápagos National Park Service in the Galápagos Islands (Cayot, 2008, "Zootierliste" 2024). However, the "Zootierliste" (2024) notes the CTC

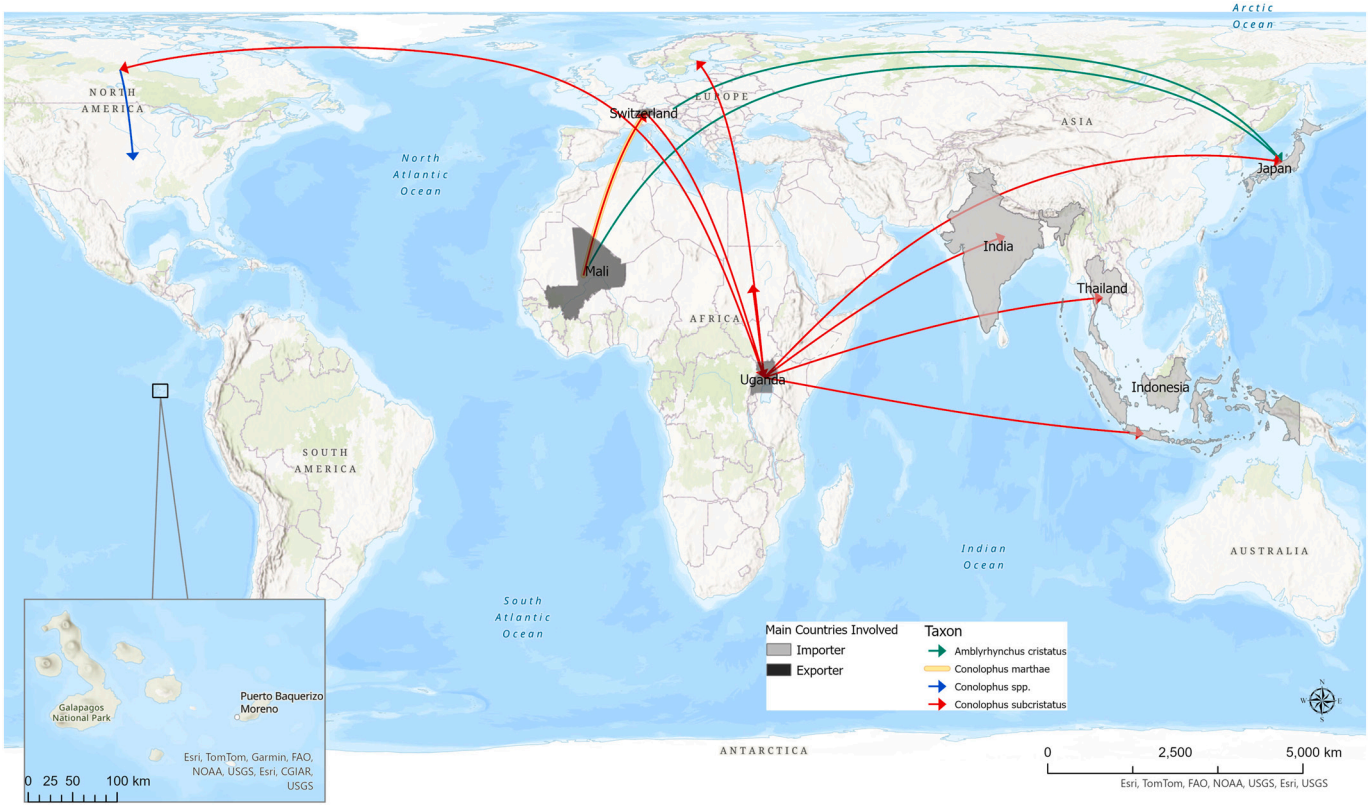


Fig. 2. Map of global trade in live Galápagos iguanas, as recorded in the CITES trade database.

