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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

To list the species of the genus *Tylototriton* in Appendix II of CITES in accordance with Resolution Conf. 9.24 (Rev. CoP17). The regulation of trade within this genus is required in accordance with:

Annex 2 a:

- criterion A, on the grounds that trade in the species *T. asperrimus*, *T. hainanensis*, *T. himalayanus*, *T. kweichowensis*, *T. ngarsuensis*, *T. panhai*, *T. shanjing*, *T. shanorum*, *T. taliangensis*, *T. verrucosus*, *T. vietnamensis*, *T. wenxianensis, T. yangi* and *T. ziegleri* must be regulated to prevent them to become eligible for listing in Appendix I in the near future;
- criterion B to ensure that the harvest of wild individuals of the species *T. anguliceps*, *T. notialis* and *T. podichthys* is not reducing the wild population to a level at which their survival might be threatened;

Annex 2 b:

- criterion A, since individuals of the species *T. anguliceps*, *T. asperrimus*, *T. hainanensis*, *T. himalayanus*, *T. kweichowensis*, *T. ngarsuensis, T. notialis*, *T. panhai*, *T. podichthys*, *T. shanjing*, *T. shanorum*, *T. taliangensis*, *T. verrucosus*, *T. vietnamensis*, *T. wenxianensis*, *T. yangi* and *T. ziegleri* are commercially exploited and eligible to be listed in Appendix II and resemble those species of the remaining genus *Tylototriton* (namely: *T. anhuiensis*, *T. broadoridgus*, *T. dabienicus*, *T. liuyangensis*, *T. lizhenchangi*, *T. pseudoverrucosus*, *T. pulcherrimus* and *T. uyenoi*) and it is unlikely that government officers responsible for trade monitoring will be able to distinguish between them.

B. Proponent

China, European Union, Socialist Republic of Viet Nam

C. Supporting statement

1. Taxonomy

1.1 Class: Amphibia

1.2 Order: Caudata

1.3 Family: *Salamandridae*

1.4 Genus: *Tylototriton* Anderson, 1871.

Tylototriton is a primitive lineage within the family Salamandridae, whose fossil record probably dates back to the middle Eocene (Mertz et al. 2000, Milner 2000). Estes (1981) assumed that primitive *Tylototriton* dispersed to eastern Asia with the loss of tropical climate in Europe; suggesting a vast pre-historical range (Hernandez 2016). Presently, *Tylototriton* comprises 25 recognized species. It is the most species rich genus within Salamandridae (Qian et al. 2017). The genus is phylogenetically divided into two subgenera, *Tylototriton* and *Yaotriton* (Dubois and Raffaëlli 2009), or two groups, the *T. verrucosus* (*Tylototriton*) group and the *T. asperrimus (Yaotriton)* group (Fei et al. 2005), respectively. The subgenus *Tylototriton* consists of: *T. anguliceps*, *T. himalayanus*, *T. kweichowensis*, *T. ngarsuensis, T. podichthys*, *T. pseudoverrucosus*, *T. shanjing*, *T. shanorum*, *T. taliangensis*, *T. uyenoi*, *T. verrucosus*, *T. pulcherrimus*, and *T. yangi;* and the subgenus *Yaotriton* consists of: *T. anhuiensis*, *T. asperrimus*, *T. broadoridgus*, *T. dabienicus*, *T. hainanensis*, *T. liuyangensis*, *T. lizhenchangi*, *T. notialis*, *T. panhai*, *T. vietnamensis*, *T. wenxianensis*, and *T. ziegleri* (Khatiwada et al. 2015, Phimmachak et al. 2015a, Frost 2018, Qian et al. 2017, Grismer et al. 2018).

1.5 Species:

1.5.1. Species endemic to People's Republic of China (Hernandez 2016, Qian et al. 2017):

T. anhuiensis Qian, Sun, Li, Guo, Pan, Kang, Wang, Jiang, Wu and Zhang, 2017; *T. broadoridgus* Shen, Jiang and Mo, 2012; *T. dabienicus* Chen, Wang and Tao, 2010; *T. hainanensis* Fei, Ye and Yang, 1984; *T. kweichowensis* Fang and Chang, 1932; *T. liuyangensis* Yang, Jiang, Shen and Fei, 2014; *T. lizhenchangi* Hou, Zhang, Jiang, Li and Lu, 2012; *T. pseudoverrucosus* Hou, Gu, Zhang, Zeng, Li and Lü, 2012; *T. pulcherrimus* Hou, Zhang, Li, and Lu, 2012; *T. shanjing* Nussbaum, Brodie and Yang, 1995; *T. taliangensis* Liu, 1950; *T. verrucosus* Anderson, 1871; *T. wenxianensis* Fei, Ye and Yang, 1984; *T. yangi* Hou, Zhang, Zhou, Li, and Lu, 2012.

1.5.2. Species endemic to the Socialist Republic of Viet Nam (Nishikawa et al. 2013b, Bernardes et al. 2017a)*:*

T. vietnamensis Böhme, Schöttler, Nguyen and Köhler, 2005; *T. ziegleri* Nishikawa, Matsui and Nguyen, 2013.

1.5.3. Species known from both China and Viet Nam (Hernandez 2016):

T. asperrimus Unterstein, 1930.

1.5.4. Species endemic to the Lao People's Democratic Republic (Phimmachak et al. 2015a):

T. podichthys Phimmachak, Aowphol, and Stuart, 2015.

1.5.5. Species known from both Viet Nam and Laos (Stuart et al. 2010, Nishikawa et al. 2013a):

T. notialis Stuart, Phimmachak, Sivongxay and Robichaud, 2010.

1.5.6. Species endemic to the Kingdom of Thailand (Nishikawa et al. 2013a):

T. uyenoi Nishikawa, Khonsue, Pomchote and Matsui, 2013.

1.5.7. Species known from Viet Nam, Laos and Thailand (Le et al. 2015, Phimmachak et al. 2015a):

T. anguliceps Le, Nguyen, Nishikawa, Nguyen, Pham, Matsui, Bernardes and Nguyen, 2015.

1.5.8. Species known from both Laos and Thailand (Phimmachak et al. 2015a):

T. panhai Nishikawa, Khonsue, Pomchote and Matsui, 2013.

1.5.9. Species endemic to the Republic of the Union of Myanmar (Nishikawa et al. 2014, Grismer et al. 2018)*:*

T. shanorum Nishikawa, Matsui and Rao, 2014; *T. ngarsuensis* Grismer, Wood, Quah, Thura, Espinoza, Grismer, Murdoch and Lin, 2018.

