

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA



Eighteenth meeting of the Conference of the Parties
Colombo (Sri Lanka), 23 May – 3 June 2019

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

The inclusion of all species of the genus *Goniurosaurus* from People's Republic of China and the Socialist Republic of Viet Nam, namely the *G. lichtenfelderi* group, the *G. luii* group, and the *G. yingdeensis* group in Appendix II of CITES in accordance with Article II 2(a) of Convention. To date thirteen species are described from China and Viet Nam. Being aware of the high diversity and narrow distributions of species within this genus, the discovery of further cryptic taxa is likely. Thus, it is proposed to include any *Goniurosaurus* species occurring within the national boundaries of China and Viet Nam.

The proposed listing satisfies criteria A and B, Annex 2(a) of Resolution Conf. 9.24 (Rev. CoP17). It is known, or can be inferred or projected, that the regulation of trade in the following species is necessary to avoid it becoming eligible for inclusion in Appendix I in the near future; and it is required to ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences.

The proposed listing includes the following yet described species:

Group *G. luii*:

Goniurosaurus araneus GRISMER, VIETS & BOYLE, 1999
Goniurosaurus bawanglingensis GRISMER, SHI, ORLOV & ANAJEVA, 2002
Goniurosaurus catbaensis ZIEGLER, NGUYEN, SCHMITZ, STENKE, RÖSLER, 2008
Goniurosaurus huuliensis ORLOV, RYABOV, NGUYEN, NGUYEN & HO, 2008
Goniurosaurus kadoorieorum YANG & CHAN, 2015
Goniurosaurus kwangsiensis YANG & CHAN, 2015
Goniurosaurus liboensis WANG, YANG & GRISMER, 2013
Goniurosaurus luii GRISMER, VIETS & BOYLE, 1999

Group *G. lichtenfelderi*:

Goniurosaurus hainanensis BARBOUR, 1908
Goniurosaurus lichtenfelderi (MOCQUARD, 1897)
Goniurosaurus zhoui ZHOU, WANG, CHEN & LIANG, 2018

Group *G. yingdeensis*:

Goniurosaurus yingdeensis WANG, YANG & CUI, 2010
Goniurosaurus zhelongi WANG, JIN, LI & GRISMER, 2014

B. Proponent

China, European Union and Viet Nam*:

C. Supporting statement

1. Taxonomy

1.1 Class: Reptilia

1.2 Order: Squamata

1.3 Family: Eublepharidae

1.4 Genus, species or subspecies, including author and year: *Goniurosaurus* Barbour, 1908

The eublepharid genus *Goniurosaurus* comprises 19 exclusively nocturnal lizard species mostly associated with rock/karst topography (Honda & Ota. 2017, Nguyen et al. 2009, Uetz et al. 2018, Zhou et al. 2018) and is distributed throughout northeastern Viet Nam including some offshore islands in the Gulf of Tonkin (Viet Nam), southern China, including Hainan Island (China), and the Ryukyu Archipelago of Japan (Nguyen et al. 2009, Honda et al. 2017, Zhou et al. 2018). Phylogenetically, *Goniurosaurus* consists of four major groups (species complexes) based on morphological and molecular characters, namely the *G. kuroiwae* group, the *G. lichtenfelderi* group, the *G. luii* group, and the *G. yingdeensis* group (Grismer et al. 2002, Yang & Chan 2015, Zhou et al. 2018, Ziegler et al. 2008). The *G. kuroiwae* group comprises six taxa from the Ryukyu Archipelago of Japan (Honda & Ota 2017, Nguyen et al. 2009, Zhou et al. 2018); the *G. luii* group is composed of *G. araneus* Grismer, Viets & Boyle, 1999 from northeastern Viet Nam and southwestern Guangxi, China, *G. bawanglingensis* Grismer, Shi, Orlov & Ananjeva, 2002 from Hainan Island, China, *G. catbaensis* Ziegler, Nguyen, Schmitz, Stenke & Rösler, 2008 from Cat Ba Island of Viet Nam, *G. huuliensis* Orlov, Ryabov, Nguyen, Nguyen & Ho, 2008 from northern Viet Nam, *G. liboensis* Wang, Yang & Grismer, 2013 from southern China, *G. kadoorieorum* and *G. kwangsiensis* Chan & Yang, 2015 from Guangxi, China, and *G. luii* Grismer, Viets & Boyle, 1999 from southwestern Guangxi and northern Viet Nam; the *G. lichtenfelderi* group includes *G. lichtenfelderi* (Mocquard, 1897) from northern Viet Nam and *G. hainanensis* Barbour, 1908 from Hainan Island, China, and *G. zhoui* Zhou, Wang, Chen & Liang, 2018 from Hainan Island, China; and the *G. yingdeensis* group includes *G. yingdeensis* Wang, Yang & Cui, 2010 and *G. zhelongi* Wang, Jin, Li & Grismer, 2014 from northwestern Guangdong, China.

It is herein proposed to include all 13 species as well as potential further cryptic species of the genus *Goniurosaurus* distributed in China and Viet Nam in Appendix II of CITES.

This proposal specifically **excludes** the following species from Japan (members of the *G. kuroiwae* group):

- G. kuroiwae* (NAMIYE, 1912);
- G. orientalis* (MAKI, 1931);
- G. sengokui* (HONDA & OTA, 2017);
- G. splendens* (NAKAMURA & UÉNO, 1959);
- G. toyamai* GRISMER, OTA & TANAKA, 1994;
- G. yamashinae* (OKADA, 1936).

Species:

Species endemic to China.

- Goniurosaurus bawanglingensis* GRISMER, SHI, ORLOV & ANAJEVA, 2002
- Goniurosaurus hainanensis* BARBOUR, 1908;
- Goniurosaurus kadoorieorum* YANG & CHAN, 2015;

* The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.

Goniurosaurus kwangsiensis YANG & CHAN, 2015
Goniurosaurus liboensis WANG, YANG & GRISMER, 2013;
Goniurosaurus yingdeensis WANG, YANG & CUI, 2010;
Goniurosaurus zhelongi WANG, JIN, LI & GRISMER, 2014;
Goniurosaurus zhoui ZHOU, WANG, CHEN & LIANG, 2018.

Species endemic to Viet Nam.

Goniurosaurus catbaensis ZIEGLER, NGUYEN, SCHMITZ, STENKE, RÖSLER, 2008;
Goniurosaurus huuliensis ORLOV, RYABOV, NGUYEN, NGUYEN & HO, 2008;
Goniurosaurus lichtenfelderi (MOCQUARD, 1897).

Species known from both China and Viet Nam.

Goniurosaurus araneus GRISMER, VIETS & BOYLE, 1999;
Goniurosaurus luyi GRISMER, VIETS & BOYLE, 1999.

1.5 Scientific synonyms:

Goniurosaurus murphyi was considered as a junior synonym of *G. lichtenfelderi* (see Grismer. 2000).
Goniurosaurus hainanensis BARBOUR, 1908 was once considered as *Eublepharis hainanensis* by Mocquard, 1897; *Goniurosaurus lichtenfelderi* by Borner, 1981; *Goniurosaurus lichtenfelderi hainanensis* by Grismer, 1987.

1.6 Common names: English:

ENGLISH

<i>Goniurosaurus</i> spp.	Tiger gecko, Leopard gecko, Cave gecko
<i>G.araneus</i>	Vietnamese leopard gecko, Vietnamese tiger Gecko
<i>G. catbaensis</i>	Catba tiger gecko
<i>G.bawanglingensis</i>	Bawangling leopard gecko, Bawangling cave gecko
<i>G.hainanensis</i>	Hainan cave gecko, Chinese cave gecko
<i>G. huuliensis</i>	Huulien tiger gecko
<i>G.kadoorieorum</i>	Kadoories' cave gecko
<i>G.kwangsiensis</i>	Guangxi cave gecko
<i>G.liboensis</i>	Libo leopard gecko
<i>G. lichtenfelderi</i>	Lichtenfelder's tiger gecko
<i>G.luyi</i>	Chinese leopard gecko, Chinese cave gecko
<i>G.yingdeensis</i>	Yingde leopard gecko
<i>G.zhelongi</i>	Zhe-long's leopard gecko
<i>G.zhoui</i>	Zhou's leopard gecko

1.7 Code numbers: N/A

2. Overview

Tiger geckos (also known as Cave geckos) of the genus *Goniurosaurus* currently comprise 19 species with a disjunct distribution in southeastern and eastern Asia. This genus contains a high level of local endemism, and many species are recorded from a single locality, mountain range or Archipelago only. In China there are eight endemic species: *G. bawanglingensis*, *G. hainanensis*, *G. kadoorieorum*, *G. kwangsiensis*, *G. liboensis*, *G. yingdeensis*, *G. zhelongi*, *G. Zhoui*; in Viet Nam there are three endemic species: *G. catbaensis*, *G. huuliensis* and *G. lichtenfelderi*. The species shared by China and Viet Nam are *G. araneus* and *G. lujii*, which also have restricted distribution ranges (Honda & Ota. 2017, Nguyen et al. 2009, Zhou et al. 2018) (Annex I, Fig 1 Table 1). In Japan, there are six endemic species which are excluded from the proposal.

Goniurosaurus is also considered as one of the most poorly studied reptile groups. Since 2008 nine species have been described as new taxa from Japan, northern Viet Nam and southern China (Orlov et al. 2008, Yang & Chan 2015, Zhou et al. 2018), and still a far greater diversity of unknown species is assumed to exist in poorly investigated forest areas. While unprecedented numbers of new species are being discovered, tiger geckos are threatened by extinction through habitat loss and over-harvesting for the pet trade. Tiger geckos have been popular in the pet market since the 1990s due to their beautiful appearance and striking color patterns. Some species are fetching high prices in the international pet market, giving local traders great incentives for excessive collection (Yang & Chan 2015). Since *Goniurosaurus* species are generally habitat specialists living in low densities in the wild and most species have highly restricted ranges, wild populations are especially vulnerable to harvest. The impact of trade is exacerbated by habitat loss, e.g. due to quarrying, forest clearance for agriculture, illegal timber logging, and impacts from tourism activities.