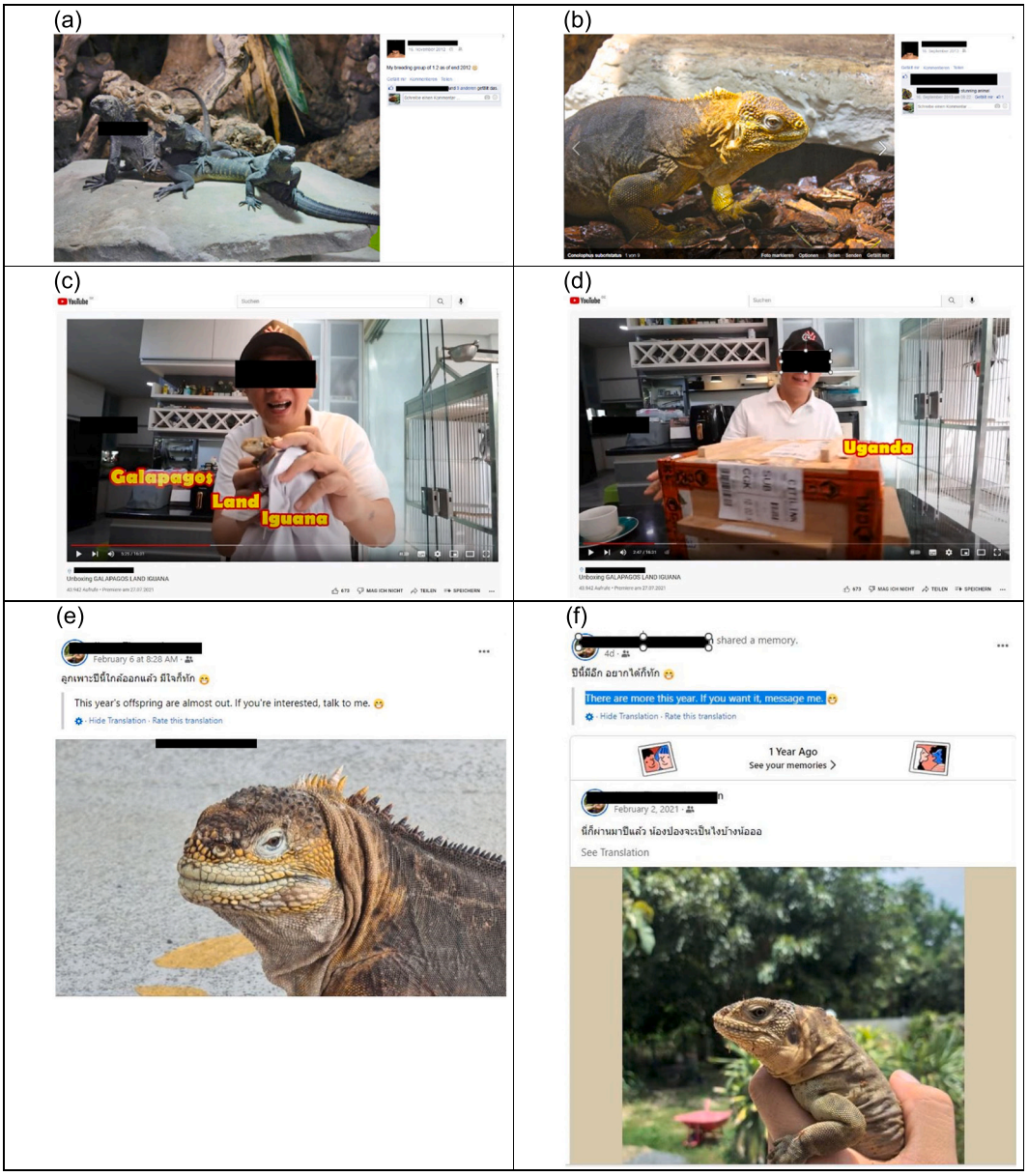


Fig. 3. Screenshots of social media posts, documenting trade in Galápagos iguanas and persons involved: (a) Three marine iguanas, kept in a facility in Switzerland, Facebook post of Nov. 2012; (b) Galápagos land iguana, kept in a facility in Switzerland, Facebook post of Sep. 2013; (c) YouTube video posted by an Indonesian wildlife trader in Sep. 2021, presenting unpackaging of juvenile Galápagos land iguanas; (d) YouTube video posted by an Indonesian wildlife trader in Sep. 2021, highlighting Uganda as origin of the shipment; (e) Facebook post by a Thai citizen at the Galápagos Islands in February 2022, showing an adult land iguana and noting: "This year's offspring are almost out. If you are interested, talk to me." (f) Facebook post by a Thai citizen at the Galápagos Islands in February 2022, re-posting a post of his visit there in Feb. 2021, with a juvenile land iguana in hand and noting: "There are more this year. If you want it, message me." (g) Instagram post by a Japanese wildlife trader, showing a marine iguana in his facility in Dec. 2022; (h) Instagram post by a Japanese wildlife trader, showing two Galápagos land iguanas in his facility in Oct. 2023; (i) Facebook post of 2012, showing the person, now running the CTC Conservation in Uganda (left), with the Mexican citizen, who was arrested in the Galápagos Islands in 2015 for smuggling of Galápagos iguanas (right); (j) Facebook post by the Thai citizen, who had offered Galápagos iguanas in Feb 2022, showing him in Uganda (in the front), together with the person running the CTC Conservation Center (left) and a German reptile trader (right).

Conservation Center in Lukalu, Uganda, and since 2023 the iZoo in Kawazu, Japan, are current holders of Galápagos land iguanas. For marine iguanas, the CTC Conservation Center is the sole recorded facility, specifically noting the subspecies "*hassi*" ("Zootierliste" 2024). The head of this facility was previously convicted in a reptile trafficking case in New Zealand (Anon., 2010a, 2010b). Although reported in the press to be a German citizen, a government source indicated that the individual is a dual citizen of the United States and Finland (Weissgold, *pers. comm. 2024*).

It is likely that in future poached and trafficked individuals of these species or their offspring will enter the international trade declared as captive bred. Thus, the inappropriate issuance of captive bred export permits exacerbates the challenges of curbing IWT and provides cover for traffickers to smuggle additional wild-caught specimens. When subsequent permits are issued, CITES Parties become complicit as the first step in "laundering" these animals.

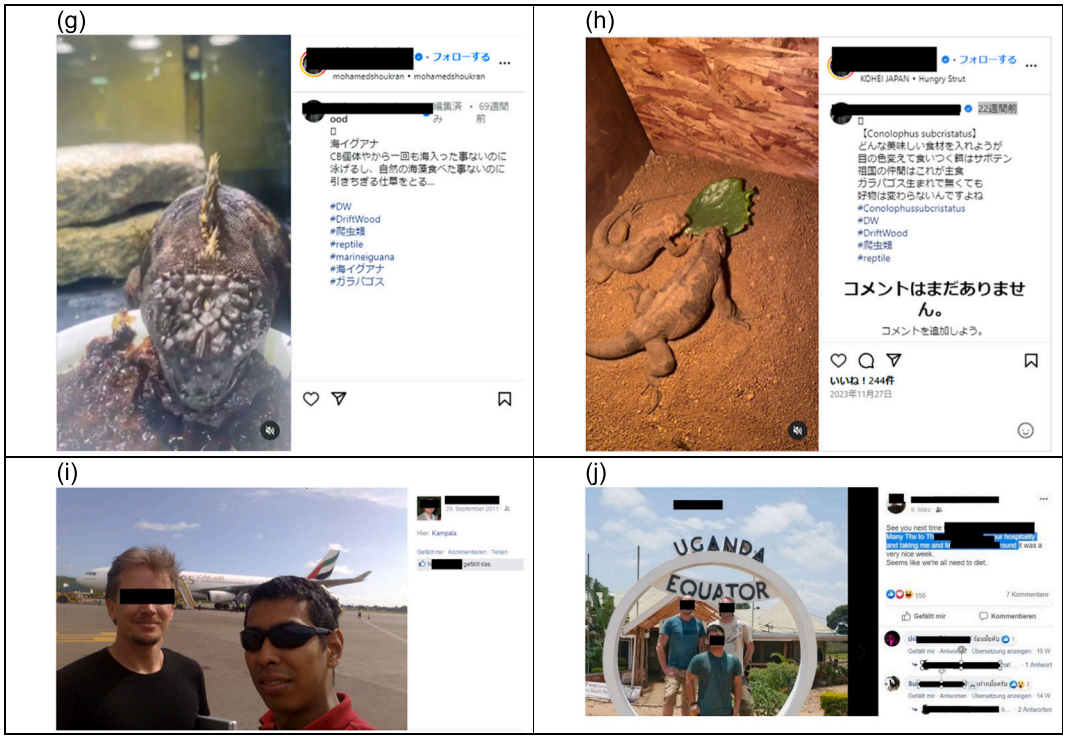


Fig. 3. (*continued*).

