



Opinion

The European Market Remains the Largest Consumer of Frogs' Legs from Wild Species

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Abstract: The loss of biodiversity due to overexploitation is well known, but a review and regulation of species used in the frogs' legs trade has yet to be accomplished. This problem relates to supply (the capture and trade of wild populations) and demand (the main consumer being the EU). The EU's responsibility should not be ignored, since unsustainable imports of certain species drives population decline and increases risk of extinction. For most organisms, including frog species in the frogs' legs trade, commercial international trade remains unregulated, includes species in extinction-threat categories on the IUCN Red List, and is not economically sustainable. With a tradition of frogs' legs consumption anchored in western EU countries, demand for many species from the principal supplying countries (Indonesia, Vietnam, Turkey, Albania) has resulted in the overexploitation of the regional populations of many species. Unfortunately, legal trade takes place in the midst of numerous uncertainties, including unresolved taxonomic status for many frogs, no database or regulation of trade-relevant species, unknown population status, and no health standards for the animals involved in the trade. In addition, regional overharvest may increase the use of pesticides, there is uncertain but likely spread of disease along the trade chain, and certification schemes for frog farming operations are both not standardised and can lead to exotic invasive species escaping into naive ecosystems. Mechanisms to help make the international trade in frogs' legs sustainable are essential, and require international agreement and targeted efforts, ideally financed by the trade sector itself.

Keywords: anurans; consumption; eastern Europe; science–policy interface; Southeast Asia; trade regulation; unsustainable



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1. Background

We are experiencing the greatest species extinction rate in human history and holistic efforts to halt this trend require prudence and responsibility. The use and over-exploitation of natural resources for short-term economic gain while disregarding long-term losses can no longer be deemed justifiable. In addition, within the environmental issues we face, recognition of the importance of biodiversity conservation has lagged behind that of climate change for many years. Now, the conservation of biodiversity is finally being brought back into the public and decision-making spheres. Despite this, legal and exploitative wildlife trade continues to be overlooked, and for amphibians (with >1200 species in trade), this represents a major threat to the survival of many species since they lack basic standards to ensure sustainability [1]. Whilst global loss of wildlife is often blamed on developing regions, we cannot afford to ignore the role of the West in fueling global biodiversity loss

through the unsustainable import of various species (see Table 1). One such example is the massive international frogs' legs trade to the European Union (EU) (especially Western Europe) representing the largest and almost entirely unregulated market.

In November 2022, 2500 delegates from governments, scientific institutes, non-governmental organisations, and industry met in Panama City for the 19th Conference of the Parties to CITES (the CoP19 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora) with 184 member States. Based on 52 proposals and ca. 100 working documents, the conservation status of almost 600 species in commercial trade was discussed [2]. Despite an extensive agenda, however, only a fraction of wildlife trade was covered. For the vast majority of the commercial international trade in wildlife, including threatened and "Data Deficient" species (as evaluated in the IUCN Red List), this trade remains largely unregulated and a serious threat to their ecological persistence, much less their economic sustainability.

Table 1. Historical and current characteristics of the global frog's legs trade (for details see [3,4]).

Country	Period	Species in Trade	Volume of Trade	Ecological Impact of Trade
India	1960s–1980s	<ul style="list-style-type: none"> Indian green frog (<i>Phrynomadus hexadactylum</i>; formerly known as <i>Euphlyctis hexadactylus</i>) Indian bullfrog (<i>Hoplobatrachus tigerinus</i>) 	Export of 39,502 tonnes 1963–1983, i.e., roughly 1881 tonnes/year, with a peak in 1981	Serious decline of wild frog populations resulted in increase in pests and related increase in pesticide use
Bangladesh	1970s–1980s	<ul style="list-style-type: none"> Indian green frog (<i>Phrynomadus hexadactylum</i>; formerly known as <i>Euphlyctis hexadactylus</i>) Indian bullfrog (<i>Hoplobatrachus tigerinus</i>) 	Export of 7519 tonnes of frogs' legs 1977–1984, i.e., roughly 1253 tonnes/year	Serious decline of wild frog populations
Indonesia	1990s–present (shifting from island to island, as populations become depleted)	<ul style="list-style-type: none"> Asian brackish frog (<i>Fejervarya cancrivora</i>) Asian grass frog (<i>Fejervarya limnocharis</i>) Giant Javan frog (<i>Limnonectes macrodon</i>) Blyth' giant frog (<i>Limnonectes blythii</i>) (see Figure 2) 	Export peak in the 1990s with 5600 tonnes/year, declining to 3800 tonnes in 1992. Largest supplier to the EU with ~3000 tonnes/year (2010–2019) (cf. Figure 1)	<i>L. macrodon</i> almost vanished from EU imports, regional declines of other frog species indicated; sharp increase in pesticides since 2002
Turkey	1990s–present	<ul style="list-style-type: none"> Bedriaga's marsh frog (<i>Pelophylax bedriagae</i>) Anatolian marsh frog (<i>Pelophylax caralitanus</i>) Eurasian marsh frog (<i>Pelophylax ridibundus</i>) 	Annual exports almost 700 tonnes/year (cf. [5]); 3rd largest supplier for the EU with ~1593 tonnes/year (2010–2019) (cf. Figure 1)	Wild frog populations decimated by c. 20% per year; likely extinction in c. 2032 if over-exploitation is not stopped; <i>P. caralitanus</i> considered as Endangered
Albania	2000s–present	<ul style="list-style-type: none"> Balkan marsh frog (<i>Pelophylax kurtmuelleri</i>) Albanian water frog (<i>Pelophylax shqipericus</i>) 	4th largest supplier for the EU with ~59 tonnes/year (2010–2019) (cf. Figure 1)	main threats for native frogs are over-exploitation and invasive frog species, introduced for commerce