Of the 19 described taxa, eight species of *Goniurosaurus* from Japan and very recently from Viet Nam have been evaluated and listed in the IUCN Red List (IUCN, 2018) with three Critically Endangered species (*G. huuliensis*, *G. toyami*, *G. yamashinae*), three Endangered species (*G. catbaensis*, *G. orientalis*, *G. splendens*) and two Vulnerable species (*G. kuroiwae*, *G. lichtenfelderi*). In May 2018, at the IUCN Red List Workshop for Chinese Lizard Species held at ChongQing China, nine species of early described *Goniurosaurus* were evaluated. As a result of the evaluation, *G. zhelongi* was classified as Critically Endangered, six species, *G. bawanglingensis*, *G. liboensis*, *G. kadoorieorum*, *G. kwangsiensis*, *G. lujii* and *G. yingdeensis* were classified as Endangered, *G. hainanensis* as Vulnerable, and *G. Zhoui* was Data Deficient.

This proposal seeks to list 13 species of the genus *Goniurosaurus* distributed in China and Viet Nam in Appendix II of CITES.

3. Species characteristics

For most of the tiger geckos from China and Viet Nam comprehensive knowledge on the distribution, natural history and biology are currently lacking.

3.1 Distribution

These 13 species of the genus *Goniurosaurus* have distributions in Hainan Island, Guangdong Province, Guangxi Zhuang Autonomous Region and the neighboring Guizhou Province of China, and Cao Bang, Lang Son, Bac Giang, Hai Duong and Quang Ninh Provinces, and Cat Ba Island and its surrounding islands in northern Viet Nam (Annex I Table 1).

3.2 Habitat

In China and Viet Nam, tiger geckos inhabit either granitic or limestone rock in primary (or old secondary) forests. Almost congeners of the *G. lichtenfelderi* group occupy granitic rocks along small streams, and brooks flow, with major distribution in northeastern Viet Nam and Hainan Island, China, while *G. Zhoui* was recently found in limestone karst areas on Hainan Island, China. Other known species of the *G. lujii* group inhabit limestone karst forests with a diverse topography composed of steep flanks, caves and sinkholes. They are usually found in crevices of limestone cliffs, on trees and under decayed trees. With respect to the *G. yingdeensis* group, the members inhabit along side of granite flagstone paths near streams (Grismer et al. 1999, Nguyen et al. 2009, Orlov et al. 2008, Wang et al. 2010, Ziegler et al. 2008, Zhou et al. 2018).

Micro-habitat preferences have been exceptionally well investigated in *G. catbaensis*. This species was found to be active in the surroundings of large limestone caves which were densely covered with in part primary forest vegetation and the vicinity of shrub vegetation on limestone rocks. Mean air temperatures at microhabitats were in mean $28.1 \pm 1.7^\circ\text{C}$ during summer. Recorded relative humidity at microsites ranged between 70-99% (Ngo et al. 2016b). Also, *G. luyi* has been found to occur within limestone caves and on limestone cliffs. Adult specimens (non-gravid) were observed in average heights of 114.7 cm above the ground, while juveniles and gravid females were residing at lower heights of 27.5 cm and 40.7 cm, respectively (Ngo et al. in press, Nguyen et al. 2016) (Annex I Figure 1,2).

3.3 Biological characteristics

Members of *Goniurosaurus* are exclusively nocturnal species and only active after sunset. They usually hide in crevices of rocks, under the rocks or in caves during the day. At night, they climb on exposed surface or rocks under bushes, or on walls inside or outside of caves. They often move near seams or small holes of rocks; and when encountering disturbance or predators, they quickly flee into stone seams or small holes to hide. *Goniurosaurus* spp. prey on small animals such as insects and earthworms. A gravid female carries only two to three eggs once a year. The eggs adhere to the stone seams. Breeding season in wild is usually from April to August. Known data on the reproduction of *Goniurosaurus* species has been mainly obtained from observations in captivity. (Annex I Table 1)

3.4 Morphological characteristics

The genus *Goniurosaurus* is subdivided in four major groups based on significant differences in morphology and molecular data, namely the *G. kuroiwae* group, the *G. lichtenfelderi* group, the *G. luyi* group, and the *G. yingdeensis* group. This classification is mostly consistent with the geographical distribution of species, like the two species of the *G. yingdeensis* group occur in northwestern Guangdong Province, China (Wang et al. 2010, Wang et al. 2014). However, the three species of the *G. lichtenfelderi* group occur in disjunct areas: *G. lichtenfelderi* occurs in both mainland and islands in northern Vietnam while *G. hainanensis* and *G. zhoui* are found in Hainan Island, China. The *G. luyi* group (including eight species) exhibits a similar disjunction, with six species occurring around the border of Vietnam and China, whereas two species, *G. bawanglingensis* is restricted to Hainan Island, China and *G. catbaensis* endemically inhabit in Cat Ba Island and Ha Long Bay, Vietnam.

Unique characters of the genus *Goniurosaurus* are possession of the derived character state of midventral contact of the prefrontal bones ventral to the frontal; having the derived character states of a dorsal ridge on the ulnar and the retention of the juvenile caudal colour pattern of black and white bands into adulthood. Its head is triangular, wider than the neck, cover with granular scales; eyes relatively large, pupils vertical; upper eyelid slightly enlarged; iris is brown, bright-orange or blood-red; Number of body bands between limb insertions in each species is 3 to 5 (Grismer 1988, Grismer et al. 1999).

Diagnostic characters to distinguish the *G. kuroiwae* group from others are: absence of preloacal pores and claws are not sheathed by scales in members of the group from the Ryukyu Archipelago, Japan. In other 13 species of *Goniurosaurus*, preloacal pores are present, and claws are sheathed by scales (Ziegler et al. 2008, Zhou et al. 2018).

Studies revealed that morphological characters amongst species in each group of the genus are significantly similar. Species identification in the genus *Goniurosaurus* by non-specialists is rather difficult, especially if location data is not provided or wrongly given. As a result, molecular analyses are necessary to determine species designations and population differentiation in this genus (Blair et al. 2009, Ngo et al. 2016b). For detailed morphological characteristics and the key to species see Annex II.

3.5 Role of the species in its ecosystem

Goniurosaurus species are mainly recorded as predators of terrestrial invertebrates, the main proportion of prey organisms consists of beetles (Coleoptera) and crickets (Orthoptera) (Nguyen 2011, Yang & Chan 2015).

4. Status and trends

4.1 Habitat trends

Species of *Goniurosaurus* are habitat-specialists, occurring in low densities even in optimal habitats, which are highly range restricted and often situated in the vicinity of remote granitic or limestone rocks in the primary and secondary forest (Ziegler et al. 2008, Orlov et al. 2008, Yang & Chan 2015, Zhou et al. 2018). Overall, the habitat of *Goniurosaurus* is assumed to decrease and degrade due to the construction of cement factories, dams, hydropower plants and roads, and tourism, agricultural and other human activities increasingly consuming natural resources shared by wildlife (Ngo et al. 2016b, Yang & Chan 2015).

Huge parts of the forests in Tay Yen Tu NR, Bac Giang Province and Yen Tu mountain, Quang Ninh Province, presenting main habitats of *G. lichtenfelderi* have been vastly cleared by slash and burn agriculture and the building of new roads in order to facilitate coal-mining and logging throughout the nature reserves, as well as to develop the region for religious tourism (van Schingen et al. 2014). According to Nguyen et al. (2016), habitat destruction for touristic purposes has dramatically increased the pressure on the wild populations of *G. catbaensis*. Natural forest on Cat Ba Island has been segregated into isolated fragments as a result of road-building and the associated development of tourist infrastructure. Tourist trails border or cross several habitat sites, or directly lead to known occurrences of the species within and around caves. Light, smoke, and pollution through waste are some of the negative impacts of tourism, although it is not yet clear, how severely this affects the species (Ngo et al. 2016b). Several karst formations on Cat Ba Island, which comprise important habitats for the species, have been recently destroyed to build a huge new tourist resort and plans exist to expand tourism in this area further. As the species is dependent on a moderate degree of forest cover, its habitats in the buffer zone of Cat Ba National Park are at risk from agricultural encroachment and associated forest fires, illegal timber logging and firewood collecting (Nguyen et al. 2016). The habitats of *G. luyi* at its type locality in Guangxi ZAR and surrounding natural habitats in southern China are at risk from habitat loss due to quarrying, as the demand for cement and mine products is rising following the rapid economic growth and urbanisation (Yang & Chang. 2015).

4.2 Population size

Except for *G. catbaensis*, comprehensive studies on population size and abundance of *Goniurosaurus* species are still lacking (Ngo et al. 2016b). The most recent investigations on *Goniurosaurus* species confirmed both, high degrees of adaptation to specific microhabitats and high levels of local endemism: many species are only known from a single mountain range or island. For this reason alone, most species probably have rather small population sizes and are considered to be vulnerable to various impacts (Ngo et al. 2016b). Naturally, species of *Goniurosaurus* are habitat-specialists living in low density in the wild, many of which have highly restricted ranges (Yang and Chan 2015). For more details on population sizes see Annex 1, Table 1.

4.3 Population structure

According to Ngo et al. (2016b), the population of the insular *G. catbaensis* in Cat Ba National Park consisted mainly of adult males, followed by adult females, subadults, and juveniles (39%, 33%, 18%, 10%, respectively). The tendency of monthly shifts in the presence of age classes showed that individuals with SVL of less than 90 mm and animals with SVL larger than 120 mm were mainly found from July onwards, while the largest individuals (SVL up to 110 mm) were recorded in August (Ngo et al. 2016b, Nguyen et al. 2016). Surveys in July 2017 and in April 2018 found that the population of *G. catbaensis* in Ha Long Bay consisted mainly of females (55% and 57% respectively), and most of the observed animals were adults (mean 77%) (Ngo et al. in press).

The population structure of the continental *G. luyi* in Ha Lang District, Cao Bang Province, Viet Nam, was investigated in June 2014, showing that adult females constitute the major proportion of the local subpopulation, followed by adult males, juveniles, and sub-adults (65%, 14%, 14%, 7%, respectively) (Ngo et al. 2016b).

The quick surveys on *G. bawanglingensis* in 2018 in Hainan Island, China revealed that subpopulations consisted mainly of adults (67%), and a sex ratio of female to male as 1.7:1.