3.4. Recent smuggling events, arrests, prosecutions, and reactions by CITES authorities

Recent prosecutions of wildlife smugglers arrested in the Galápagos Islands highlight an ongoing illegal trade in iguanas (Table 4) and indicate that Uganda is the main hub for this transnationally organized natural resource crime. Several cases likely linked to this network are outlined here. In 2010, a canine unit operating in the Galápagos airport detected two live marine iguanas (and a dead sea turtle) in a secret compartment of a shipping box. The perpetrator abandoned the animals, fled the scene, and was not apprehended (Anon., 2010c). In July 2012, a German citizen was arrested on Baltra Island for attempting to smuggle four juvenile land iguanas in his luggage (AFP, 2013). In August 2015, a Mexican citizen was arrested on Santa Cruz Island with nine marine and two land iguanas, all of them juveniles. According to Ecuador's enforcement authorities these animals were allegedly destined for transport to Uganda (Anon., 2015). Photos published on Facebook in the 2010s indicate the connection between the Mexican trafficker and the head of the CTC Conservation Center in Uganda (Fig. 3i). In February 2022, a Thai citizen posted photos of wild Galápagos land iguanas on his Facebook page, noting that "*this year's offspring are almost out…if you are interested, talk to me*" (Fig. 3e), and indicated that he had visited the Galápagos Islands the year before, by reposting a post from 2021 with the remark: "*There are more this year…if you want it, message me*" (Fig. 3f). Another Facebook post shows him in Uganda, only a few weeks later, together with the head of the CTC Conservation Center and a German wildlife trader (Fig. 3j). In June 2022, five "golden land iguanas" (probably *C. subcristatus*) and 84 giant tortoises were seized from a boat off the province of Santa Elena. Three individuals were later convicted and sentenced to a year in jail by an Ecuadorian court in this trafficking event (Galápagos Conservancy, 2022; Korea Times, 2022).

Juvenile iguanas are often preferred by traffickers because their smaller size facilitates concealment, packing and shipment. More individuals can be concealed if they are small, potentially yielding higher illicit profits. Juvenile individual animals also may adapt to captivity more successfully and be more reproductively active compared to adults, which may have challenges adjusting to captive conditions. For non-experts, juvenile Galápagos land iguanas are also difficult to distinguish from offspring of other iguana species because their colour and patterns have not yet developed fully (Gentile et al., 2013). Lastly, juveniles may more easily be accepted as captive-bred offspring during inspections.

The legal acquisition of Galápagos iguanas documented in the CITES trade database (Tables 2,3) has been questioned by some CITES Parties, as reflected by two recent measures:

1) In September 2020, the CITES Scientific Review Group of the European Union issued a "Negative Opinion" to prevent the issuance of import permits for Galápagos land iguanas from any exporting (or re-exporting) country, for wild-caught, farmed or captive-bred specimens (SRG, 2020a). This decision was confirmed at a second meeting in December 2020 (SRG, 2020b) and is still valid at the time of writing.
2) In March 2022, Ecuador's CITES authority submitted an Information Document (Ecuador, 2022) to the 74th meeting of the CITES Standing Committee, which provided an overview of recent smuggling cases, expressed serious concerns about the ongoing illegal trade and noted that the issuance of CITES permits for these illegally sourced animals, and their alleged captive-bred offspring, undermines the integrity of the CITES Appendix II permit system (Ecuador, 2022).

4. Discussion and conclusion

Management of wildlife resources are core pillars of the Convention on Biodiversity (CBD) and CITES. Yet despite the wide membership in these conventions – the CBD has 196 Parties and CITES 185 (CBD, 2024; CITES, 2025) – enforcement and implementation efforts vary widely between countries and even taxa. However, at a national level, both the existence and implementation and enforcement of regulations may vary considerably.

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Table 4
Documented and indicated smuggling events of land and marine iguanas.

Date	Location	Citizens involved	Species and numbers, details	Reference
September 2010	Galápagos airport, Baltra	Unknown	2 marine iguanas and 1 deceased sea turtle seized	Anon., 2010c
July 2012	Galápagos National Park	German citizen (Dirk B.), convicted in Jan. 2013, sentenced to 4 yrs. (with previous arrest in Fiji Islands for reptile smuggling)	4 juvenile Galápagos land iguanas seized, originating from Baltra and Seymour Norte	AFP, 2013, Gentile et al., 2013
September 2015	Puerto Ayora, Island of Santa Cruz	Mexican citizen (Gustavo T. A.), sentenced to 2 yrs., with previous record of 18 weeks arrest in New Zealand	9 hatchlings of *A. cristatus*, 2 juvenile Galápagos land iguanas seized, to be smuggled to Uganda	Costa Rica Star, 2016, Forsythe, 2015, EFP and AP, 2015, Radio New Zealand, 2010
February 2022		Thai citizen	Social media offer offspring of Galápagos land iguanas, to be collected on site	Ecuador, 2022
June 2022	Boat located 30 nautical miles off province of Santa Elena	Unknown nationality (Freddy Alfonso C., Darío J., & Maria Petrona S.), sentenced to 1 yr	5 Galápagos land iguanas and 84 juvenile giant tortoises (*Chelonoidis niger* ssp.) seized	Galápagos Conservancy, 2022, Korea Times, 2022

Services (IPBES) notes that around 50,000 wildlife species are in trade globally (IPBES, 2019; Marshall et al., 2020). Demand for exotic pets may be growing, with animals such as reptiles at particularly high risk, but frequently overlooked in international regulations (Marshall et al., 2020). In our experience, consumer demand in the pet trade is often for high volume, less expensive animals. Commercial hobbyists and collectors, a sub-group of the larger pet trade, often demand higher-value species which are often more endangered, protected by law, and difficult to obtain legally. Given that novelty and rarity often drive demand, and are often associated with high prices, particularly in the hobbyist/collector trade, vulnerable species may be at greater risk, especially when they have limited ranges (e.g., Angulo et al., 2009; Chunco et al., 2013). As insular endemic species, the land and marine iguanas of the Galápagos Islands are at inherently greater risk of over-exploitation and illegal commercial trade than geographically widespread less endangered species (Reynolds, 2011; Auliya et al., 2016; Shepherd et al., 2019). Because these animals are coveted in the reptilian equivalent of a luxury commercial pet trade, with little to no benefit accruing to the diversity of the islands or people of the Galápagos, consumer and "laundering" states which issue export permits are complicit in giving rise to and enabling this illegal trade.