1.5.10. Species known from both the Federal Democratic Republic of Nepal and the Republic of India (Khatiwada et al. 2015):

T. himalayanus Khatiwada, Wang, Ghimire, Vasudevan, Paudel and Jiang, 2015.

1.5.11. Species known from Kingdom of Bhutan (Palden 2003, Wangyal and Gurung 2012, Khatiwada et al. 2015).

T. cf. *himalayanus*: named nationally as *T. verrucosus* and covered by National Protection Laws, however genetic studies are still not available. Given the high cryptic diversity uncovered inside the historical *T. verrucosus* (currently only considered to exist in West Yunnan Province, China), and the description of *T. himalayanus* in 2015 from the vicinities, it is more likely that this species refers to *T. himalayanus* instead.

1.6 Scientific synonyms: *T. pulcherrima* (identified or not as a sub-species of *T. verrucosus*) presents an error in the gender of the species name (Frost 2018). Herein the synonym *T. pulcherrimus* is used instead, following Fei et al. (2012) and Hernandez (2016).

T. taliangensis was elevated to its own genus, *Liangshantriton*, by Fei et al. (2012), but Raffaëlli (2013), Hernandez (2016) and Frost (2018) support permanence within *Tylototriton*.

T. daweishanensis is a synonym for *T. yangi* (Nishikawa et al. 2015).

1.7 Common names: English: Crocodile Newts, Knobby Newts.
Chinese: 疣螈 yóu yuán
Vietnamese: Cá cóc sần
French: Triton crocodile
German: Krokodilmolch

1.8 Code numbers: N/A

2. Overview

This proposal is to list the genus *Tylototriton* (Crocodile Newts), which has a restricted distribution range in the countries of China, Viet Nam, Laos, Thailand, Myanmar, India, Nepal and Bhutan in Appendix II of the Convention. The genus *Tylototriton,* which belongs to the family Salamadridae, is currently represented by 25 species, from which 20 are endemic species (Sparreboom 2014, Hernandez 2016, Qian et al. 2017, Grismer et al. 2018) (Annex II). The high rate of species discoveries within the genus has increased the number of known species from 8 to 24 since 2010 (a threefold increase).

Crocodile newts can be found in mountain ranges in tropical and subtropical dry and moist broadleaf forests and temperate broadleaf forests from 181 to 2,679 m elevation. Individuals usually accumulate in lentic habitats that are created during the monsoon season, for reproduction and the development of aquatic larvae. Sexual maturation is reached between 3 and 5 years. Outside of the breeding season, adults and juveniles are mostly terrestrial and fossorial, living in the near vicinity of their aquatic breeding sites. Clutches usually consist of less than 100 eggs.

The genus *Tylototriton* mainly comprises small ranged species that consist of few and small populations. Habitats are fragmented and steadily shrinking. Declines have been observed in the extent and quality of habitats, as well as in the number of individuals (IUCN 2018). Besides habitat loss, species are harvested from the wild as food source, for use in traditional medicine and to supply the international pet trade. The usually predictable high concentration of individuals in small breeding sites during the reproductive season makes most *Tylototriton* species especially vulnerable to over-harvesting at known localities. At least 12 species are recorded on species level in the international trade and are mainly exported to the European, North American, and Japanese markets, even though many species are protected in their native countries (Nishikawa et al. 2013b). There are many references of various species in China (e.g. *T. asperrimus* in Guangdong, *T. shanjing*, *T. yangi*) being collected in large numbers during the breeding season and sold for the pet trade via Hong Kong SAR (Hernandez 2016Rare or only recently described species can be bought for large sums of money, making it a very lucrative business (Rowley et al. 2010). The lucrative demand of the international trade may drive to local extirpations of salamandrid populations, for example, *T. yangi* was for sale in the international pet trade only one year after its description; *T. himalayanus* and *T. shanorum* were being commercialized 3 to 5 decades before their description as new species. This trade may be even of greater concern given emerging molecular data suggesting that currently widespread species of Asian salamanders represent complexes of more range-restricted species (Weisrock et al. 2006, Rowley et al. 2010). Most *Tylototriton* species look alike and are considered morphological complexes, like *T. verrucosus*, *T. shanjing* and *T. asperrimus* masking together at least nine known other species (Annex III, Fig. 1). The identifications within the genus are difficult or even impossible for a non-specialist (Rowley et al. 2016, Rowley and Stuart 2014) and exact locality information of many imported animals is often unknown. Many species likely have been, and continue to be, traded under an incorrect name, erroneously or deliberately (Rowley et al. 2016) and individuals traded in dry condition for medicine reasons are beyond recognition at species level (Rowley and Stuart 2014).

Currently, only half of the species have been evaluated by the IUCN (IUCN 2018), thereof 10 in the categories from NT to EN. Even though many species are protected in their native countries, the range of *Tylototriton* includes eight countries with different management priorities and adequate enforcement measures are often lacking (Rowley et al. 2010) (see Annex I, Table 1 for an overview of the relevant factors affecting the different species). As *Tylototriton* is internationally not protected, international trade in the species occurs rather unnoticed, until reports from large caliper seizures. The inclusion in CITES Appendix II might reduce harvesting, which will have effects not only on wild populations, but will also serve as a preventive measure to safeguard Paleartic and Neartic salamanders from pathogen transfer in their native ranges. Asian salamanders and in particular *Tylototriton* species are hosts to *Bd* and *Bsal*, two fungi species, lethal to a range of other amphibians.