4.4 Population trends

Since *Goniurosaurus* species are habitat specialists and most species are only recorded from a single locality it can be assumed that populations will suffer declines in the future, associated to a steady decrease, fragmentation and degradation of their respective habitats. Not a single specimen could be observed at a formerly populated site after an extreme flood in August 2015 in Viet Hai Village on Cat Ba Island. Since North Viet Nam has experienced an increase of heavy storms and floods in the last years (Ngo et al., in press.), it can be assumed that natural catastrophes will lead to a decline or even extirpation of local populations in the future. Since *Goniurosaurus* generally occur at low abundances, it can be assumed, that the ability to recover from natural catastrophes and overharvesting is relatively low. Evidence from field work suggests that populations at *G. araneus* and *G. luyi* were already extirpated at their respective type localities in the past due to over-harvesting for the pet trade (Stuart et al. 2006, Ngo et al. 2016b). Similar trends are also inferred in the populations of *G. yingdeensis* and *G. zhelongi* (Geggel 2016). During the field surveys on *G. bawanglingensis*, *G. hainanensis*, *G. yingdeensis* and *G. zhelongi* in 2017 and 2018 local rangers said that impacts such as habitat degradation and illegal harvest have frequently observed which could have been the cause for the species only occurring rarely in recent years and the populations could be considered to be in decline.

4.5 Geographic trends

According to Ngo et al. (in press.) climate change might strongly affect habitat suitability in the future, especially of Cat Ba and Ha Long Bay Archipelago, as increasing heavy storms and flooding have been recorded in the region. Furthermore, climate change is assumed to be associated with a rise of the water level that might further affect the availability of suitable habitats on small islands.

5. Threats

Tiger geckos are threatened by habitat loss and harvest for the pet trade and local use. Tiger geckos have been popular in the pet market since the 1990s due to their beautiful colour patterns and convenient size. The pressure from harvesting is considered a serious threat to the survival of Tiger geckos, since *Goniurosaurus* species are habitat specialists occurring in low densities in the wild, while most species have highly restricted distribution ranges. For instance, *G. luyi* was rapidly overexploited to the point of local extirpation at its type locality only shortly after its scientific description in 1999 (Stuart et al. 2006, Yang & Chan 2015). In the populations of *G. yingdeensis* and *G. zhelongi* similar trends are taking place in their type localities respectively (Geggel 2016). As a result, the authors described and published *G. kadoorieorum* and *G. kwangsiensis* in 2015 and *G. zhoui* in 2018 with confidential type localities.

Even though *G. catbaensis* was only described recently and furthermore only occurs within a protected area, the species has already been observed on offer regularly in European pet markets, such as the reptile fair in Hamm, Germany, as well as on internet platforms by several independent dealers (Ngo et al. in press). It could be more aggravated in Cat Ba Island and Ha Long Bay, where are popular tourist sites in Viet Nam. Thus awareness of and interest in this attractive insular gecko may increase on the local, national or international level shortly (Ngo et al. in press).

According to Ngo et al. (in press), wild *G. catbaensis* sub-populations are strongly affected by anthropogenic impacts. The impact of trade on wild populations of *Goniurosaurus* spp. is exacerbated by habitat loss due to quarrying, forest clearance for agriculture, illegal timber logging, and impacts from tourism activities (Grismer et al. 1999, Ngo et al. 2016b, Zhou et al. 2018).

Other known threats to these species are associated with climate change and associated exceptional weather events, such as increasingly extreme floods and storms in northeastern Viet Nam since August 2015 (Ngo et al. in press). The strong flood event in 2015 appeared to have caused local extirpations of *G. catbaensis* at sites on Cat Ba Island (Ngo et al. in press). According to Ngo et al. (in press) *G. catbaensis*, like other congeners, is assumed to be especially vulnerable to extinction by climate change due to an assumed narrow temperature optimum and only a few options for behavioural and physiological compensation.

6. Utilization and trade

6.1 National utilization

Occasionally *G. araneus*, *G. luii*, *G. kadoorieorum* and *G. kwangsiensis* are harvested from the wild in China for the use in the traditional medicine (Grismer 1999, Lee et al. 2004, Stuart & Grismer 2006, Yang and Chan 2015). In Viet Nam, *G. huuliensis* specimens have been used by locals for the traditional medicine (Ngo pers. obs.). Furthermore, various *Goniurosaurus* species are locally sold as pets in Viet Nam (Ngo pers. obs.) and China mainland and Hongkong SAR, China.

6.2 Legal trade

Tiger geckos of the genus *Goniurosaurus* have been popular in the pet market since the 1990s, due to their beautiful appearance and colour patterns. Especially rare species fetch high prices, giving traders great incentive for poaching and excessive collection (Yang & Chan 2015). Grismer et al. (1999) reported an exemplary case of one dealer exporting over 10,000 individuals of *G. luii* and *G. araneus* to the USA for the pet trade. Stuart et al. (2006) also claim that *G. luii* reached a price of 1500 to 2000\$ per individual in importing countries. Already before its description in 1999, these two *Goniurosaurus* had been overexploited for commercial use, which presumably led to the extirpation from their type localities (Grismer et al. 1999, Ngo et al. 2016b, Stuart et al. 2006). Currently, hundreds of captive-born juveniles of *Goniurosaurus* species were available on the world pet market every year for about \$40 each (Stuart et al. 2006).

Most, if not all *Goniurosaurus* species are being sold in the international pet market, mainly in Europe and the US. According to the LEMIS database of the U.S. Fish & Wildlife Service, a total of 16,714 specimens of *Goniurosaurus* spp. have been imported into the USA between 1999 and 2018. The number of imported species mainly consisted of 138 specimens of *G. araneus*, 999 *G. hainanensis*, 7,281 *G. lichtenfelderi* and 608 *G. luii*. *Goniurosaurus* species were imported into the USA from 15 countries, and the majority of these animals were traded in live (90%), 11,515 specimens (68.9%) were wild caught and 5,086 animals (30.4%) were allegedly bred in captivity, for mainly commercial purposes (97%), while only 3% were imported for scientific purposes and zoo uses.

A market survey in March 2018 confirmed that the trade in *Goniurosaurus* specimens mainly takes place online as well as on international reptile fairs (Appendix III, Fig 2, 3, 4) in Europe. It was recorded that specimens fetch prices between US\$35 and 200 in the international internet markets, e.g., *G. hainanensis* was recorded for sale for US\$ 45 – 90, *G. lichtenfelderi* for US\$ 60-90 per specimen, *G. araneus* for US\$175 for two unsexed juveniles or for one male, *G. bawanglingensis* for €175 per pair, *G. catbaensis* for 300€ (US\$340) per pair, *G. huuliensis* for US\$400 per pair or US\$150 for one male and *G. luii* for US\$175 per two juveniles, or for US\$40 - 60 per pair or one (Appendix III, table 1). The confusion in identification between *G. luii* and *G. kadoorieorum* animals for sale was recorded on Facebook's page of a private dealer (Appendix III, Fig. 7).

According to Altherr (in lit.) a total of 535 specimens of six *Goniurosaurus* species were spotted for sale on 120 different online adverts with prices from €35 to 120 (US\$40 – 137) between September 2017 and March 2018. In particular, *G. araneus* specimens (n = 56) were offered for sale of US\$142, *G. catbaensis* (n = 29) for US\$170, *G. hainanensis* (n = 162) for €35 - 140, *G. huuliensis* (n = 41), *G. lichtenfelderi* (n = 97) and *G. luii* (n=150) for €35 - 142 (Appendix III, Table 1).

There is no definitive data to describe the domestic status quo of legal trade in China since the species have extremely narrow distribution ranges, are very rare but have not been listed in the *Lists of Wildlife under Special State Protection of China*. Several cases were recorded during a survey of the online market like Tabao.com in November 2018. *G. yingdeensis*, *G. liboensis* and *G. bawanglingensis* were offered by dealers for high prices of US\$130 - 215 per individual. One online dealer offered *G. hainanensis* in a large quantity with a lower price of US\$15 per individual. Juveniles of *G. luii* from China were offered for a price of about €50 per individual.

6.3 Parts and derivatives in trade

The trade in this genus includes mainly live animals, and there is no evidence of any parts or derivatives in the trade.

6.4 Illegal trade

In Vietnam, collecting wild animals for the pet trade without permits is illegal. However, members of *Goniurosaurus* were found to be sold in local pet shops as well as on Vietnamese internet platforms.

According to an interview with a pet shop owner in Dong Nai Province, southern Viet Nam in April 2018, *G. lichtenfelderi* and *G. huuliensis* were currently not available on stock, as they were very difficult to be collected in the wild at that time. Accordingly, specimens were recently only rarely advertised on several Vietnamese internet platforms, such as Facebook and Zalo online for sale for US\$20 - 25. At least 20 specimens of *G. lichtenfelderi* or *G. huuliensis* were recorded to have been allegedly smuggled without any permits from Viet Nam to Thailand with prices about US\$100 per individual in 2016 (Ngo et al. pers. comm. 2018) (Appendix III, Table 1).

During the last years, several extensive field surveys in Cao Bang failed to record any specimens of *G. araneus* in northern Viet Nam (Ngo et al. 2016b). It was predicted that *G. araneus* has already extirpated from its type locality in Viet Nam (Ngo et al. 2016b). However, *G. araneus* (with Chinese origin) have been observed for sale in Viet Nam in 2018. According to one dealer in Dong Nai Province, southern Viet Nam, 50 animals were illegally imported from China in 2016 and then smuggled to Thailand with a higher price of 150\$ per individual (Appendix III, Table 1).

It has been observed in both local and international pet markets, even though it was only described recently (Ziegler et al. 2008, Ngo et al. 2016b). In Viet Nam, the Cat Ba Tiger Gecko has been frequently observed in local pet shops in southern Viet Nam as well as in Hang Market, Hai Phong City, northern Viet Nam during recent years. Four local Vietnamese dealers (two shop owners, one private keeper and one hunter) have been interviewed in April 2018. Specimens of *G. catbaensis* were collected at the type locality on Cat Ba Island, Hai Phong city and subsequently offered, for sale for US\$7 to 25 in Viet Nam. At least 20 specimens of *G. catbaensis* were reportedly smuggled to Thailand with a higher price up to US\$150 per individual (Appendix III, Table 1).