It is imperative that action be taken to prevent future illegal trade in marine and land Galápagos iguanas and previous illegal activity should be explored as part of a larger criminal context linked to transnational organized natural resource crime (Vega Barrera et al., 2023). Aware of the high market value of Galápagos iguanas in the commercial hobbyist trade, and the possibility that such animals could be poached and trafficked, concerned scientists increasingly refrain from publishing specific location data for populations (e.g., Loreti et al., 2020; Gargano et al., 2022). Our data show that since 2017, Uganda is the sole supplier for Galápagos land and marine iguanas in the international trade (Tables 2,3 and Fig. 2), while all available information fails to demonstrate the legal origin of the founder or breeding stock and recent arrests and seizures of Galápagos iguanas in Ecuador were linked to Uganda.

Ecuador, as the only range state for these endemic species, has never issued CITES commercial export permits for international trade in these species (Tables 2,3), nor is there any evidence of legal trade in live specimens since CITES entered into force in 1975. Mali's role as a hub and Switzerland's issuance of export permits without appropriate verification of the legal acquisition of the animals have enabled the "legalization" of trafficked founder individuals and the subsequent trade in allegedly captive-bred offspring. These countries did not do their due diligence and seek information from the range state (Ecuador) or exporter(s) on the legality of the founders and/or breeders. In this context, data on the keeping and breeding of Galapagos marine and land iguanas remain vague and challenging (Cayot and Oftedal, 1995; Murphy, 2015); marine iguanas have yet not been bred in captivity (Wikelski and Nelson, 2004). The prevalence of trade in the offspring of trafficked founders creates a veneer of legality and allows additional loopholes to form which can provide 'cover' or enable future laundering.

International trade as documented in the CITES trade database undoubtedly does not fully follow accurate and truthful documentation of Member States involved (e.g., Foster et al., 2016; D'Cruze and Macdonald, 2016; Berec et al., 2018), reducing credibility and challenging analytical studies. Several likely inaccurate documented transactions have been outlined in Table 2, however, one entry, the export of two *C. subcristatus* from Sudan to China in 2019 (indicating Uganda as the origin), was not reported before February 2025, which leads to ambiguities about the actual events, obscures relevant data for analysis purposes and raises questions about what data has not yet been provided, or never will be.

In their description of Uganda's wildlife law enforcement culture and operations, van Uhm and Moreto (2017)) conclude that trusted Ugandan agencies demonstrate the deep-seated nature of corruption involved in International Wildlife Trade. Uganda, as the current sole exporter of live Galápagos iguanas, holds a global monopoly for commercial trade in these animals, reported as "captive bred." An operational pipeline from Ecuador's Galápagos Islands through Mali, Switzerland, or Uganda, and from there to Asia, is first described herein (Fig. 2). Uganda is most recently linked to known smuggling cases including wildlife traffickers arrested in the Galápagos Islands, but according to enforcement authorities, sent parcels with iguana hatchlings to Uganda (Anon., 2015). Recent media reports (Table 4) and a YouTube video (Fig. 3c, d) clearly indicate Uganda is an established hub and transit point for illegally sourced Galápagos iguanas and possibly their offspring.

It is incumbent upon CITES Parties to enforce regulations that combat the illegal trade in Galápagos iguanas; including, if appropriate, sanctions on countries that act in clear violation of the Convention. Importing countries must also be vigilant, and question permits issued for allegedly captive-bred animals by non-range states. Furthermore, due to their precarious status in the wild, we urge the CITES Parties to transfer all four species of Galápagos iguanas (*Conolophus subcristatus, C. marthae, C. pallidus* and *Amblyrhynchus cristatus*) from CITES Appendix II to Appendix I at the next meeting of the CITES Conference of the Parties (CoP20, 24 November-5 December 2025). This approach would mirror their threatened status and Ecuador's strict no-commercial-export policy, resulting in higher fines and more prosecutions, potentially on a global scale.

Additionally, until valid permits are presented for the lawful export of live specimens of each of these species from Ecuador, the ongoing international trade in allegedly "captive-bred" Galápagos iguanas should be halted immediately. The CITES Parties should improve their current permit issuing standards to no longer enable the "legalization" of

these, and any other trafficked CITES-listed species, and to meet the standard set in CITES Resolution Conf. 18.7 (Rev. CoP19), *Legal acquisition findings*, paragraph 5, that the lawful origins of founder stock must be established prior to the issuance of an export permit. The standard of legal acquisition under CITES is no different for Appendix II species as for those listed on Appendix I. Parties need to stop rewarding traffickers by issuing permits for "captive-bred" specimens which are either trafficked specimens themselves or the progeny of trafficked founders/breeders. Governments must exercise all due diligence in investigating claims of captive breeding for these and other species, as per CITES Resolution Conf. 18.7 (CoP19).

The CITES Parties should notify all persons or businesses known to hold Galápagos iguanas within their borders that those animals and/or their offspring are not eligible for CITES export permits – because it cannot be found that such animals were lawfully acquired under the requirements of CITES and that permits will not be issued. Any Parties presented with such permits accompanying animals intended for import, should, in consultation with Ecuador, treat those permits as invalid and if possible, confiscate the animals. We call upon the CITES Animals and Standing Committees or Parties to make such a recommendation to the 20th meeting of the CITES Conference of the Parties (24 November-5 December 2025, in Uzbekistan).

For Galápagos iguanas a DNA database is already existent that can support enforcement efforts (Gentile et al., 2013), which will benefit from international collaboration and coordination of multiple stakeholders (e.g., scientists, zoo personnel, national park officers, NGO's, law enforcement authorities; cf. Ogden, 2012).

This review illustrates a situation for many species in demand in the high-end, commercial hobbyist and collectors' trade. In particular, the findings discussed herein mirror the situation of other insular and range-restricted taxa, which are often in demand in trade. Examples include, but are not limited to, Fiji (*Brachylophus* spp.) and Caribbean rock (*Cyclura* spp.) iguanas, West Indies dwarf boas (*Tropidophis* spp.), New Zealand (*Naultinus* spp.) and New Caledonian (*Rhacodactylus* spp.) geckos, Southeast Asian freshwater turtles (*Leucocephalon yuwonoi*, *Siebenrockiella leytensis* or *Chelodina mccordi*), and pit vipers (e.g. *Trimeresurus mcgregori*) (https://www.iucnredlist.org/search).

Therefore, the enforcement of appropriate legislation for Galápagos iguanas is equally applicable to other CITES-listed species if countries better collaborate in addressing such situations. The fact that it is possible to smuggle protected species out of the Galápagos also means that law enforcement agencies and Wildlife Enforcement Networks would benefit from assistance to combat illegal trans-national trafficking networks, root out corruption that facilitates wildlife trafficking, and build capacity and political will to promote conservation of national biodiversity heritages. CITES permitting authorities should not compound this very serious problem by issuing export permits for trafficked animals or their offspring without a conclusive review of the legal origin of the founder stock and the credibility of the applicants.