Considering the significant trade in *Tylototriton* and the difficulties in identifying individual species it has been already recommended by several researches (Rowley and Stuart 2014, Rowley et al. 2016, F. Pasmans pers. com.) that *Tylototriton* should be listed in the Appendices of CITES at the genus level.

3. Species characteristics

3.1 Distribution

The genus is distributed in mountain ranges from eastern Himalaya, through Indochina, to southern and central China, including: Nepal, India, Bhutan, Myanmar, Thailand, Laos, Viet Nam and China at elevations from 181 to 2,679 m above sea level (asl.) (Nishikawa et al. 2014, Sparreboom 2014).

For specific species distributions see Annex II.

3.2 Habitat

Tylototriton species inhabit forests in mountain regions within the tropical and subtropical dry and moist broadleaf forests of Indochina and South China, up to the temperate broadleaf forest of the Eastern

Himalayas, and the temperate broadleaf mixed forests (Central China). These forests need to have a high amount of annual precipitation during the summer monsoon, to support water bodies with a long hydroperiod to sustain the development of aquatic larvae (Bernardes et al. 2013, Bernardes et al. 2017a).Adults return to the breeding site from where they originated, probably due to habitat predictability (Bernardes et al. 2013), supporting the theory that these species are philopatric and poor dispersers. It is likely that most adults stay in the near vicinity of their breeding site even outside of the reproductive season (Seglie et al. 2010, Sun et al. 2011). *Tylototriton* species change habitat during the year, from a terrestrial habitat during the dry season to an aquatic to semi-aquatic habitat during the wet season (Phimmachak et al. 2015b), as well as during their life stages from exclusively aquatic larvae to full terrestrial adults during the dry season.

Most species can only be found in undisturbed habitat, although there is evidence of some species occurring in the vicinity of human settlements, like *T. verrucosus*, *T. shanjing*, *T. yangi*, *T. kweichowensis* (Hernandez 2016), or even using artificial aquatic habitats, like *T. uyenoi* (Nishikawa et al. 2013a).

3.3 Biological characteristics

The genus shows high site fidelity and poor migration abilities (Seglie et al. 2010, Sun et al. 2011 Bernardes et al. 2013). Adults are mostly terrestrial to semi-fossorial year round, except for the breeding season, when large numbers accumulate at aquatic breeding sites (Khatiwada et al. 2015, Hernandez 2016). Some species however show semi-aquatic, e.g. *T. uyenoi* (Nishikawa et al. 2013a), *T. himalayanus* (Seglie et al. 2003) to aquatic behavior, e.g. *T. shanorum* (Hernandez 2016).

The breeding season generally starts around April-May and continues throughout the rainy season, until July (Seglie et al. 2010, Nishikawa et al. 2013a, Bernardes et al. 2017b). Depending on the species, gravid females lay either small aquatic or large terrestrial eggs nearby the water. Clutches usually consist of less than 100 eggs (*T. ziegleri*: 67 ± 32 eggs, *T. vietnamensis*: 43 ± 19 eggs (Bernardes et al. 2017b), *T. himalayanus*: 26 – 60 eggs (Kuzmin et al. 1994, Shrestha 1989), *T. asperrimus*: 30 – 52 eggs, *T. wenxianensis*: 56 – 81 eggs,*T. hainanensis*: 58 - 90 eggs (Sparreboom 2014). The high egg count reported for *T. taliangensis* with clutches of 250 – 280 eggs and *T. kweichowensis* with 120 – 140 eggs (Sparreboom 2014) are either exceptionally large and / or may represent an erroneous count consisting of multiple clutches occurring fairly together. Due to a number of reasons (e.g. unfertilization, development of mycosis, unexpected dry/hot climacteric conditions, predation, etc.) not all eggs will develop into viable larvae, and a mortality rate of 50 to 90 % can be expected (Ziegler et al. 2008). Tian *et al.* (1998) reported a hatching rate of 44 % for *T. kweichowensis*.

Studies on a population of *T. himalayanus* from India found that sexual maturity is reached between 3 and 5 years(Kuzmin et al.1994), while Seglie et al. (2010) discovered that females reach sexual maturity later than males, at 3.2 and 2.5 years, respectively (N= 38 females and 50 males). *T. panhai* in Thailand reaches sexual maturity at around 4 year in both sexes (N= 2 females and 12 males) (Khonsue et al. 2010).

3.4 Morphological characteristics

Most newly described species have been differentiated on the basis of mitochondrial DNA sequence divergence, coloration in life, or size and morphometric differences, often by means of high technology e.g. X-ray microtomography of the skull morphology (Stuart et al. 2010, Nishikawa et al. 2013a,b, Nishikawa et al. 2014, Le et al. 2015, Phimmachak et al. 2015a). There is a high morphological conservatism within the genus (Stuart et al. 2010, Nishikawa et al. 2013b), making *Tylototriton* known for its cryptic diversity (Annex III, Fig. 1). To aggravate the identification of *Tylototriton* species, there is an additional great morphological variation also within individuals of the same population (M. Bernardes pers. com.; Annex III, Fig. 2).

The genus *Tylototriton* is characterized by the following combination of characters: medium-sized newts with total lengths from 16 to 23 cm (Hernandez 2016), rough skin covered with fine warts, dorsolateral bony ridges on head, vertebral ridge distinct, knob-like rib nodules, limbs long and thin, tail thin (Nishikawa et al. 2013a, Le et al. 2015) and absence of sharp-tipped ribs that penetrate the skin (Nussbaum and Brodie 1982). Sexual dimorphism is poorly expressed in this genus.

For specific morphologic characteristics of single species see Annex III.

3.5 Role of the species in its ecosystem

Tylototriton species are opportunistic predators. Adults feed on aquatic to terrestrial arthropods, mollusks, annelids, amphibian tadpoles and even own larvae (Kuzmin et al. 1994, Dasgupta 1996, Anders et al. 1998, Ferrer and Zimmer 2007). The larvae are carnivorous, feeding on microcrustaceans, chironomids, mosquito larvae and small benthic prey (Dasgupta 1983).