Since 2014, wild caught *G. luyi* individuals were frequently recorded in local pet shops from Dong Nai Province and Ho Chi Minh City, southern Viet Nam as well as on Facebook, Zalo online and other internet platforms (Appendix III, Fig. 5B). A recent survey in 2018 found that *G. luyi* is being offered locally for US\$20 to 25 per animal. Interviews with two local dealers and two private keepers in Southern Viet Nam revealed that they paid local villagers living within the species' distribution range in Cao Bang Province, northern Viet Nam, for collecting *G. luyi* during the non-hibernation season from April to September, confirming the wild source of traded animals. According to local traders, charges of at least 50 specimens per deal are frequently being exported to Thailand and Indonesia without any permits for prices of US \$100-150 per individual, from where specimens will allegedly be mainly exported to Europe and the United States (Appendix III, Table 1).

6.5 Actual or potential trade impacts

There is concrete evidence that wild sourced *Goniurosaurus* species are subject to local and international trade (Grismer et al. 1999, Ngo et al. in press, Ngo et al. pers. obs, Stuart et al. 2006). Since the genus is not protected and trade is not monitored so far, it can be assumed that the reported cases only reflect a small quantity of the entirely harvested animals. Due to the restricted distribution range, low densities and specialisation to specific habitats, *Goniurosaurus* species are considered to be especially vulnerable to unsustainable harvest (Ngo et al. 2016b). In the case of *G. araneus*, it is assumed that over-exploitation probably led to its extinction from the type locality in North Viet Nam (Ngo et al. 2016b). A similar scenario has been reported for *G. luyi* in South China (Stuart et al. 2006). It can be assumed that more recently discovered species are likewise vulnerable to exploitation if the trade is not being controlled.

7. Legal instruments

7.1 National

In China, from 2000 on, the former recognised *G. lichtenfelderi* and *G. hainanensis* have been listed as the species of terrestrial wildlife which are beneficial or of important economic or scientific value. Although there is no full transcription on how to syncretise and harmonise the differentiation between

the fast-changing nomenclature of species and the relatively stable lists of protection, logically the newly described species of *Goniurosaurus* in China should be considered as cryptic species of *G. lichtenfelderi* and *G. hainanensis*, and are also under protection. *G. hainanensis* and *G. bawanglingensis* have been further listed as wildlife under special local protection in Hainan province. According to *the Law of the People's Republic of China on the Protection of Wildlife*, anyone who intends to hunt or catch wildlife that is not under special state protection must obtain a hunting license and observe the hunting quota assigned. In nature reserves, the hunting and catching of wildlife and other activities which are harmful to the survival of wildlife are prohibited.

The genus *Goniurosaurus* has become threatened by extinction through habitat loss and over-exploitation, but no member of the genus *Goniurosaurus* is as yet included in any wildlife protection laws in Viet Nam (Ngo et al. 2016b). However, collecting wild animals including *Goniurosaurus* species has been strictly restricted within protected areas as national parks and nature reserves in Viet Nam. *Goniurosaurus* spp. has been proposed to be listed in the Governmental Decree as Group II B, which will be enforced in early 2019.

7.2 International

Due to the lack of basic data on population sizes and distribution, *Goniurosaurus* has not received increasing attention concerns protection except for *G. catbaensis*. Based on first population and trade investigations, the species *G. catbaensis* has recently been received increasing attention from all around the world in protection and was listed in the IUCN Red List of Threatened species as "Endangered" (Nguyen et al. 2016), and two species (*G. huuliensis* and *G. lichtenfelderi*) were afterward listed as "Critically Endangered" and "Vulnerable" respectively (IUCN, 2018).

In May 2018, at the IUCN Red List Workshop for Chinese Lizard Species held at ChongQing China, nine species of early described *Goniurosaurus* were evaluated. As a result of the evaluation, *G. zhelongi* is Critically Endangered, six species, *G. bawanglingensis*, *G. liboensis*, *G. kadoorieorum*, *G. kwangsiensis*, *G. luyi* and *G. yingdeensis* are Endangered, *G. hainanensis* is Vulnerable, and *G. zhoui* is Data Deficient.

8. Species management

8.1 Management measures

Several *Goniurosaurus* species occur inside protected areas (Annex I Table 1). The hunting and collecting of the wildlife are forbidden according to the *Law in the Protection of Wildlife* and the *Regulations in the Nature Reserves of the People's Republic of China and Socialist Republic of Viet Nam*. Habitats covered by nature reserves also benefit from regulations.

8.2 Population monitoring

A Population monitoring program of *G. bawanglingensis* has been established since 2006 (Qi et al. 2007). The population of *G. catbaensis* and *G. luyi* have been repeatedly surveyed in the course of the last few years to monitor population trends and threats by using a capture-recapture method.

8.3 Control measures

8.3.1 International

None.

8.3.2 Domestic

See 7.1. All the Vietnamese species of *Goniurosaurus* have been proposed to be listed in the Group IIB of the Governmental Decree, which will be enforced in early 2019.

8.4 Captive breeding and artificial propagation

Goniurosaurus species are also being kept in zoos and other wildlife organisation for scientific purposes and captive breeding. Data on captive *Goniurosaurus* species were assessed by ZIMS (Zoological

Information Management System of Species 360, accessed in August 2018). There is a total of 34 specimens kept in 7 institutions (in the U.S: *G. hainanensis* n=7 [3 x wild caught and 4 x captive bred] in 2 institutions, *G. lichtenfelderi* n=11[all captive bred] in 1 institution, and *G. sp* n=4 [1 x captive bred and 3 x undetermined] in 4 institutions; in Europe *G. luii* n=12 [all captive bred] in 2 institutions). According to data from www.zootierliste.de, there are six species kept in 4 zoological institutions, namely: *G. araneus* (3 institutions), *G. catbaensis* (1 institution), *G. hainanensis* (1 institution), *G. huuliensis* (1 institution), *G. lichtenfelderi* (1 institution) and *G. luii* (3 institutions). However, topical details on the number and origin of individuals are not visible from that source.

According to the LEMIS database a total of 16,714 *Goniurosaurus* spp. specimens have been imported into the US between 1999 and 2018 that were hatched in captivity for major commercial purposes and scientific uses.

In Viet Nam, three *Goniurosaurus* species (*G. lichtenfelderi*, *G. catbaensis*, *G. luii*) are currently kept at the Me Linh Station for Biodiversity in Vinh Phuc Province, to establish an ex-situ back-up population (Ziegler et al. 2016). The first successful reproduction of *G. catbaensis* at the Me Linh Station, Viet Nam occurred in July 2018 (Ngo pers. obs.).

8.5 Habitat conservation

There are no existing specific measures to protect the habitat of *Goniurosaurus* species or specifically protect the species. However, some species occur within protected areas such as Cat Ba National Park and Ha Long Bay, a World Heritage Site (*G. catbaensis*), Bai Tu Long National Park and Tay Yen Tu Nature Reserve (*G. lichtenfelderi*) and Huu Lien Nature Reserve (*G. huuliensis*) (Ngo et al. 2016, Orlov et al. 2008, Ziegler et al. 2008). Habitat conservation measures have been frequently conducted by provincial governments and non-governmental organizations from around the world (Cat Ba Biosphere Reserve Authority. 2013, Forest Protection Department of Bac Giang Province (2010), The Management Department of Ha Long Bay 2014). Ngo et al. (2016b) suggested that *G. catbaensis* should be considered as a flagship species for Cat Ba National Park. Signboards highlighting the conservation needs of *G. catbaensis* were designed and provided to the provincial authorities to be displayed in Ha Long Bay (Ngo et al. pers. obs. (2018), Appendix IV, Figure 1).

8.6 Safeguards

9. Information on similar species

Other species within this genus are found in Japan with six endemic species of the *G. kuroiwa* group: *G. kuroiwa*, *G. orientalis*, *G. splendens*, *G. toyamai*, *G. yamashinae*, and *G. sengokuii* (Honda & Ota. 2017). The keys to distinguish *G. kuroiwa* group to others are: for members of the group from the Ryukyu Archipelago, Japan, their preloacal pores are absent, and claws are not sheathed by scales. In other 13 species of *Goniurosaurus*, preloacal pores are present, and claws are sheathed by scales (Ziegler et al. 2008).

10. Consultations

11. Additional remarks

12. References

- Auliya M. 2003. *Hot trade in cool creatures: A review of the live reptile trade in the European Union in the 1990s with a focus on Germany*. TRAFFIC Europe, Brussels, Belgium
- Blair, C., Orlov, N.L., Shi, H.T. & Murphy, R.W. (2009) A taxonomic re-evaluation of *Goniurosaurus hainanensis* (Squamata: Eublepharidae) from Hainan Island, China. *Russian Journal of Herpetology*, 16, 35–40.
- Böhm, M., B. Collen, J.E. Baillie, P. Bowles, J. Chanson, et al. (2013). The conservation status of the world's reptiles. *Biological Conservation*, 157 (2013), pp. 372-385
- Catba Biosphere Reserve Authority. 2013. *Cat Ba Archipelago Biosphere Reserve*. Hai Phong City, Viet Nam, third edition. 28 p.