Finally, we urge Mali, Switzerland, and Uganda to cancel CITES export permits previously issued for Galápagos iguanas and we encourage all CITES Parties to refrain from issuing future export permits or re-export certificates for Galápagos iguanas. Furthermore, importing countries should, in accordance with national law, confiscate all individuals for which a legal origin cannot be demonstrated. In a broader context, this review reinforces the need for exporting countries to ensure lawful acquisition of all animals including founder and breeding stock as per CITES Resolution 18.7 (Rev. CoP19) *Legal acquisition findings*. Importing countries, which suspect animals to be of illegal origin should report such trade to relevant enforcement and management authorities, including the authorities of range states.

CRediT authorship contribution statement

Mark Auliya: Writing – review & editing, Writing – original draft, Validation, Conceptualization. **Vincent Nijman:** Writing – review & editing, Validation, Resources, Methodology, Conceptualization. **Sandra Altherr:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Conceptualization. **Washington T. Aguilera:** Writing – review & editing, Validation, Resources. **Daniel Ariano-Sanchéz:** Writing – review & editing, Validation, Resources. **Juan Carlos Cantu:** Writing – review & editing, Validation, Resources. **Giuliano Colosimo:** Writing – review & editing. **Gabriele Gentile:** Writing – review & editing, Validation, Resources. **Glenn Gerber:** Writing – review & editing, Validation, Resources. **Tandora Grant:** Writing – review & editing, Validation, Resources. **Evert Henningheim:** Writing – review & editing, Validation, Resources. **Alice Hughes:** Writing – review & editing, Validation, Resources. **Charles R. Knapp:** Writing – review & editing, Validation, Resources. **Susan Lieberman:** Writing – review & editing, Validation, Resources. **Catherine Malone:** Writing – review & editing, Validation, Resources. **Stesha A. Pasachnik:** Writing – review & editing, Validation, Resources. **Gohar Petrossian:** Writing – review & editing, Visualization, Validation. **Christian Sevilla:** Writing – review & editing, Validation. **Monique Sosnowski:** Writing – review & editing, Validation. **Bruce Weissgold:** Writing – review & editing, Validation, Resources, Investigation, Conceptualization.

Author contributions

This review was conceptualized by SA, MA, VN and BW; all authors were involved in its design. Collected "historical" data were provided by SA, AH, VN, and SP; all other authors contributed with relevant data. GP created the map illustration. Finally, all authors revised sections of the review; the version submitted here was approved by all authors.

Declaration of competing interest

The authors declare no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.biocon.2025.111104.

Data availability

Data will be made available on request.

References

AFP, 2013. German convicted of smuggling Galapagos iguanas. Online article of Jan 6. https://phys.org/news/2013-01-german-convicted-smuggling-galapagos-iguanas.html accessed in Feb 2024.

Angermeyer, E., 2014. Traficantes de iguanas – Traffic of iguanas. Paper presented at the Galápagos land and marine iguanas workshop, IUCN SSC Iguana specialist group meeting, Puerto Ayora, 28–29 October 2014.

Angulo, E., Deves, A.-L., Saint Jalmes, M., Courchamp, F., 2009. Fatal attraction: rare species in the spotlight. Proc. R. Soc. B 276, 1331–1337. https://doi.org/10.1098/rspb.2008.1475.

Anon, 2010a. German reptile smuggler jailed in New Zealand. Online article of 3 March in IOL. https://www.iol.co.za/mercury/world/german-reptile-smuggler-jailed-in-new-zealand-475079.

Anon, 2010b. Remaining gecko smugglers sentenced. Online article of 29 March in RMZ (Radio New Zealand). https://www.rnz.co.nz/news/national/29629/remaining-gecko-smugglers-sentenced. accessed in Feb 2024.

Anon, 2010c. Smuggling of Marine Iguanas Thwarted by K-9 Corps. Online article from Sea Sheperd Conservation Society posted by CNH Tours at. https://www.cnhtours.com/news/2010/10/29/smuggling-of-marine-iguanas-thwarted-by-k-9-corps/. accessed in Feb 2024.

Anon, 2015. Galapagos Islands wildlife trafficking. Online article by *Deutsche Welle*, dated 8th September 2015. https://www.dw.com/en/arrest-in-galapagos-islands-wildlife-trafficking/a-18699826. accessed on 1st February 2024.

Auliya, M., Altherr, S., Ariano-Sanchez, D., et al., 2016. Trade in live reptiles, its impact on wild populations, and the role of the European market. Biol. Conserv. 204 (A), 103–119.

van Balen, S., Dirgayusa, I., Putra, I., Prins, H., 2000. Status and distribution of the endemic Bali starling *Leucopsar rothschildi*. Oryx 34, 188–197.