4. Status and trends

4.1 Habitat trends

Without exception, decreasing habitats were reported for all species that have been assessed by the IUCN Red List. Due to the strong habitat affinity and low dispersal capacities of *Tylototriton* spp. (Seglie et al. 2010, Sun et al. 2011, Hernandez 2016) habitat loss and degradation around their breeding sites are particularly detrimental to populations (Nishikawa et al. 2013b).

Anthropogenic activities negatively affecting the habitats of *Tylototriton* are related to direct forest destruction (e.g. conversion of land for agricultural practices, substitution for more profitable vegetation like for example for the paper industry, animal husbandry, logging, mining, slash and burn activities) or indirectly through habitat modification (e.g. pollution from agrochemicals, increased tourism). Seglie et al. (2003) found that more than 40 % of the breeding sites of *T. himalayanus* in West Bengal were destroyed in a period of four years, and converted to agricultural land.

Most species are only known from a few localities. As an aggravation only a few occurrences are included within protected areas, increasing their probability of further degradation. For example *T. ziegleri* is a small-ranged species (Nishikawa et al. 2013b), known only from four localities in the North of Vietnam, none of them situated within protected areas (Bernardes et al. 2017b). In Tay Yen Tu Nature Reserve, North Viet Nam, habitats of *T. vietnamensis* undergo substantial degradation due to coal mining exploration (Bernardes et al. 2017a). Additionally this region is an important religious touristic site that experienced a high development in the last years, related with infrastructure development (e.g. cable cars, roads) associated with forest destruction and fragmentation that led to an easier access to breeding ponds (M. Bernardes pers. com.).

4.2 Population size

Since *Tylototriton* is usually secretive and hard to sample outside of the breeding season, most available studies were performed during the reproductive season, when sexual mature individuals gather at breading sites. Population assessments revealed generally small population sizes in investigated species. *T.* cf. *asperrimus* has been found in 18 of 103 plots accounting for a total of 68 individuals in Houhe National Nature Reserve, China (Sun et al. 2011). For *T. himalayanus* a population density of 18 to 101 (average = 47) individuals per 100 m^2 and a size of 250 individuals was estimated in Darjeeling district, India (Seglie et al. 2003). A total of 80 adult *T.* cf. *himalayanus* were collected from three different districts (Toebisa, Kabjisa, Kazh) in Bhutan (Wanggyal and Gurung 2012). *T. panhai* was found to be rare in Phitsanulok Province, Thailand (Konsue et al. 2010). For *T. podichthys* Phimmachak et al. (2015b) found maximum estimated densities of 8.75 newts/ 100 m^2 of suitable stream and estimated a total of 301 individuals in Kham district, Xiengkhouang Province, Laos. Bernardes et al. (2017a) recorded *T. vietnamensis* in 18 of 29 potential breeding sites in Bac Giang and Quang Ninh provinces, Viet Nam.

During 54 survey occasions at these locations 216 to 24 adults were respectively discovered. Several field surveys on *T. ziegleri* found only small number of encountered adults per breeding site during the breeding season (M. Bernardes pers. com.).

4.3 Population structure

Information regarding the sex ratio generally depends on the time of the year the sampling is made. With the exception of *T. podichthys*, which did not seem to differ significantly throughout the year (Phimmachak et al. 2015b); in *T. shanjing* more males were found in the beginning and at the end of the breeding season, and more females in the middle of the season (Phimmachak et al. 2015b); in *T.* cf. *himalayanus* the number of males exceeded the number of females in two populations and it was balanced on the third (Wangyal and Gurung 2012); *T. vietnamensis* showed a highly biased male skewed sex-ratio during the breeding season (M. Bernardes pers. com.).

Age assessments in *Tylototriton* found that during the breeding season in *T. himalayanus* the age of females (N= 38) ranged from 5 to 9 years, while the age of males (N= 50) ranged from 2 to 7 years (Seglie et al. 2010b). Kuzmin *et al.* (1994) found that most frequent age class was 5 years old (N= 28). Khonsue et al. (2010) found a lifespan of 4 to 8 years in males and 4 to 6 years in females in *T. panhai*).

4.4 Population trends

As most *Tylototriton* species have small distributions, existing habitats are experiencing declines and this genus is commonly harvested for medicine or the trade, it can be expected that the extent species are, or will be experiencing population declines.

For 11 of the 13 species which are assessed by the IUCN Red List a population decline is reported, while the population trend was classified unknown for the remaining two species *T. notialis* and *T. verrucosus*. The *T. verrucosus* species complex seems to have been extirpated from the area of Doi Phu Kha, Nan Province, Thailand where it had been previously reported (Chuaynkern and Duengkae, 2014), and from some parts in Northern Viet Nam (Nguyen et al. 2009, van Dijk et al. 2009). For *T. himalayanus*, which is not assessed by IUCN, a reduction of more than 40 % in the number of populations since the last four years was recorded by Seglie et al. (2003).

4.5 Geographic trends

The extent and quality of natural habitats in Southeast Asia and China are declining and represent a major threat to biodiversity (Achard et al. 2002, Sodhi et al. 2004, Yiming and Wilcove 2005, Sodhi et al. 2009). Most causes are related to infrastructure development and the rapid expansion of agricultural land (Sodhi et al. 2009), but also logging has a major impact and has enormously increased in China alone over the last half century (Yiming and Wilcove 2005). In Viet Nam, for example the extent of primary forest has decreased by about 79% during the last 20 years alone (FAO 2010). Since range countries are experiencing economic and demographic growth, it is predictable that the pressure on natural ecosystems will continue to increase.

5. Threats

13 *Tylototriton* species have been assessed by the IUCN Red List so far, 10 of them were in the categories from NT to EN (for details see table 1). The IUCN assessment of *T. vietnamensis* has recently been increased from Near Threatened to Endangered (IUCN SSC ASG 2016a). Main threats to *Tylototriton* are related with habitat loss and degradation especially around the breeding habitats (Nishikawa et al. 2013b), as these species show philopatry and limited mobility. Among the major causes for habitat loss are 1) changes in land use like increasing land for agriculture, mining and farm land; 2) exploitation of natural reserves; 3) increased development; 4) re-forestation based on more profitable cultures; 5) introduction of exotic species (like carp farming practices) in ponds that would otherwise be suitable breeding sites; 6) pollution; and 7) climate change and severe weather, e.g. droughts (Kuzmin et al. 1994, Seglie et al. 2003, Datong et al. 2004, Liang and Changyuan 2004, Haitao and Chan 2008, van

Dijk et al. 2009, Bernardes et al. 2013, van Schingen 2014, Phimmachak et al. 2015b, Hernandez 2016, IUCN 2018).