- Carola Jucknie, Derek Vera, Rachel Wintjen. 2013. Three to Get Ready: *Goniurosaurus*
<http://www.geckotime.com/three-to-get-ready-goniurosaurus/> August 27, 2013
- Chan Bosco Pui Lok · Chen Qing · Wang Xingqing. (2007). Preliminary report of terrestrial vertebrates at Xianling area, Hainan. *Tropical Forestry*, 35(suppl.):22-23,21.
- Chen, T., Meng, Y., Jiang, K., Li, P., Wen, B., Lu, W., Lazell, J. & Hou, M. (2014) New record of the Leopard Gecko *Goniurosaurus araneus* (Squamata: Eublepharidae) for China and habitat partitioning between geographically and phylogenetically close Leopard Geckos. *IRCF Reptiles & Amphibians*, 21, 16–27.
- Forest Protection Department of Bac Giang Province (2010). *Tay Yen Tu Nature Reserve: biodiversity conservation value and development potential*. Hanoi: Publishing House for Science and Technology.
- Geggel L. For Rare-Species Poachers, Scientific Journals Are Treasure Maps.
<https://www.yahoo.com/news/rare-species-poachers-scientific-journals-treasure-maps-164110846.html>
 February 22, 2016
- Grismer L.L., Viets B.E., Boyle L.J. (1999): Two new continental Species of *Goniurosaurus* (Squamata: Eublepharidae) with a Phylogeny and Evolutionary Classification of the Genus. *Journal of Herpetology*, 33, pp. 382-393.
- Grismer, L.L., Shi, H., Orlov, N.L. & Ananjeva, N.B. (2002) A new species of *Goniurosaurus* (Squamata: Eublepharidae) from Hainan Island, China. *Journal of Herpetology*, 36, 217–224.
- Honda, M. & Ota, H. (2017) On the live coloration and partial mitochondrial DNA sequences in the topotypic population of *Goniurosaurus kuroiwae orientalis* (Squamata: Eublepharidae), with description of a new subspecies from Tokashikijima Island, Ryukyu Archipelago, Japan. *Asian Herpetological Research*, 8, 96–107.
- Kurita, T., Kawamura, R., Toda, M. (2013): Limestone Cave as a cradle of the Ryukyu ground gecko, *Goniurosaurus kuroiwae*. *Herpetological Review*, 44(4), 569-572.
- Lee, K.S., Lau, M.W.N., and Chan, B.P.L. 2004. Wild animal trade monitoring at selected markets in Guangzhou and Shenzhen, South China, 2000–2003. Kadoorie Farm and Botanic Garden Technical Report No. 2, Hong Kong SAR, China
- Ngo, H. N., Le, Q. T., Nguyen, Q. T., Le, D. M., van Schingen, M., Ziegler, T.: First record of the Cat Ba tiger gecko, *Goniurosaurus catbaensis*, from Ha Long Bay, Quang Ninh Province, Viet Nam: Microhabitat selection, potential distribution, and threat evaluation. (In press)
- Ngo, H.N., Ziegler, T., Nguyen, T.Q., Pham, C.T., Nguyen, T.T., Le, M. D., van Schingen, M. (2016b). First population assessment of two cryptic Tiger Geckos (*Goniurosaurus*) from northern Viet Nam: Implications for conservation. *Amphibian & Reptile Conservation* 10(1): 34-45.
- Ngo, N. H., Nguyen, Q. T., Nguyen, T. H. T. (2016a). Dietary ecology of the Tiger Gecko *Goniurosaurus catbaensis* in Cat Ba National Park, Hai Phong Province, Viet Nam. *Proceedings in the 3th national scientific workshop “Amphibia and Reptile in Viet Nam”*: 181-186
- Nguyen, T.Q. (2011). Systematics, ecology, and conservation of the lizard fauna in northeastern Viet Nam, with special focus on *Pseudocalotes* (Agamidae), *Goniurosaurus* (Eublepharidae), *Sphenomorphus* and *Tropidophorus* (Scincidae) from this country. University of Bonn, Germany.
- Nguyen, T.Q., Ngo, H., van Schingen, M. & Ziegler, T. (2016b). *Goniurosaurus catbaensis*. The IUCN Red List of Threatened Species 2016: e.T18917684A18917688
- Nguyen, V. S., Ho, T. C. & Nguyen, Q. T. (2009), “Herpetofauna of Viet Nam. Edition Chimaira, Frankfurt am Main”.
- Orlov, N.L., Ryabov, S.A., Nguyen, T.T., Nguyen, T.Q. & Ho, C.T. (2008) A new species of *Goniurosaurus* (Sauria: Gekkota: Eublepharidae) from north Viet Nam. *Russian Journal of Herpetology*, 15 (3), 229–244
- Ota, H. 2010. *Goniurosaurus kuroiwae*. The IUCN Red List of Threatened Species 2010: e.T40793A10356760
- Qi Xuming, Tian Mi, Li Xiaocheng, Yang Shibin · Yang Min. 2011. The study on population condition and quantity of *Goniurosaurus bawanglingensis*. *Tropical Forestry*, 39(1): 47-49

- Seufer, H., Y. Kaverkin & A. Kirschner. 2005. *The Eyelash Geckos, care, breeding and natural history*. Kirschner & Seufer Verlag, Karlsruhe, Germany. ISBN: 3980420787.
- Shi, H., Zhao, E., Wang, L.. 1999. *Amphibian and Reptile Fauna of Hainan* (Chinese Edition). Science Press (May 1, 2011), Beijing. 285p.
- Stuart BL, Rhodin AG, Grismer LL, Hansel T. (2006). Scientific description can imperil species. *Science* 312: 1137. doi: <http://dx.doi.org/10.1126/science.312.5777.1137b>
- Thanh V. N., Truong N. Q. Grismer L. L., Ziegler T. (2006). First record of the Chinese Leopard Gecko, *Goniurosaurus luii* (Reptilia: Eublepharidae) from Vietnam. *Current Herpetology*, 25(2): 93-95.
- The Management Department of Ha Long Bay. 2014. *Ha Long Bay Natural World Heritage*. Second edition. Quang Ninh Province, Viet Nam. 76 p.
- Uetz, P., Freed, P. & Hošek, J. (2018) The Reptile Database. Available from: <http://www.reptile-database.org/> (accessed 10 April 2018)
- UNEP-WCMC (2009). Review of non-CITES reptiles that are known or likely to be in international trade. A Report to the European Commission. UNEPWCMC, Cambridge.
- van Schingen M, Pham CT, Thi HA, Bernardes M, Hecht VL, Nguyen TQ, Bonkowski M, Ziegler T. (2014). Current status of the Crocodile Lizard *Shinisaurus crocodilurus* Ahl, 1930 in Viet Nam with implications for conservation measures. *Revue Suisse de Zoologie* 121(3): 1–15
- Wang Y. Y., Jin M. J., Li Y. L., Grismer L. L. 2014. Description of a new species of *Goniurosaurus* (Squamata: Eublepharidae) from the Guangdong Province, China, based on molecular and morphological data. *Herpetologica*, 70(3): 309-322.
- Wang Y. Y., Yang J. H., Cui R. F. 2010. A new species of *Goniurosaurus* (Squamata: Eublepharidae) from Yingde, Guangdong Province, China. *Herpetologica*, 66(2):229-240.
- Wang Y. Y., Yang J. H., Grismer L. L. 2013. A new species of *Goniurosaurus* (Squamata: Eublepharidae) from Libo, Guizhou Province, China. *Herpetologica*, 69(2): 214-226.
- Yang, J.H., Chan, B.P. (2015): Two new species of the genus *Goniurosaurus* (Squamata: Sauria: Eublepharidae) from southern China. *Zootaxa* 3980 (1): 067-080.
- Zhao Ermi, Zhao Kengtang, Zhou Kaiya, et al. 1999. *Fauna Sinica Reptilia* Vol. 2 Squamata, Lacertilia. Science Press, pp77-80
- Zhou R. B., Wang N., Chen B., Liang B. 2018. Morphological evidence uncovers a new species of *Goniurosaurus* (Squamata: Eublepharidae) from the Hainan Island, China. *Zootaxa*, 4369(2): 281-291.
- Ziegler, T., Nguyen, T.Q., Schmitz, A., Stenke, R. & Rösler, H. (2008) A new species of *Goniurosaurus* from Cat Ba Island, Hai Phong, northern Viet Nam (Squamata: Eublepharidae). *Zootaxa*, 1771, 16–30.
- Ziegler, T., Rauhaus, A., Mutschmann, F., Dang, H. P., Pham, T. C., Nguyen, Q. T. (2016): Building up of keeping facilities and breeding projects for frogs, newts and lizards at the Me Linh Station for Biodiversity in northern Viet Nam, including improvement of housing conditions for confiscated reptiles and primates. *Elsevier*, 85: 91-120.

Annex I. Basic information about *Goniurosaurus* spp. distributed in China and Viet Nam

Table 1 Information and overview of *Goniurosaurus* spp. distributed in China and Viet Nam

	Distribution	Biological characteristics	Population size
<i>Goniurosaurus lichtenfelderi</i> group			
<p><i>Goniurosaurus hainanensis</i> BARBOUR, 1908</p>  <p align="center">Photo by Zhou Jiajun</p>	<p>The species is known from its type locality on Hainan Island, China. It was found at elevations from 81 m to 765 m above sea level (a.s.l.) (Blair et al. 2009, Zhou et al. 2018). The whole land area of Hainan Island, China encompasses 33,920 km². The effective suitable area (and so its maximum area of occupancy) for <i>G. hainanensis</i> is at several counties and mountains, and the size is about 1000 km² (Shi et al. 2011).</p>	<p>Eggs have a length of 15.97 mm, a width of 11.97 mm and a weight of 1.28 g, at Day 3 after laying (Zhou et al. 2018).</p>	<p>Twenty-four specimens (13 males, 11 females) were collected by N. Orlov, R. Murphy, and H. Shi from June 2005 (Blair et al. 2009). Four individuals were counted in quick surveys for subpopulations in three sites during Aug 2017 to May 2018 along transects at a length of totally 5km long.</p>
<p><i>Goniurosaurus lichtenfelderi</i> (MOCQUARD, 1897)</p>  <p align="center">Photo by Hai Ngoc Ngo</p>	<p>This species is endemic to northeastern Viet Nam, found in granite valleys of forest streams in Hai Duong, Bac Giang and Quang Ninh Provinces, at elevations from 100 to 600 m a.s.l. Its habitat locates in Nature reserves like Bai Tu Long National Park (Quang Ninh Province) and Tay Yen Tu Nature Reserve (Bac Giang Province) (Nguyen et al. 2009, Orlov et al. 2008).</p>	<p>Females can lay two to three clutches of eggs per period of reproduction in captivity. The mean lengths of the soft-shelled eggs are 28 x 14 mm, weighing about 2.6 g. Juveniles hatch after 65-70 days with a total length of 81 mm (snout-vent length of 42 mm, tail length 39 mm) in captivity (Seufer et al. 2005).</p>	<p>Generally only two single specimens of <i>G. lichtenfelderi</i> have been recorded during past extensive annual surveys in Bac Giang and Quang Ninh Provinces (2013-2016) and 20 animals were found within two transects (length of transects from 600 m to 800 m) in Bai Tu Long National Park, Quang Ninh Province in April 2018, assuming that the species only occurs in relatively low densities (Pham, van Schingen pers.</p>