Berec, M., Vršecká, L., Šetlíková, I., 2018. What is the reality of wildlife trade volume? CITES trade database limitations. Biol. Conserv. 224, 111–116.
Boyle, B., 2024. EU's legal loophole feeds gray market for world's rarest parrot. Article, *Mongabay*, 17 January 2024. https://news.mongabay.com/2024/01/eus-legal-loophole-feeds-gray-market-for-worlds-rarest-parrot/. accessed in Feb 2024.
Buckley, L.J., de Queiroz, K., Grant, T.D., et al., 2016. A checklist of the iguanas of the world (Iguanidae; Iguaninae). Herpetol. Conserv. Biol. 11 (Monograph 6), 4–46.
Busilacchi, S., Butler, J., van Putten, I., et al., 2022. Why does illegal wildlife trade persist in spite of legal alternatives in transboundary regions? Hum. Dimens. Wildl. 27 (1), 51–68. https://doi.org/10.1080/10871209.2021.1876963.
Cayot, L., 2008. The restoration of giant tortoise and land iguana populations in Galápagos. Galapagos Research 65, 39–43.
Cayot, L.C., Oftedal, O.T., 1995. The importance of nutrition in rearing programs for Galapagos land iguanas and giant tortoises. Desert tortoise council - proceedings of the 1995 symposium 51–53.
CBD, 2024. List of Parties. https://www.cbd.int/information/parties.shtml accessed in April 2024.
Chunco, A., Phimmachak, S., Sivongxay, N., Stuart, B., 2013. Predicting environmental suitability for a rare and threatened species (Lao newt, *Laotriton laoensis*) using validated species distribution models. PLoS One 8 (3), e59853. https://doi.org/10.1371/journal.pone.0059853.
CITES, 2022. Conf. 18.7 (Rev. CoP19) Legal acquisition findings. at: https://cites.org/sites/default/files/documents/COP/19/resolution/E-Res-18-07-R19.pdf. accessed in May 2024.
CITES, 2025. https://cites.org/eng/disc/parties/index.php accessed in February 2025.
Collins, K., Keith, I., Dawson, T., 2020. Countering the threat of invasive species to the Galapagos marine reserve. Marine Protected Areas Science, Policy and Management 285-298. https://doi.org/10.1016/B978-0-08-102698-4.00015-0.
Conservation International, 2024. Biodiversity hotspots: Targeted instruments in nature's most important places. https://www.conservation.org/priorities/biodiversity-hotspots accessed in April 2024.
Costa Rica Star News, 2016. Galapagos iguana smuggler sentenced to two years in prison. Online article of Feb 14. https://news.co.cr/galapagos-iguana-smuggler-sentenced-to-two-years-in-prison/44765/. accessed in Feb 2024.
Courchamp, F., Angulo, E., Rivalan, P., et al., 2006. Rarity value and species extinction: the anthropogenic Allee effect. PLoS Biol. 4 (12), e415. https://doi.org/10.1371/journal.pbio.0040415.
D'Cruze, N., Macdonald, D.W., 2016. A review of global trends in CITES live wildlife confiscations. Nature Conservation 15, 47–63. https://doi.org/10.3897/natureconservation.15.10005.
Dueñas, A., Jiménez-Uzcátegui, G., Bosker, T., 2021. The effects of climate change on wildlife biodiversity of the Galapagos Islands. Climate Change Ecology 2, 100026.
EAZA, 2024. Danny De Man, EAZA Executive Office, in litt. to Pro Wildlife, dated 19 February.
Ecuador, 2022. Comercio ilegal de iguanas de las islas Galápagos - Ecuador. In: Information document SC 74 Inf. 26 to the CITES Standing Committee meeting, Lyon, France, pp. 7–11. March 2022. Available at https://cites.org/sites/default/files/eng/com/sc/74/Inf/S-SC74-Inf-26.pdf.
EFP & AP, 2015. Galapagos Islands wildlife trafficking. In: Online Article of 8 Sep. Welle, Deutsche. https://www.dw.com/en/arrest-in-galapagos-islands-wildlife-trafficking/a-18699826.
Escobar-Camacho, D., Rosero, P., Castrejón, M., et al., 2021. Oceanic islands and climate: using a multi-criteria model of drivers of change to select key conservation areas in Galapagos. Reg. Environ. Chang. 21, 47. https://doi.org/10.1007/s10113-021-01768-0.
Facebook, 2013. https://www.facebook.com/photo/?fbid=532715473468163&set=pcb.532716216801422 retrieved 12 June 2024.
Feitosa, L., Martins, A., Giarrizzo, T., et al., 2018. DNA-based identification reveals illegal trade of threatened shark species in a global elasmobranch conservation hotspot. Sci. Rep. 8, 3347. https://doi.org/10.1038/s41598-018-21683-5.
Forsythe, H., 2015. Man arrested in iguana smuggling attempt. Online Article of Sep 9, Galapagos Conservation Trust. https://galapagosconservation.org.uk/man-arrested-in-iguana-smuggling-attempt/.
Foster, S., Wiswedel, S., Vincent, A., 2016. Opportunities and challenges for analysis of wildlife trade using CITES data–seahorses as a case study. Aquat. Conserv. Mar. Freshwat. Ecosyst. 26 (1), 154–172.
Galapagos Conservancy, 2022. Traffickers of Galápagos wildlife receive jail sentence for smuggling attempt. Online article of Oct 6 at. *PR Newswire*. https://www.prnewswire.com/news-releases/traffickers-of-galapagos-wildlife-receive-jail-sentence-for-smuggling-attempt-301642205.html.
Gargano, M., Colosimo, G., Gratton, P., et al., 2022. Nitrogen and carbon stable isotope analysis sheds light on trophic competition between two syntopic land iguana species from Galápagos. Sci. Rep. 12, 16897. https://doi.org/10.1038/s41598-022-21134-2.
Gentile, G., 2012. *Conolophus marthae*. The IUCN Red List of Threatened Species 2012: e. T174472A1414375. https://doi.org/10.2305/IUCN.UK.2012-1.RLTS.T174472A1414375.en accessed on 21 December 2023.
Gentile, G., Grant, T.D., 2020. *Conolophus pallidus*. The IUCN Red List of Threatened Species 2020: e.T5239A3014028. https://doi.org/10.2305/IUCN.UK.2020-2.RLTS.T5239A3014028.en accessed on 21 December 2023.
Gentile, G., Ciambotta, M., Tapia, W., 2013. Illegal wildlife trade in Galápagos: molecular tools help the taxonomic identification of confiscated iguanas and guide their rapid repatriation. Conserv. Genet. Resour. 5, 867–872. https://doi.org/10.1007/s12686-013-9915-7.
Government of Ecuador, 2024. Parque Nacional Galápagos. https://galapagos.gob.ec/parque-nacional-galapagos/ accessed on 5th February 2024.