Table 1. Cont.

Country	Period	Species in Trade	Volume of Trade	Ecological Impact of Trade
Vietnam	2000s–present	<ul style="list-style-type: none"> • East Asian bullfrog (<i>Hoplobatrachus rugulosus</i>) • Chinese edible frog (<i>Quasipaa spinosa</i>) 	2nd largest supplier for the EU with imports of ~844 tonnes/year (2010–2019) (cf. Figure 1)	Frog farms are continuously restocked with wild-caught individuals

2. Europe’s Hunger for Frogs’ Legs—A Threat to Biodiversity

The global trade in frogs’ legs was not on the agenda of CITES CoP19, despite being a serious threat for an increasing number of amphibian species across a growing number of regions, mainly in Asia but also in South-Eastern Europe [3]. The substantial trade in frogs’ legs, with annual EU imports of 4070 tonnes (cf. Figure 1), correlating roughly to 81–200 million frogs [4], is a good example of how the exploitation of wild populations can not only put the survival of targeted species at risk through unsustainable harvest rates, but can also have deleterious consequences for entire ecosystems (see Table 1). Wherever frogs are vanishing, an essential ecosystem service for pest control is lost, causing insect populations to dramatically grow and crop failures/damage, trophic cascades as communities change, and results in increased application of pesticides [6]. This, in turn, has negative consequences for remaining amphibians [7] as well as other species, including humans. The largely unmonitored overexploitation of frog populations, especially for consumption in Europe, has been going on for several decades.

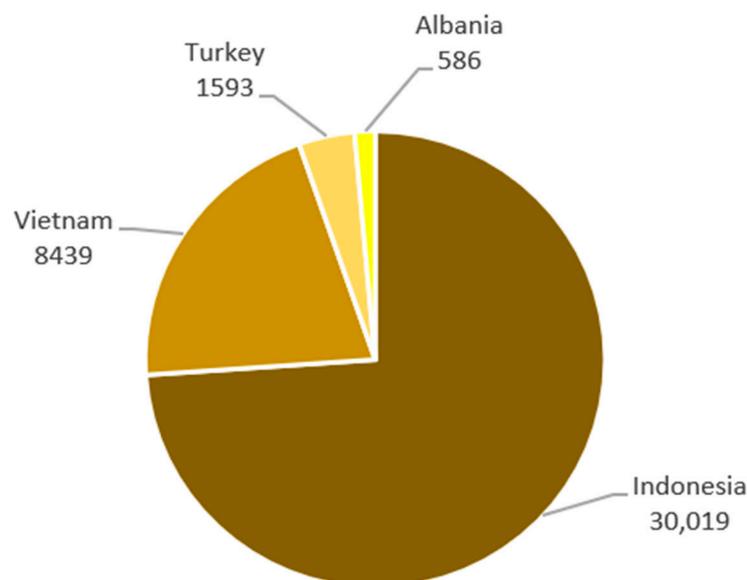


Figure 1. Suppliers for the EU’s frogs’ legs imports (rounded in tonnes), in the period 2010–2019 [4]. Indonesia, Turkey, and Albania source wild populations; Vietnam also farms species for the EU [8].

The development of the commercial trade in frogs’ legs is global and has a history of mismanagement and unsustainability. For example, after local frog populations collapse and protective measures are put in place, the trade shifts to new countries or regions for supply. Subsequent frog populations are then exploited to the point of collapse and the cycle continues. International calls by several experts have voiced for the need of regulations to stop the “extinction domino effect” based on an ecological cascade stemming from the initial loss of a small number of species [3,4]. Furthermore, the lack of sustainability in the frogs’ legs trade not only harms wild frog populations, but also impacts human livelihoods

with insect pests (both for crop damage as well as arboviruses and other mosquito-mediated human diseases), increased pesticide use, and direct financial losses.



Figure 2. Two adult specimens of the *Limnonectes blythii* species complex from a large-scale collector in North Sumatra, 1996, © Mark Auliya; note: in 2004 the species was evaluated “Near Threatened”, in 2021 “Least Concern”; both assessments indicate a decreasing population trend (<https://www.iucnredlist.org> accessed on 1 November 2022); members of this complex are involved in domestic and international trade. In 2006, it was already found that this taxon was regionally overharvested, and in the 1980s, it was one of the dominant species that Indonesia exported to Europe [3,4].