Another leading threat to *Tylototriton* is over-harvesting for food, traditional medicine, the international pet trade and the use as baits for fishing (Stuart et al. 2004, Rowley et al. 2010, Sparreboom 2014). Specimens are even persecuted and killed for being associated with bad omen (IUCN SSC ASG 2017a). The natural history of *Tylototriton* species makes the genus highly vulnerable to harvesting, as adults may be easily found concentrated in breeding sites. Diseases are also identified threats to *Tylototriton*, for example, it has been demonstrated under laboratorial conditions that Chytridiomycosis caused both by *Batrachochytrium dendobatidis* (*Bd*) and *B. salamandrivorans* (*Bsal*) cause juvenile mortality in "Vietnamese salamanders" (Laking et al. 2017), and that *T. wenxianensis* seemed to be highly vulnerable (Martel et al. 2014). Furthermore, there are reports of imported specimens to include parasites, bacteria and fungi infections (Raffaëlli 2013, Pasmans et al. 2014), or even ranavirus infections, which affected a large number of imported wild-caught specimens (Pasmans et al. 2008, 2014).

The understanding of species composition and distribution within the genus has changed dramatically in recent years, due to high discovery rates and recognition of cryptic diversity. Therefore threat levels are still expected to be underestimated since some taxa that were previously considered to be widely distributed (e.g. *T. verrucosus* and *T. asperrimus*) are now known to enclose other related species with significantly smaller ranges and fewer populations.

6. Utilization and trade

6.1 National utilization

In the native range of *Tylototriton* spp*.,* animals are harvested from the wild in large numbers during the breeding season to be used either as food source, in traditional medicine, or as pets (Wongratana 1984, Rowley et al. 2010, Das and Dutta 2014, Sparreboom 2014, Hernandez 2016, Rowley et al. 2016, Wang et al. 2017,). Evidence of use for medicine purposes was found locally in *T. kweichowensis*, *T. yangi*, *T. panhai*, *T. shanorum;* both locally and nationally in *T asperrimus*, *T. taliangensis*, *T. verrucosus* and *T. shanjing* and nationally in *T. notialis. T. podichthys* and *T. ziegleri* are also used for medicine purpose (Wongratana 1984, Hernandez 2016, Wang et al. 2017, IUCN 2018,). Collection of *Tylototriton* spp. for the pet trade is reported from Viet Nam, China and Thailand, referring to at least: *T. vietnamensis*, *T. ziegleri*, *T. shanjing* and *T. verrucosus* (Phimmachak et al. 2015b, IUCN 2018). Newts of the genus *Tylototriton* can be found on stock for sale in pet shops in the urban areas of Viet Nam, often far away from natural habitats (Rowley et al. 2016). *T. vietnamensis* was found on sale at Mount Yen Tu pagoda for tourists (Bernardes et al. 2017a).

6.2 Legal trade

The international trade in *Tylototriton* spp. is documented from 1960's throughout the 1980's, when large numbers were exported to Europe. At that time only about four species were known and *T. verrucosus* (from Myanmar, India and relatives, now *T. shanorum* and *T. himalayanus*) were the most frequently exported species. The high availability of animals back then led to their introduction in many medical and laboratory experiments (e.g. Ferrier and Beetschen 1973, Hernandez 2016). *T. kweichowensis* was imported in large amounts into Europe between 1990 and 1995, but only few keepers have managed to keep the species (Hernandez 2016).

Currently trade in Asian newts as pets is happening on a global scale, with a thriving market throughout Europe, Asia and the Americas (Rowley et al. 2016). Main importers in Europe are Germany, Austria, Netherlands, United Kingdom, Poland, Italy, Spain and France; but Asia (Hong Kong SAR, Japan, Malaysia, Viet Nam), and also the USA, and Canada, are also involved in the trade (Rowley et al. 2016). The problem of the unaccounted trade includes the unregulated and unrecorded wildlife trade worldwide, the often illegal trade, and the animals that perish before reaching final destination, making it very difficult

to reach “real numbers" (Rowley et al. 2016). Therefore the high probability of underestimations reported for the legal trade (Sodhi et al. 2004).

According to the CITES trade database (UNEP-WCMC 2015), which give only a mere fraction of the total trade, 1,737 animals traded between 2010 and 2015, including *T. kweichowensis* (49 %), *T. asperrimus* (33 %), *T. verrucosus* (17 %) and *T. vietnamensis* (1 %). Most animals were traded for commercial purpose (96 %) and had unknown origin (81 %), while only 19 % were labeled wild caught. China accounts as the major exporter with 72 % of the total exportations recorded for this genus, followed by Hong Kong SAR with 27 %. Germany is the major import destination with 82 % of the recorded trade. Viet Nam, Japan and Republic of Korea were also listed as exporters or "crossing points" and Spain, Czech Republic and China as importers. According to the LEMIS Database of the U.S. Fish and Wildlife Service, imports to the USA, added up to a total of 35,237 individuals of *Tylototriton* spp. between 1999 and 2017, from which 76 % were wild caught, while the majority of trafficked animals (99 %) were live specimens for trade purposes. The most frequently traded species was *T. verrucosus* (71 %), followed by *Tylototriton* spp. (15 %) and *T kweichowensis* (11 %), and in smaller amounts *T. shanjing*, *T. taliangensis* and *T. asperrimus*.

Rowley et al. (2016) also reported wild caught specimens of e.g., *T. asperrimus* and *T. shanjing* for sale in the US and *T. yangi* for sale in Europe (Italy), thus species for which there aren’t any trade data available, proving until then undetected trade.