Hinsley, A., Willis, J., Dent, A., et al., 2023. Trading species to extinction: evidence of extinction linked to the wildlife trade. Cambridge Prisms: Extinction 1 (e10), 1–9. https://doi.org/10.1017/ext.2023.7.
Hogg, C., Dennison, S., Frankham, G., et al., 2018. Stopping the spin cycle: genetics and bio-banking as a tool for addressing the laundering of illegally caught wildlife as 'captive-bred'. Conserv. Genet. Resour. 10, 237–246. https://doi.org/10.1007/s12686-017-0784-3.
Hogue, A., Breon, K., 2022. The greatest threats to species. Conservation Science and Practice 4 (5), e12670. https://doi.org/10.1111/csp2.12670.
Hughes, A., Auliya, M., Altherr, S., et al., 2023. Determining the sustainability of legal wildlife trade. J. Environ. Manag. 341, 117987.
IPBES, 2019. In: Díaz, S., Settele, J., Brondízio, E., et al. (Eds.), Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES Secretariat, Bonn, Germany, p. 56.
IPBES (n.d.). Megadiverse countries. https://www.ipbes.net/glossary-tag/megadiverse-countries (accessed in Feb 2024).
IUCN, 2024. The IUCN Red List of Threatened Species. Version 2023-1. https://www.iucnredlist.org accessed in Feb 2024.
IUCN SSC ISG – Iguana Specialist Group, 2014. 2014 Puerto Ayora. Santa Cruz, *Galápagos* at. https://www.iucn-isg.org/about/isg-conferences/2014-puerto-ayora-galapagos/. (Accessed 22 May 2024).
IUCN SSC ISG – Iguana Specialist Group, 2015. Updates from the co-chairs and program officer. ISG Newsletter 15, 3–4.
King, W., 1978. Chapter 15 - the wildlife trade. Pp. 253-271. In. Wildlife and America – contributions to an understanding of American wildlife and its conservation. In: Brokaw, H.P. (Ed.), council on environmental quality, U.S. Fish and Wildlife Service, Forest Service. National Oceanic and Atmospheric Administration, Washington D.C.
Korea Times, 2022. Galapagos Tortoise, iguana Traffickers Jailed for One Year. Online article at. https://www.koreatimes.co.kr/www/world/2024/05/501_337096.html. accessed on 17 May 2024.
Kumar, K., Gentile, G., Grant, T., 2020. *Conolophus subcristatus*. The IUCN Red List of Threatened Species 2020: e.T5240A3014082. https://doi.org/10.2305/IUCN.UK.2020-2.RLTS.T5240A3014082.en accessed on 21 December 2023.
Kupferschmidt, K., 2022. A wild hope. Science 376, 1148–1153.
Laws, E., 2017. The Political Economy of the Illegal Wildlife Trade. K4D Helpdesk Report. Institute of Development Studies, Brighton, UK, p. 11. Available at https://assets.publishing.service.gov.uk/media/5975dcf740f0b649a700000e/151-The-political-economy-of-the-illegal-wildlife-trade.pdf.
Loreti, P., Bracciale, L., Colosimo, G., et al., 2020. Assessment and validation of miniaturized technology for the remote tracking of critically endangered Galápagos pink land iguana (*Conolophus marthae*). Animal Biotelemetry 8, 3. https://doi.org/10.1186/s40317-020-0192-4.
Lyons, J., Natusch, D., 2011. Wildlife laundering through breeding farms: illegal harvest, population declines and a means of regulating the trade of green pythons (*Morelia viridis*) from Indonesia. Biol. Conserv. 144, 3073–3081.
MacLeod, A., Nelson, K., Grant, T., 2020. *Amblyrhynchus cristatus* (errata version published in 2020). The IUCN Red List of Threatened Species 2020: e. T1086A177552193. https://doi.org/10.2305/IUCN.UK.2020-2.RLTS.T1086A177552193.en accessed on 21 December 2023.
Marshall, B., Strine, C., Hughes, A., 2020. Thousands of reptile species threatened by under-regulated global trade. Nat. Commun. 11 (1), 1–12.
Ministry of Environment, 2024. Parque Nacional Galápagos. https://www.ambiente.gob.ec/parque-nacional-galapagos/ accessed on 5th February 2024.
Miralles, A., Macleod, A., Rodríguez, A., et al., 2017. Shedding light on the imps of darkness: an integrative taxonomic revision of the Galápagos marine iguanas (genus *Amblyrhynchus*). Zool. J. Linnean Soc. 181 (3), 678–710. https://doi.org/10.1093/zoolinnean/zlx007.
Murphy, J., 2015. Studies on lizards and tuataras in zoos and aquariums. Part I – introduction, history, families Iguanidae, Agamidae, Chamaeleonidae, and infraorder Gekkota. Herpetological Reviews 46, 464–482.
Nellemann, C., Henriksen, R., Kreilhuber, A., et al., 2016. The rise of environmental crime – a growing threat to natural resources peace, development and security. A UNEP INTERPOL rapid response assessment. In: United Nations environment Programme and RHIPTO Rapid Response – Norwegian Center for Global Analyses (eds.), p. 108.
Nijman, V., 2021. Zoos consenting to the illegal wildlife trade – the earless monitor lizard as a case study. Nature Conservation 44, 69–79.
Ogden, R., 2012. DNA applications and implementation. In: Huffman, J., Wallace, J., Wiley-Blackwell (Eds.), Wildlife Forensics – Methods and Applications. John Wiley & Sons, Ltd. U.K, pp. 273–292.
Omifolaji, J., Hughes, A., Ibrahim, A., et al., 2022. Dissecting the illegal pangolin trade in China: an insight from seizures data reports. Nature Conservation 45, 17–38. https://doi.org/10.3897/natureconservation.45.57962.
Outhwaite, W., 2020. Addressing corruption in CITES documentation processes. TNRC Topic Brief. In: https://c402277.ssl.cf1.rackcdn.com/publications/1309/files/original/Topic-Brief-Addressing-corruption-in-CITES-documentation-processes.pdf?1583178470. accessed in Apr 2024.
Pawley, R., 1966. Observations on the care and nutrition of a captive group of marine iguanas *Amblyrhynchus cristatus*. International Zoo Yearbook 6, 107–115.
Peaker, M., 2019. Galapagos marine iguanas in zoos. Online article at. https://zoologyweblog.blogspot.com/2019/06/galapagos-marine-iguanas-in-zoos.html. (Accessed 9 April 2024).
Perälä, J., 2022. Testudo kleinmanni (amended version of 2003 assessment). The IUCN red list of threatened species 2022, e.T21652A217969981. https://doi.org/10.2305/IUCN.UK.2022-1.RLTS.T21652A217969981.en.