With its *European Green Deal* and *Biodiversity Strategy 2030*, the EU has defined ambitious targets to combat dramatic global loss of biodiversity and environmental degradation [9,10]. In practice, however, the EU remains a leading destination for legal and illegal wildlife and its products, with much of this trade neither regulated nor sustainable [11]. For instance, according to EUROSTAT, the European statistics database, the EU imported about 40,700 tonnes of frogs’ legs between 2010–2019 [4], roughly 814–2000 million individual frogs. The vast majority of these frogs are taken from the wild, mainly in Indonesia, Turkey, and Albania, where large-legged frog species are primarily targeted, and local population declines have been documented. Only in Vietnam, the second largest supplier for the EU market (after Indonesia), are frogs farmed on a large scale. Wild native frog populations there are in double jeopardy: native species are collected to restock farms [12] and simultaneously displaced by highly invasive non-native species such as the American bullfrog (*Lithobates catesbeianus*) [13]. Indeed, there is an additional threat from the risk of pathogens (e.g., the fungus *Batrachochytrium*, which has driven widespread extinction in other regions) from invasive species introduced via the trade.

Problematic issues related to the EU’s import of frogs’ legs have been highlighted in 2011 [5], but no changes since then have been implemented to ensure a sustainable trade. Disregarding the extent of exploitation [4,14] and our inability to identify species that characterises the frogs’ legs trade [3,15] only exacerbates prioritising short-term economic benefits that are deemed more important than the development of a sustainable international trade. This comes despite numerous efforts at multilateral international conventions, e.g., the CBD to halt the loss of biodiversity, including the Aichi Biodiversity Targets [16] and prior CITES exposure to the issues. A further reminder of the importance of understanding all dimensions of trade is from the ninth session of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 9) in July 2022 in Germany, the new IPBES assessment report on sustainable use of wild species was launched [17]. Much of the current work on the report focuses on science-based valuation of natural resources as the central focus of economic decision making [18]. The frogs’ legs trade also falls under the purview of the United Nations Sustainable Development Goals

(SDGs), wherein SDG 15 indicates clear guidelines to protect and promote sustainable use of natural resources and prevent the loss of biodiversity. Data collected as part of the IUCN Red List assessments should be carefully assessed for compliance with the SDGs [19]. Unfortunately, this allows the trade to ignore species with out-of-date assessments (as well as unassessed species), assenting these species to continue to be exploited despite their unknown conservation status. With the upcoming CITES conference CoP 19 in November 2022, there is the opportunity to re-initiate the process of thoughtful legal and scientific conservation measures that has been on pause since 1985, when the most traded species in the trade were first listed in CITES Appendix II, a status that requires export permits to ensure sustainable levels of international trade.

3. Essential Considerations for a Sustainable Trade of Frogs' Legs

The path towards a more sustainable commercial trade is possible and beneficial in both the short- and long-term. Clarifying the uncertainties would allow population data to guide for a more sustainable commercial trade and better understand the impact harvest has on populations/species. This path, however, requires international agreement and focused effort, ideally funded by the trade itself. These are the very minimal essential elements for a successful sustainable trade of frogs' legs:

- Before implementing a monitored sustainable trade of species and populations, the viability of these must be ensured to afford prescribed numbers for offtake; if necessary, some previously intensively used populations would need to be temporarily suspended from trade.
- Ensure full transparency in trade data and taxonomic certainty in detailed trade records at the species level. This will probably require DNA barcoding of shipments in the trade.
- Identify geographical origin of wild and captive bred frogs to assess impacts on native communities and disease transmission.
- List all trade-relevant species in legal codes and regulations, including the EU wildlife trade regulation 338/97 and in cooperation with exporting countries in CITES Appendix II.
- Promote accurate and scientific population monitoring of harvested species, complying with non-detriment findings (NDFs) of CITES.
- Develop and implement a centralised wildlife trade database for the EU and biosecurity measures along the trade chain to prevent the spread disease.
- Maintain IUCN Red List assessments up to date for trade-relevant species and evaluate them according to the impact that trade may have on harvested populations and species.
- Implement standardised certification schemes for frog farms to avoid negative local and regional ecological impacts.

Mechanisms to transition the international trade in frogs' legs to become sustainable and responsible are attainable, and are urgently needed before dire warnings are realised, e.g., (i) increase in overexploited species/populations, (ii) ongoing spread of (pathogenic) diseases, (iii) a regional increase in the use of pesticides, (iv) inclusion of other species harvested and traded for consumption, and (v) a more extensive detrimental impact on relevant ecosystems and their services. We strongly urge the decision-makers at CITES to enforce their mandated duty and promote a sustainable trade in frogs' legs.

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