For more detailed information on this issue see Annex IV and the associated figures.

6.3 Parts and derivatives in trade

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

6.4 Illegal trade

The illegal trade is considered a major threat to this genus (Rowley et al. 2010, Phimmachak et al. 2012). Scientific publications are currently advising authors to avoid revealing exact locality data of Asian newts as a way to protect them from withdrawal (Hou et al. 2014, Rowley et al. 2016) as the economic profit associated with rare or newly described species is an additional incentive to their trade. Harvesting of *Tylototriton spp.* is not authorized in most range states; however poaching continues to take place (Stuart et al. 2008).

For more detailed information on this issue see Annex IV.

6.5 Actual or potential trade impacts

Among the major concerns regarding the trade of this genus are direct impacts on wild *Tylototriton* populations, as well as the associated potential of pathogen transfer carried by them (Auliya et al. 2016).

The endemic nature in association with the narrow distribution ranges, decreasing habitat’ trends, small and decreasing population size, lack of comprehensive captive breeding programs and lack of appropriate habitat conservation make *Tylototriton* species especially vulnerable to the additional pressure from harvesting for any trade (Stuart 2008, Rowley et al. 2010). The high prices that rare or recently described species can achieve in the international pet trade may enhance the pressure on the more vulnerable populations and may rapidly lead to local extirpation of populations (Rowley et al. 2010). This problem may be of even greater concern given the emerging taxonomical evidence suggesting that currently widespread species of Asian salamandrids represent complexes of more range-restricted and ecologically specialist species (Weisrock et al. 2006).

A mass mortality event reported from imported *T. kweichowensis* seems to have been triggered by severe stresses during capture and transport (Pasmans et al. 2008). *Tylototriton* species are likely sensitive to

displacement and it can be assumed that the number of animals available in the trade is only a small percentage of the initial number that was harvested, particularly if the transit is long or involves many transportation steps.

The salamander chytrid fungus (*Bsal*), which is mostly virulent for salamanders, and has been responsible for causing severe mortality in *Salamandra salamandra* populations in Europe (Martel et al. 2013), is suspected to have entered Europe through the Asian salamander trade (Martel et al. 2014).

For more detailed information on this issue see Annex IV.

7. Legal instruments

7.1 National

People's Republic of China.

In 1988, *T. asperrimus*, *T. kweichowensis*, *T. taliangensis* and *T. verrucosus* were listed as grade II of state-protected species, and their collection, transport, cultivation, and sale requires permission from provincial authorities. At the same time the Law of Wild Animals Protection of the People's Republic of China was announced and prohibits the collection, internal trade, import or export of wild animals considered rare and endangered, and transportation of wildlife between provinces requires a permit (Jiang et al. 2014). 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 *Tylototriton* in China should be considered as cryptic species of the former listed species and are also under protection.

The remaining species occurring in the country appear to be not protected.

Socialist Republic of Viet Nam.

Tylototriton spp. has proposed to be listed in the Governmental Decree as Group II B, which will be enforced in early 2019. Collecting animals from the wild must be permitted by local authorities.

Lao People's Democratic Republic.

No *Tylototriton* species appears to be protected in Lao PDR.

Kingdom of Thailand.

"*T. verrucosus*" is protected from exploitation under the Wild Animal Reservation and Protection Act B.E.2535 (WARPA), last revised in 1992 (Chuaynkern and Duengkae 2014). Currently this species in Thailand is recognized as *T. uyenoi*, *T. panhai* or *T. anguliceps* and it is (at the moment) not clear to which population the Act refers too. Following Hernandez (2016) *T. anguliceps* is protected by Thai conservation laws.

Republic of the Union of Myanmar.

T. shanorum (as *T. verrucosus*) seems to be protected by legislation (Seglie et al. 2010), but the protection status is unclear.

Republic of India.

T. himalayanus (as *T. verrucosus*) is listed under the endangered category of India Wildlife (Protection) Act of 1972, which protects animals against wildlife trafficking.

Federal Democratic Republic of Nepal.

T. himalayanus (as *T. verrucosus*) was listed in 2010 under the Schedule II of the Nepalese government's National Parks and Wildlife Conservation (NPWC) Act of 1974 (Shah 2014).

Bhutan.

T. cf. *himalayanus* (as *T. verrucosus*) is protected by legislation, but the protection status is unclear.

7.2 International

Species of the genus *Tylototriton* have been listed on Annex D of the EU Wildlife Trade Regulations (EC) No 338/97) in 2009. Recently this genus was included in the Decision (EU) 2018/320 of 28 February 2018 on animal health protection measures for intra-Union trade in salamanders and the introduction into the Union of such animals in relation to the fungus *Bsal*. In the U.S., *Tylototriton* spp. has been included in a list of 20 genera of salamanders that are present in the international pet trade and pose a risk of spreading the disease as “injurious wildlife” under the Lacey Act (18 U.S.C. § 42), from 28 January 2016, published by the U.S. Fish and Wildlife Service in order to avoid the introduction of *Bsal* into North America. This precautionary action was intended to restrict the import of *Tylototriton* spp. into the country and restrict interstate transport. However the U.S. Court of Appeals ruled on 7 April 2017, to not restrict interstate transport of listed species.

8. Species management

8.1 Management measures

See sections 8.4 and 8.5.

8.2 Population monitoring

In Viet Nam population monitoring has included a screening for presence of chytrid fungus by VNMN and international colleagues from Gent University (e.g., Thien et al. 2013, Laking et al. 2017). Furthermore, several populations of *T. vietnamensis* and *T. ziegleri* from Bac Giang, Quang Ninh, Ha Giang and Cao Bang provinces have been repeatedly investigated during the reproductive season between 2010 and 2014: monitoring habitats, population trends and threats. Results indicate ongoing habitat degradation and continuous negative pressure on wild populations (M. Bernardes pers. com.).

8.3 Control measures

8.3.1 International

See section 7.2.

8.3.2 Domestic

See section 7.1.