Phelps, J., Biggs, D., Webb, E.L., 2016. Tools and terms for understanding illegal wildlife trade. Front. Ecol. Environ. 14, 479–489.
Price, R., 2017. Economic Drivers and Effects of the Illegal Wildlife Trade in Sub Saharan Africa. K4D Helpdesk Report.. Institute of Development Studies, Brighton, UK.
Quinzin, M., Bishop, P., Miller, M., et al., 2023. Galapagos giant tortoise trafficking case demonstrates the utility and applications of long-term comprehensive genetic monitoring. Anim. Conserv. 26 (6), 826–838. https://doi.org/10.1111/acv.12870.
Radio New Zealand, 2010. Remaining gecko smugglers sentenced. Online article of March 29. https://www.rnz.co.nz/news/national/29629/remaining-gecko-smugglers-sentenced. accessed in Feb 2024.
Reptil, T.V., 2016. YouTube video, *Reptil TV Folge 89 Besuch im iZoo Japan 2016*. at: https://www.youtube.com/watch?v=WgT54CCvods. (Accessed 22 May 2024).
Reynolds, G., 2011. Status, conservation, and introduction of amphibians and reptiles in the Turks and Caicos Islands, British West Indies. In: Hailey, A., Wilson, B., Horrocks, J. (Eds.), Conservation of Caribbean Island Herpetofaunas Volume 2: Regional Accounts of the West Indies. Brill, Leiden, pp. 377–406.
Rueda, D., Castaño, P., Campbell, K., et al., 2023. Galápagos Pink Land iguana (*Conolophus marthae*): Conservation and Management Plan 2022–2027. IUCN, Gland, Switzerland, p. 43.
Salafsky, N., Salzer, D., Stattersfield, A., et al., 2008. A standard lexicon for biodiversity conservation: unified classifications of threats and actions. Conserv. Biol. 22, 897–911. https://doi.org/10.1111/j.1523-1739.2008.00937.
Shepherd, C., Sy, E., 2017. First record of international trafficking of critically endangered long-beaked echidnas (*Zaglossus* sp.). *Journal of Indonesian*. Nat. Hist. 5 (1 & 2), 22–26.
Shepherd, C., Janssen, J., Noseworthy, J., 2019. A case for listing the Union Island gecko *Gonatodes daudini* in the appendices of CITES. Global Ecology and Conservation 17, e00549.
SRG, 2020a. Short summary of conclusions. 91st Meeting of the Scientific Review Group on Trade in Wild Fauna and Flora, meeting of 21st. September 2020. Pp 1-4. Available at https://circabc.europa.eu/sd/a/c61b8cd9-e430-4a3c-b9c4-9803ee957aa6/91_summary_SRG.pdf.
SRG, 2020b. Short summary of conclusions. 92nd Meeting of the Scientific Review Group on Trade in Wild Fauna and Flora, meeting of 3rd December 2020. Available at https://circabc.europa.eu/sd/a/a30daa66-704d-4160-a7fe-81948f22944b/92_summary_SRG.pdf. accessed in Jan 2024.
Stoner, S., Nijman, V., 2015. The case for CITES appendix I-listing of earless monitor lizards *Lanthanotus borneensis*. TRAFFIC Bulletin 27 (2), 55–58.
t Sas-Rolfes, M., 2015. The Economics and Politics of Wildlife Trade Regulation, Paper submitted to PERC Workshop on "Wildlife Conservation, Trade and Property Rights", Bozeman, MT, July 26–29. https://www.z2systems.com/neon/resource/perc/files/tsasPERC%20Wildlife%20Workshop%20MtR(1).pdf.
Tittensor, D., Harfoot, M., McLardy, C., et al., 2020. Evaluating the relationships between the legal and illegal international wildlife trades. Conserv. Lett. 13, e12724. https://doi.org/10.1111/conl.12724.
Tow, J., Symes, W., Carrasco, L., 2021. Economic value of illegal wildlife trade entering the USA. PLoS One 16 (10), e0258523. https://doi.org/10.1371/journal.pone.0258523.
TRAFFIC, 2008. What's Driving the Wildlife Trade? A Review of Expert Opinion on Economic and Social Drivers of the Wildlife Trade and Trade Control Efforts in Cambodia, Indonesia, Lao PDR and Vietnam. East Asia and Pacific Region Sustainable Development Discussion Papers. East Asia and Pacific Region Sustainable Development Department,. World Bank, Washington, DC.
TTWG -Turtle Taxonomy Working Group, Rhodin, A., Iverson, J., van Dijk, P., Stanford, C., Goode, E., Buhlmann, K., Mittermeier, R., 2021. Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. In: Chelonian Research Monographs. Turtles of the World: Annotated Checklist and Atlas of Taxonomy, Synonymy, Distribution, and Conservation Status (9th Ed.), 8, pp. 1–472. https://doi.org/10.3854/crm.8.checklist.atlas.v9.2021.
Uetz, P., Freed, P., Aguilar, R., et al., 2023. The Reptile Database. http://www.reptile-database.org accessed 1st February 2024.
van Uhm, D., Moreto, W., 2017. Corruption within the illegal wildlife trade: a symbiotic and antithetical enterprise. Brit. J. Criminology 58 (4), 864–885. https://doi.org/10.1093/bjc/azx032.
UNEP-WCMC, 2025. CITES trade database – extraction of trade data for marine and land iguanas (*Amblyrhynchus cristatus* and *Conolophus spp./subcristatus*) for the period 1975–2022. Extracted in June 2024 and updated in February 2025.
UNESCO, 1978. Final Report, Second Session, Washington D.C. (USA), 5-8 September 1978. CC-78/CONF.Ol0/10 Rev.
Vega Barrera, E., Ferri, D., Mena, C., 2023. The extinction market: Reflections on the possible future of the illegal Galapagos wildlife trade. In: Walsh, S., Mena, C., Stewart, J., Muñoz Pérez, J. (Eds.), Island Ecosystems. Social and Ecological Interactions in the Galapagos Islands. Springer, Cham. https://doi.org/10.1007/978-3-031-28089-4_32.
Vega, F., 2022. Where are the pink iguanas of the Galapagos? Online article of Apr 27, Bitácora Ambiental. https://en.bitacoraec.com/post/where-are-the-pink-iguanas-of-galapagos.
Weissgold, B., 2024. US wildlife trade data lack quality control necessary for accurate scientific interpretation and policy application. Conserv. Lett. 17 (2), e13005. https://doi.org/10.1111/conl.13005.
Wijnstekers, W., 2011. The Evolution of CITES – 9th Edition (International Council for Game and Wildlife Conservation).
Wikelski, M., Nelson, K., 2004. Conservation of Galápagos marine iguanas (*Amblyrhynchus cristatus*). IGUANA 11 (4), 190–197.
Wittemyer, G., Northrupa, J., Blanc, J., et al., 2014. Illegal killing for ivory drives global decline in African elephants. PNAS 111, 13117–13121. https://doi.org/10.1073/pnas.1403984111.
Wyatt, T., Johnson, K., Hunter, L., et al., 2018. Corruption and wildlife trafficking: three case studies involving Asia. Asian Criminology 13, 35–55. https://doi.org/10.1007/s11417-017-9255-8.
ZIMS, 2024. Extract from the Species360 Zoological Information Management Software Database (January 2024).
Zootierliste, 2024. Search for *Conolophus* and *Amblyrhynchus*. at. https://www.zootierliste.de/en/?org=7. accessed on 5th February 2024.