			obs. 2013-2014, Ngo et al. 2018 pers. obs.).
<p><i>Goniurosaurus zhoui</i> ZHOU, WANG, CHEN & LIANG, 2018</p>  <p>Photo by Zhou Runbang</p>	<p>This species is endemic to Hainan Province of China. It occurs in a typical karst area with an elevation of 220–300 meters in the central mountain of Hainan Island, mainly the Yinggeling NNR which has a size of 504.6 km² (Zhou et al.2018).</p>	<p>It is a nocturnal limestone-dwelling specialist. Gravid females usually are found in March and April, which suggests that the breeding season is during that time. Eggs have a length of 22.56 mm, a width of 13.15 mm and a weight of 2.25g, at Day 3 after laying (Zhou et al. 2018).</p>	<p>More than seven individuals of <i>G. zhoui</i> were collected during the herpetological surveys at the type locality from November 2015 to April 2017 (Zhou et al. 2018).</p>
<i>Goniurosaurus luii</i> group			
<p><i>Goniurosaurus araneus</i> GRISMER, VIETS & BOYLE, 1999</p>  <p>Photo by Tyus Ma</p>	<p>In Viet Nam, this species was only found at the type locality in Cao Bang Province, Viet Nam in 1999. However, it has not been rediscovered in Viet Nam. In China, it is currently known from Nonggang National Nature Reserve, Guangxi ZAR elevations of 150-170 m a.s.l. at sites distributed over a range of more than 100 km² (Chen et al. 2014, Grismer et al. 1999)</p>	<p>The gestation period lasts 1.5-2 months, and eggs that have developed are well-visible through the females' transparent skin on the belly. Usually, the eggs are deposited within the ground. Females, depending on their state of health, can lay two to three clutches of eggs per reproduction period. Freshly laid eggs measure on average 28 x 15 mm and weigh about 2.6 g (Seufer et al. 2005). Juveniles hatch after 65-70 days depending on temperature during incubation. Hatchlings measure about 44 mm snout-vent length, and</p>	<p>The species has not been recorded any more at the type locality in North Viet Nam for several years, even though numerous extensive surveys have been carried out within its type locality during recent years (2010-2018).</p>

		43 mm tail length (Seufer et al. 2005).	
<p><i>Goniurosaurus bawanglingensis</i> GRISMER, SHI, ORLOV & ANAJEVA, 2002</p>  <p>Photo by Xie Weiliang</p>	<p>This species is endemic to Hainan Island, China. It is found only in Bawangling Mountain, including the Bawangling National Nature Reserve and its surrounding areas (Grismer et al. 2002, Shi et al. 2011, Qi et al. 2011, Chan et al. 2007). The area size of the Bawangling NNR is about 299.8 km². The population of tiger gecko in Yinggeling Mountain is identified as <i>G. Zhoui</i>.</p>	<p>The species inhabits near limestone or granite in original forests or older secondary forests and is nocturnal and often active on the ground, rocks, or earthen embankments after rain (Grismer et al. 2002). Eggs have a length of 19.52 mm, a width of 10.42 mm and a weight of 1.25 g, at Day 3 after laying (Zhou et al. 2018).</p>	<p>Subpopulations of <i>G. bawanglingensis</i> in three isolated sites, the Dongyi, Dongliu and Yajia, were estimated with sizes of about 180, 110 and 90 individuals respectively (Qi et al. 2011). In 2018, a quick field survey was conducted in three sites, the Bawangling forest park, Empiral cave and Exian hill and counted only 12 individuals along a transect at a length of totally 15km long.</p>
<p><i>Goniurosaurus catbaensis</i> ZIEGLER, TRUONG, SCHMITZ, STENKE & RÖSLER, 2008</p>  <p>Photo from Ziegler et al. 2008</p>	<p>This species is endemic to Cat Ba Island (about 200 km²), Cat Ba Archipelago and some small offshore islands in adjacent Ha Long Bay in the Gulf of Tonkin, northeastern Viet Nam. Suitable habitats only comprise a small part of the total area. The species has been found at elevations from 4 to 132 m asl (Ngo et al. 2016b, Ngo et al. in press.).</p>	<p>High percentages of gravid females have been recorded between April and July on Cat Ba Island and Ha Long Bay; each female usually contains two eggs (Ngo et al. 2016b, Ngo et al. in press).</p>	<p>First population estimation of the insular <i>G. catbaensis</i> based on a capture-recapture approach revealed a small population size that varied between 16 and 24 individuals per site and a fairly low density of 12 individuals per 100m of suitable habitat on Cat Ba Island (Ngo et al. 2016b). These values only reflect the situation at the two known sites of the species on the island and might not capture the population over the entire range of the taxon. However, <i>G. catbaensis</i> is relatively restricted in its distribution to associated limestone habitats in remote areas. Thus, the total</p>

			population size of the species is assumed to be relatively small (Ngo et al. 2016b, Nguyen et al. 2016).
<p><i>Goniurosaurus huuliensis</i> ORLOV, RYABOV, NGUYEN, NGUYEN & HO, 2008</p>  <p>Photo from Orlov et al. 2008</p>	<p>The species is only known from its type locality in isolated karst mountains of Huu Lien Nature Reserve, Huu Lung District, Lang Son Province, northern Viet Nam, with an area of smaller than 80 km² at 300-370 m elevation (Nguyen et al. 2009, Orlov et al. 2008).</p>	<p>Records with no special characteristics.</p>	<p>Only seven specimens were found during surveys in June 2003 (Orlov et al. 2008).</p>
<p><i>Goniurosaurus kadoorieorum</i> YANG & CHAN, 2015</p>  <p>photo from (Yang & Chang. 2015)</p>	<p>The species is only known from its type locality in Guangxi ZAR in southern China (Yang & Chang. 2015).</p>	<p>Records with no special characteristics.</p>	<p>Only five specimens were collected during surveys in May 2014 (Yang & Chan. 2015).</p>
<p><i>Goniurosaurus kwangsiensis</i> YANG & CHAN, 2015</p>	<p>This endemic species is found in Guangxi ZAR (Yang and Chan, 2015). The distribution area is mainly in the Nonggang NNR, which has a size of 100.8 km².</p>	<p>Records with no special characteristics.</p>	<p>Four specimens were collected during surveys in May 2014 (Yang & Chan. 2015).</p>

 <p>Photo by Xie Weiliang</p>			
<p><i>Goniurosaurus liboensis</i> WANG, YANG & GRISMER, 2013</p>  <p>Photo by Apus wd</p>	<p>This species is found in Maolan NNR of Guizhou Province and Mulun NNR of Guangxi ZAR, with area sizes of 212.8km² and 108.3km² respectively (Wang et al. 2013).</p>	<p>Records with no special characteristics.</p>	<p>Four specimens were collected during surveys in 2010 (Wang et al. 2013).</p>
<p><i>Goniurosaurus luyi</i> GRISMER, VIETS & BOYLE, 1999</p>  <p>Photo by Li Cheng</p>	<p>The species has been reported from several counties and cities in Guangxi ZAR, China (type locality) and adjacent Cao Bang and Lang Son Provinces, northeastern Viet Nam. The species was found at elevation ranges from 180 to 260 m a.s.l. in China and 350-600 m a.s.l. in Viet Nam (Grismer et al. 1999, Nguyen et al. 2009).</p>	<p>High numbers of gravid females have been recorded between May and July in <i>G. luyi</i> within natural habitats (Grismer et al. 1999, Ngo et al. 2016b). Females of <i>G. luyi</i> may produce two to three clutches of two soft-shelled eggs each per reproductive period, depending on their state of health in captivity (Seufer et al. 2005). The soft-shelled eggs of <i>G. luyi</i> have a mean length of 28 x 14 mm and a mean weight of</p>	<p>21 individuals and a density of 0.8 individuals per km/transect of suitable habitat at a known site in Ha Lang District, Cao Bang Province, northern Viet Nam. This site includes several separated karst caves and mountains that were each found to be inhabited only by a few individuals, respectively (Ngo et al. 2016b, van Schingen. pers. obs.).</p>

		2.6 g. Juveniles hatched after an incubation time of about two months in captivity. Mean measured total lengths of offspring have been 72 - 79 mm (snout-vent from 42-47 mm) (Seufer et al. 2005).	
<i>Goniurosaurus yingdeensis</i> group			
<p><i>Goniurosaurus yingdeensis</i> WANG, YANG & CUI, 2010</p>  <p>Photo by Wang Jian</p>	<p>This species is endemic to Guangdong Province, China and is only found in Shimentai NNR at Yingde city, Guangdong Province. The distribution area of Yingde tiger gecko is one-third of the area of Shimentai NNR which has a size of 400km² (Wang et al. 2010).</p>	<p>It moults in April to June; Breeding season is between April and July. The tails of Males are more likely to dock (Wang et al. 2010).</p>	<p>During the field surveys on <i>G. yingdeensis</i> and <i>G. zhelongi</i> in Shimentai NNR in May 2018, no individuals were found in their type locality and surrounded lands. Three individuals of <i>G. yingdeensis</i> and four animals of <i>G. zhelongi</i> were counted outside the type locality along a transect at a length of totally 2km long.</p>
<p><i>Goniurosaurus zhelongi</i> WANG, JIN, LI & GRISMER, 2014</p>  <p>Photo by Zheng Sheng</p>	<p>This species is also endemic to Guangdong Province of China and occupies the other two-thirds part of the area of Shimentai NNR (Wang et al. 2014).</p>	<p>Records with no special characteristics.</p>	<p>During the field surveys on <i>G. yingdeensis</i> and <i>G. zhelongi</i> in Shimentai NNR in May 2018, no individuals were found in their type locality and surrounded lands. Three individuals of <i>G. yingdeensis</i> and four animals of <i>G. zhelongi</i> were counted outside the type locality along a transect at a length of totally 2km long.</p>



Figure 1. Typical habitat of genus *Goniurosaurus* in China.