8.4 Captive breeding

Many *Tylototriton* species are reportedly difficult to maintain in captivity (Hernandez 2016). There are reports of successful breeding of: *T. asperrimus*, *T. kweichowensis*, *T. panhai*, *T. pulcherrimus*, *T. shanjing*, *T. taliangensis*, *T. uyenoi*, *T. verrucosus*, *T. vietnamensis*, *T. wenxianensis*, *T. yangi* (Sparreboom 2014, Hernandez 2016, Ziegler pers. com. 2018).

Captive breeding programs are known to be taking place within range countries in: Viet Nam, at the Me Linh Station for Biodiversity for *T. vietnamensis* and *T. ziegleri* (Ziegler 2016); Darjeeling, India, at the Padmaja Naidu Himalayan Zoological Park (PNHZP) for *T. himalayanus,* where recommendations were made for a conservation breeding program that extended to the Himalayan Zoological Park, and Sikkim and Manipur Zoo (Gupta et al. 2015); in Thailand at the Breeding Center Phu Ping Palace Ratchaniwet in Doi Suthep in Chiang Mai Province for *T. uyenoi* (Hernandez 2016).

According to ZIMS (Zoological Information Management System of Species360) a total of 53 institutions (30 in Europe, 21 in the U.S. and 2 in Asia) are keeping a total of 370 *Tylototriton* specimens (224

specimens in Europe, 126 specimens in the U.S. and 20 specimens in Asia); from 6 species (N= 10 *T. kweichowensis*, N= 135 *T. shanjing*, N= 1 *T. taliangensis*, N= 125 *T. verrucosus*, N= 2 *T. vietnamensis* and N= 1 *T. ziegleri*). There is evidence of 18 additional institutions keeping *Tylototriton* spp. (including also *T. asperrimus*) (www.zootierliste.de).

8.5 Conservation

There are no existing specific measures to protect *Tylototriton* spp. species or their habitats. Most populations occur outside protected areas (IUCN 2018, Bernardes et al. 2017b). For species specific information of occurrence within protected areas see Annex II. An awareness campaign to protect *T. vietnamensis* was initiated by the Cologne Zoo and the Institute of Ecology and Biological Resources (IEBR), Viet Nam in close collaboration with the Forest Protection Department (FDP) of Bac Giang Province (Ziegler 2015).

9. Information on similar species

Phylogenetically, *Tylototriton* spp. forms a clade with the genera *Pleurodeles* and *Echinotriton* sharing also morphological similarities with the latter genus, from which it was separated by in 1982 (Nussbaum et al.). There are currently three known species of *Echinotriton* discontinuously distributed in China and Japan with endangered conservation status.

10. Consultations

A consultation was launched by the European Union and its Member States to all other range States than China and Viet Nam, namely Bhutan, India, Myanmar, Nepal, Thailand and Laos. So far, no objections against the listing have been received.

11. Additional remarks

The following populations still await genetic confirmation: *T.* cf. *himalayanus* from Bhutan*; T.* cf. *himalayanus* from far east Himalaya (information from Mansukhani et al. [1976] and Pawar et al. [2007] in Seglie et al. [2003 and 2010]); *T.* cf. *verrucosus* from Maram, Senapati district, Manipur, India (Lucy et al. 2014); *T.* cf. *shanorum* from Kachin state, North Myanmar (Hernandez 2016)*; T.* cf. *verrucosus* from Lai Chau and Lao Cai provinces, northern Viet Nam (Nguyen et al. 2009, Nishikawa et al. 2013b); and there are undescribed taxa within *T. wenxianensis* (Hernandez 2016).

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Annex I - Conservation status

Table 1. Overview about relevant factors, which have shown to affect different *Tylototriton* species.

Species	Habitat loss	Small range	Decreased pop trend	Intentional harvest	Human consump.	Use in medicine	Internat. trade	IUCN cat. (date ass.)
T. anguliceps:	x		x	x				LC (2016)
T. anhuiensis:								
T. asperrimus:	x		x	x		x	x	NT (2008)
T. broadoridgus:								
T. dabienicus:								
T. hainanensis:	x	x	x				x	E (2008)
T. himalayanus:	x			x			x	
T. kweichowensis:	x	x	x	x		x	x	VU (2004)
T. liuyangensis:								
T. lizhenchangi:							x	
T. ngarsuensis	x	x	x	x		x	x	
T. notialis:	x	x	x	x		x		VU (2015)
T. panhai:	x					x	x	
T. podichthys:	x		x	x		x		LC (2017)
T. pseudoverrucosus:	x							
T. pulcherrimus:							x	
T. shanjing:	x		x	x		x	x	NT (2004)
T. shanorum:	x	x	x	x		x	x	VU (2017)
T. taliangensis:	x		x	x		x	x	NT (2004)
T. uyenoi:								
T. verrucosus:	x		x	x		x	x	LC (2004)
T. vietnamensis:	x	x	x	x			x	E (2016)
T. wenxianensis:	x		x				x	VU (2004)
T. yangi:						x	x	
T. ziegleri:	x	x	x	x		x	x	VU (2017)