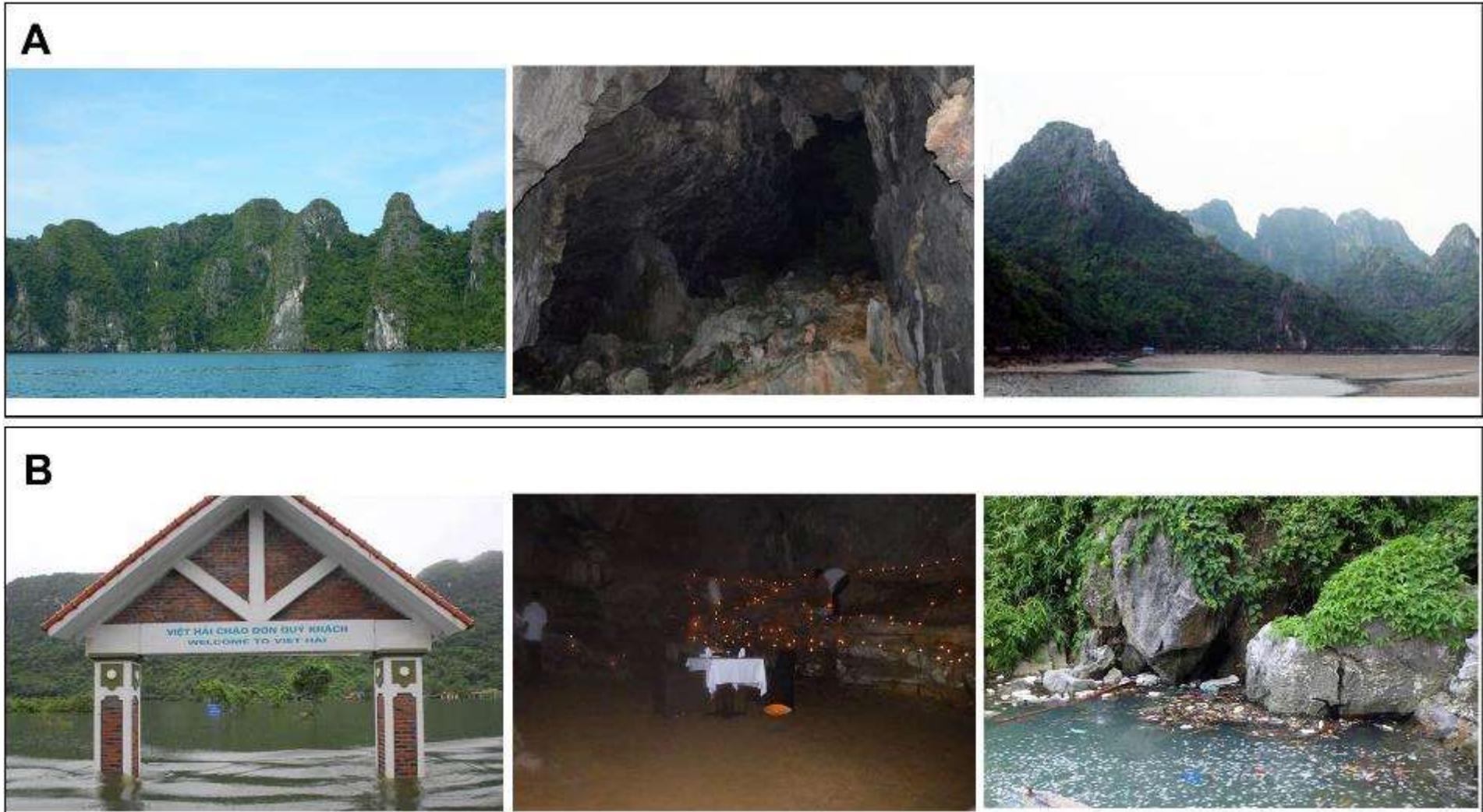


Figure 2. A. Intact typical habitats, and B. Habitats destruction of genus *Goniurosaurus* in Vietnam.

Annex II

Key to the proposed 13 species of genus *Goniurosaurus* (modified from Nguyen. 2011, Zhou et al. 2018)

1	Fewer than 16 Preloacal pores	2	
--	16 or more preloacal pores	3	
2	10–13 preloacal pores; dark brown dorsal ground colour		<i>G. yingdeensis</i>
--	Nine preloacal pores; brownish-black dorsal ground colour		<i>G. zhelongi</i>
3	36–46 preloacal pores	12	
--	16–33 preloacal pores	4	
4	Nuchal loop posteriorly protracted	5	
--	Nuchal loop posteriorly rounded	11	
5	Olive green iris		<i>G. kadoorieorum</i>
--	Yellow, orange or brown iris	6	
6	31–33 preloacal pores		<i>G. kwangsiensis</i>
--	Fewer than 30 preloacal pores	7	
7	41–44 eyelid fringe scales		<i>G. huuliensis</i>
--	52 or more eyelid fringe scales	8	
8	An enlarged row of supraorbital tubercles present	9	
--	An enlarged row of supraorbital tubercles absent		<i>G. araneus</i>
9	Internasal absent; 16–21 preloacal pores		<i>G. Catbaensis</i>
--	1–3 internasals; 23–29 preloacal pores	10	
10	The outer surface of upper eyelid composed of granular scales one-half the size of those on top of head; nuchal loop 11–12 granular scale rows in width		<i>G. luii</i>
--	Upper eyelid scales similar in size to granular scales on the top of the head; nuchal loop 6–7 granular scale rows in width		<i>G. liboensis</i>
11	43–56 eyelid fringe scales; only distributed in Northern Vietnam		<i>G. lichtenfelderi</i>
--	54–77 eyelid fringe scales; only distributed in Hainan Island, China		<i>G. hainanensis</i>
12	37–46 preloacal pores; yellow-grey dorsal ground colour		<i>G. bawanglingensis</i>
--	36–38 preloacal pores; light purple-brown dorsal ground colour		<i>G. Zhoui</i>

Annex III

Examples of trade in *Goniurosaurus* specimens.

Table 1: Trade in *Goniurosaurus* spp. based on a recent internet survey and interviews with dealers.

Date	Country	Trade type	Species	Cost	Purpose	Source	Comment
10.3.2018	Czech Republic	Demand	<i>G. hainanensis</i>	45 € each	shop	www.terrарistik.com	
10.3.2018	France	Demand	<i>G. hainanensis</i>	60 € each	private	www.terrарistik.com	
10.3.2018	Germany		<i>G. hainanensis</i>	?	private	Reptile fair, Germany	Wild specimens of <i>G. hainanensis</i> are still frequently imported for sale
10.3.2018	Germany	Offer	<i>G. hainanensis</i>	90€ pair	private	Reptile fair, Germany	
12.3.2018	Viet Nam	Offer	<i>G. lichtenfelderi</i>	100 \$ each	shop	Pet shop in Bien Hoa, Dong Nai Province	Animals were advertised for sale for two years ago and smuggled to Thailand
10.3.2018	France	Demand	<i>G. lichtenfelderi</i>	60 € each	private	www.terrарistik.com	
10.3.2018	Germany		<i>G. lichtenfelderi</i>	90 € pair	private	www.terrарistik.com	
12.3.2018	Viet Nam	Offer	<i>G. araneus</i>	150 \$	shop	Pet shop in Bien Hoa, Dong Nai Province	Imported from China for sale
06.9.2018	Germany	Offer	<i>G. bawanglingensis</i>	175 € pair	fair	Reptile fair in Hamm, Germany	
12.3.2018	Viet Nam	Offer	<i>G. catbaensis</i>	20 \$ to 150 \$ each	shop	Pet shop in Bien Hoa, Dong Nai Province	No stock at the moment. Animals are sold from April to August, and smuggled to Thailand
14.3.2018	Viet Nam	Offer	<i>G. catbaensis</i>	20 \$ to 25 \$ each	shop	Pet shop in Ho Chi Minh city	Available specimens are observed on Youtube guide to bred
09.2016	Viet Nam	Offer	<i>G. catbaensis</i>	20 \$ each	private	in Ho Chi Minh city	Two wild couples of <i>G. catbaensis</i> were illegally collected
08. 2015	Viet Nam	Offer	<i>G. catbaensis</i>	7 \$ each	hunter	Hang Market in Hai Phong city	Four animals were collected in nature by local hunters
10.3.2018	Germany	Offer	<i>G. catbaensis</i>	200 €/ individual or 300 €/ pair	fair	Reptile fair in Hamm, Germany	200€/ individual or 300€/ pair
12.3.2018	Viet Nam	Offer	<i>G. huuliensis</i>	20 \$ to 100 \$ each	shop	Pet shop in Bien Hoa, Dong Nai Province	Animals were advertised for sale for two years ago and smuggled to Thailand.
13.3.2018	Viet Nam	Offer	<i>G. huuliensis</i>	30 \$ each	private	Facebook	20 animals are available for sale from April to August

09.2016	Viet Nam	Offer	<i>G. huuliensis</i>	20 \$ each	private	Facebook	one male and two females were collected in nature
06.4.2018	?	Demand	<i>G. huuliensis</i>	150 \$ each 400\$ pair	private	Facebook	150\$ for alone male; 400\$ for pair
12.3.2018	Viet Nam	Offer	<i>G. luyi</i>	20 \$ to 120 \$ each	shop	Pet shop in Bien Hoa, Dong Nai Province	40 specimens have been offered from local hunters in Cao Bang Province from April to August and smuggled to Thailand
14.3.2018	Viet Nam	Offer	<i>G. luyi</i>	20 \$ to 25 \$ each	shop	Pet shop in Ho Chi Minh city	Available specimens are observed on a Youtube guide for breeding, as well as on Facebook
12.3.2018	Viet Nam	Offer	<i>G. luyi</i>	25 \$ each	private	in Ho Chi Minh city	Animals were bred for sale
09. 2016	Viet Nam	Offer	<i>G. luyi</i>	20 \$ each	private	in Ho Chi Minh city	
10.3.2018	Germany	Offer	<i>G. luyi</i>	90 € pair	private	Reptile fair in Hamm, Germany	
10.3.2018	Germany	Offer	<i>G. luyi</i>	40-60 €?	private	Reptile fair in Hamm, Germany	
10.3.2018	France	Demand	<i>G. luyi</i>	60 € each	private	www.terrarium.com	
March 2018		Offer	<i>G. luyi</i>	79.99 \$	Internet Shop	sales@backwaterreptiles.com	Currently out of stock
March 2018		Offer	<i>G. lichtenfelderi</i>	"Your price"	Internet Shop	Reptile Rapture	Currently out of stock
March 2018		Offer	<i>G. luyi</i>	89.99 \$	Internet Shop	Reptiles-N-Critters.com	In stock
September 2017 to March /2018	Europe	Offer	<i>Goniurosaurus araneus</i>	142 €	Internet shop	Terrarium.com; Enimalia.com; FB Group Rare Reptiles – EUROPE; three FB Terrarium Hamm	56 live specimens were offered for sale on 17 different adverts
September 2017 to March /2018	Europe	Offer	<i>Goniurosaurus catbaensis</i>	170 €	Internet shop	Terrarium.com; FB Group Terrarium Hamm - Terrarium Börse	29 individuals were offered for sale on eight different adverts
September 2017 to March /2018	Europe	Offer	<i>Goniurosaurus hainanensis</i>	35 € to 140 €	Internet shop	Terrarium.com; Enimalia.com; two FB Group Reptiles – EUROPE; three FBs Terrarium Hamm	162 individuals were offered for sale on 42 different adverts
September 2017 to	Europe	Offer	<i>Goniurosaurus huuliensis</i>	?	Internet shop	Terrarium.com; one FB Group Reptiles –	41 individuals were offered for sale on 8 different adverts

March /2018						EUROPE; two FBs Terraristika Hamm	
September 2017 to March /2018	Europe	Offer	<i>Goniurosaurus lichtenfelderi</i>	?	Internet shop	Terraristik.com; Enimalia.com two FB Group Reptiles – EUROPE; two FBs Terraristika Hamm	97 individuals were offered for sale on 23 different adverts
September 2017 to March /2018	Europe	Offer	<i>Goniurosaurus luii</i>	35 € to 142 €	Internet shop	Terraristik.com; three FBs Terraristika Hamm; eBay	150 individuals were offered for sale on 22 different adverts
06.04.2016	Viet Nam	Offer	<i>G. luii</i>		Facebook	Reptile World	
06.04.2016			<i>Goniurosaurus</i> spp.		Facebook	Golconda Imp & Exp Trading co	
			<i>G. luii</i> , <i>G. catbaensis</i> , <i>G. lichtenfelderi</i> , <i>G. araneus</i> , <i>G. hainanensis</i> , <i>G. huuliensis</i>		Internet shop	www.supremegecko.com	
November, 2018	China	Offer	<i>G. Yingdeensis</i>	116 to 127€	Internet shop	Taobao	Claimed juvenile and CB
November, 2018	China	Offer	<i>G. liboensis</i>	129 to 190€	Internet shop	Taobao	One case shows 4 records of successful transection; one case claimed CB juvenile
November, 2018	China	Offer	<i>G. hainanensis</i>	13€	Internet shop	Taobao	
November, 2018	China	Offer	<i>G. bawanglingensis</i>	114€	Internet shop	Taobao	Claimed CB
November, 2018	China	Offer	<i>G. luii</i>	50	Internet shop	Taobao	Claimed CB juvenile

Table 2: Impacts on *Goniurosaurus catbaensis* at different sites. Obtained from Ngo et al. in prep.

Study sites	Population size (Mean)	Harvest	Tourist activities	Habitat degradation	Total impacts
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Sites near the headquarters of Cat Ba National Park (NP) - Ngo et al. 2016	5	Medium	High	Medium	Medium
Viet Hai Commune – Cat Ba NP – Ngo et al. 2016	10	Medium	Medium	Low	Medium
One site in Viet Hai Commune- Cat Ba NP Ngo et al. in press	0	-	-	High	High
Ha Long Bay (4 islands) – Ngo et al. n press	51	Not recorded	Not recorded	Low	Low
Ha Long Bay's Caves (4 caves) - Ngo et al. n press	2 (total animals)	Not recorded	High	Medium	Medium



Figure 2. *G. catbaensis* offered for 200€ /individual or 300€/ pair on the reptile fair in Hamm in March 2018. The habitat type was falsely described to be “desert”.

Figure 4. Examples of internet shops regularly offering *Goniurosaurus* spp.

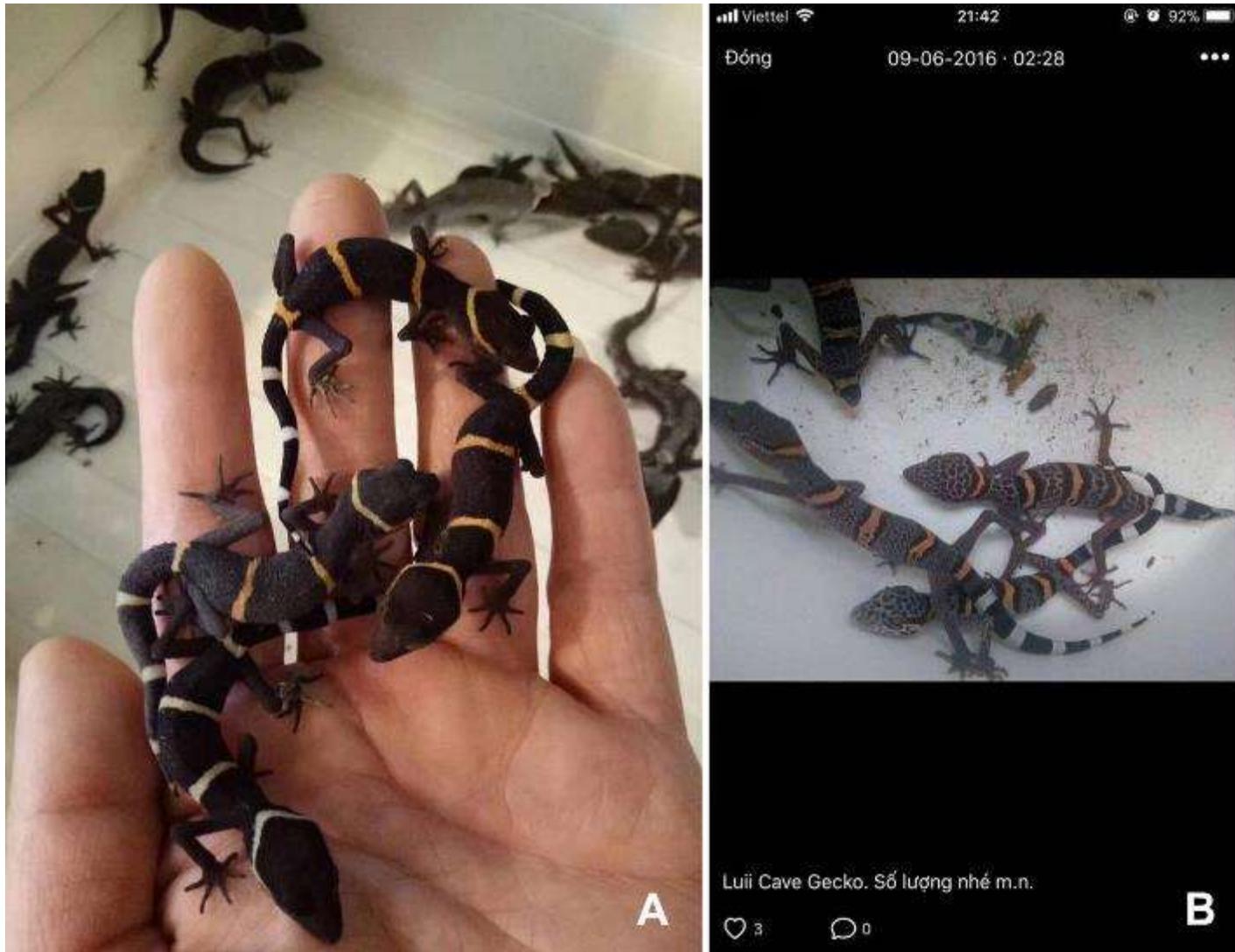


Figure 5: Examples of illegal trade within the genus *Goniurosaurus* in Viet Nam: A. *G. lichtenfelderi* animals hatched in captivity (from parents that mated in the wild) found on the internet; B. *G. luii* specimens that were collected in the wild for sale on Zalo online.



Hướng dẫn nuôi thạch sùng mí - nữ hoàng thằn lằn Việt Nam - part 2

11,405 lượt xem

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VietNamTurtle Keeper

Xuất bản 28 thg 8, 2016

DĂNG KÝ 27 N

Video clip quay lại cảnh thạch sùng mí kiểm ăn vào ban đêm :) các thức ăn - hình dáng con bố mẹ khi trưởng thành :)

[HIỂN THỊ THÊM](#)

Figure 6. Video guides how to keep *Goniurosaurus* spp. on Youtube

luii? kadoorieorum?



Figure 7: An example of the confusion of a private dealer in the identification between *G. luii* and *G. kadoorieorum*. Source: Facebook.

Annex IV

Conservation

Chung tay bảo vệ loài
Thạch sùng mí cát bà ở Vịnh Hạ Long
Protection of the Cat Ba Tiger Gecko in Ha Long Bay

Tên khoa học:
Goniurosaurus catbaensis ZIEGLER, NGUYEN, SCHMITZ, STENKE, RÖSLER, 2008
Được mô tả năm 2008
Hiện chỉ ghi nhận tại đảo Cát Bà và Vịnh Hạ Long

Hãy chung tay bảo vệ loài Thạch sùng mí cát bà
Bảo tồn sinh cảnh sống:
- Hãy bảo vệ rừng tại Vịnh Hạ Long
- Hãy bỏ rác vào thùng, không tô vẽ, phá hủy hang động
Không săn bắt Thạch sùng mí và các loài động vật hoang dã

Scientific name:
Goniurosaurus catbaensis ZIEGLER, NGUYEN, SCHMITZ, STENKE, RÖSLER, 2008
A recently discovered species in 2008
Currently known only from Cat Ba Island and Ha Long Bay

Together we protect the Cat Ba Tiger Gecko
Habitat protection:
- Protect forest of Ha Long Bay
- Put the garbage into wastebasket, do not paint, destroy caves and limestone cliffs
Don't collect the Tiger Gecko and other wildlife species

JGBO
KÖLNER ZOO
VNMI
WAZA

Figure 1. Signboard handed over to the Ha Long Bay Management Department to point to the threats and conservation of the Cat Ba Tiger Gecko in English and Vietnamese languages.