Annex II - Habitat and distribution

Tylototriton usually reproduce in shallow temporary ponds, e.g. *T. vietnamensis* breeding ponds show an average of 110.462 ± 128.015 m^2 and range between 3 and 60 cm in depth (Bernardes et al. 2017b). Other water bodies occupied by some species may include deep permanent ponds like in the karst habitat of *T. ziegleri* up to 2 m (Bernardes et al. 2017b); larger lakes like in the case of *T. himalayanus* with an area of around 400 to 600 m^2 and 70 to 50 cm in depth (Seglie et al. 2003), or even reaching higher depths between 2 and 6 m (Kuzmin et al. 1994); small streams with slow current e.g., *T. notialis* with 3 m width and 10 to 30 cm depth (Stuart et al. 2010), *T. ziegleri* (Nishikawa et al. 2013b); and exceptionally relatively wide streams like in *T. anguliceps* in Laos, with 5 to 7 m in width (Phimmachak et al. 2015a); or wetlands like paddy fields, e.g., *T.* cf. *himalayanus* (from Bhutan) (Wangyal and Gurung 2012). *Tylototriton* species are not usually found co-habiting with fish populations, exception known for *T. panhai* (Hernandez and Hou 2018) and *T. himalayanus* (Seglie et al. 2003). The later species was found in an artificial fishing pond with no evidence of successful reproduction, which is plausible as fishes feed on eggs and larvae of newts. It seems that big and deep ponds (from about 750 m^2 area) even though occurring at the type locality of *T. vietnamensis*, which were independent from rain regime and supported a well-sustained aquatic ecosystem, are less likely to support presence of *Tylototriton*, probably due to negative biotic interactions (Bernardes et al. 2013). Aquatic breeding sites may additionally be characterized either by a high presence of emergent or surface vegetation e.g. more than 70 % in *T. himalayanus* (Seglie et al. 2003) or no vegetation at all within and around the pond, besides the fallen canopy leafs and forest debris e.g. *T. vietnamensis* (Bernardes et al. 2013), but usually with high canopy cover (Bernardes *et al.* 2017b).

The climatic conditions within the entire range of the genus are variable, generally with warm summer temperatures and cold winters, and different species are probably adapted to different climatic regimes. Some species experience rather extreme annual temperature fluctuations, like *T. pulcherrimus* with summer temperatures reaching 36 °C and winter temperatures dropping to 1 °C (Hernandez 2016), or even to -5 °C, like in the eastern Himalayan habitats of *T. himalayanus* (Seglie et al. 2010). Relative humidity is usually near the point of saturation for the whole range (Hernandez 2016).

Specific species distributions within the genus *Tylototriton*:

1. ***T. anguliceps* Le, Nguyen, Nishikawa, Nguyen, Pham, Matsui, Bernardes and Nguyen, 2015.** Distributed in northwestern Viet Nam, Dien Bien Province, Muong Nhe district, Muong Nhe Nature Reserve at 1,704 m asl. and Son La Province, Thuan Chau district, Nong Vai village and Song Ma district, Tup Pha B village at elevations between 1,595 to 1,778 m asl., in northern Thailand, Chiang Rai Province, Doi Lahnga, Khun Chae National Park at 1,443 m asl. (Pomchote et al. 2008, Le et al. 2015), and in northern Laos, Luang Namtha Province, Viengphoukha district, Phou Ya Kaho village at 1,466 m asl. (Phimmachak et al. 2015a). It has an estimated extent of occurrence (EOO) of 110, 738 km^2 (IUCN SSC ASG 2016a).

2. ***T. anhuiensis* Qian, Sun, Li, Guo, Pan, Kang, Wang, Jiang, Wu and Zhang, 2017.** Endemic to southern part of Dabie Mountains in Yaoluoping National Nature Reserve, Yuexi County, Anhui Province in China, at elevations of 1,000 to 1,200 m asl. (Qian et al. 2017).

3. ***T. asperrimus* Unterstein, 1930**. Distributed in South China, Guangxi Province and North Vietnam (Hernandez 2016).

4. ***T. broadoridgus* Shen, Jiang & Mo, 2012.** Distributed in Lianyewan, Tianping Mountains in Sangzhi County, Hunan Province, China, at an elevation from 1000 to 1600 m (Shen et al. 2012). A second population seems to have been discovered in central Hunan Province (Hernandez 2016).

5. ***T. dabienicus*** **Chen, Wang and Tao, 2010**. Huangbaishan National Forest Park (and probably in the bamboo forests around the reserve), Dabie Mountains, Shangcheng County, Henan Province, China, at 698 to 767 m elevation (Hernandez 2016).

6. ***T. hainanensis*** **Fei, Ye and Yang, 1984**. Endemic to Hainan Island in South China. It is known from only 5 areas: Bawangling National Nature Reserve, Diao Luo Shan Forest Park, Jianfengling Nature Reserve, Yinggeling Provencial Nature Reserve and Mount Whuzi between 770 and 950 m asl. (Hernandez 2016). EOO 5,000 km^2 and Area Of Occurrence (AOO) less than 500 km^2 (Haitao and Chan 2008).

7. ***T. himalayanus*** **Khatiwada, Wang, Ghimire, Vasudevan, Paudel and Jiang, 2015.** The species is known from Illam district, Mechi Zone, eastern Nepal and from Darjeeling district, West Bengal, India from elevations between 900 and 2,317 m asl. (Khatiwada et al. 2015). It has the widest altitudinal range within the whole genus (Fei et al. 2009). It is likely to be the same population that Nag and Vasudevan (2014) reported in Kurseong district, West Bengal, in the vicinity of the population from Darjeeling. Old records from Dhankuta district, Nepal (Shrestha 1988) have not yet been confirmed by recent surveys (Khatiwada et al. 2015). If the populations from Phunakha district, Wangdue Phodrang Valley, and in Sarpang, Bhutan (Palden 2003, Wangyal and Gurung, 2012) (Hernandez 2016) proves to be conspecific, this species would also occur in Bhutan between 1,255 and 2,679 m elevation. Pawar et al. (2007) based on niche modeling for distributions in Northeast India, estimated the total expected occurrence of this species to be 75,000 km^2, from which 4.9 % are included within protected areas.

8. ***T. kweichowensis*** **Fang and Chang, 1932**. The species' type locality is from Kungchishan, Dafang (= Dading) County. Endemic from China, from western Guizhou Province, Bijie Prefecture, Dafang, Hezhang, Nayong, Weining Yi, and Zhijin counties, and in Liupanshui Prefecture, Shuicheng County, from north-eastern Yunnan Province, in Zhaotong Prefecture, Yiliang and Yongshan Counties and central Yunnan, Kunming Prefecture, Panlong County (Zhang et al. 2013, Raffaëlli 2013, Sparreboom 2014). AOO less than 2,000 km^2 (Datong et al. 2004).

9. ***T. liuyangensis*** **Yang, Jiang, Shen and Fei, 2014.** Endemic to China, from Chuandiwo in the Dawei Mountain National Forest Park, Liuyang, northeastern Hunan Province, at an elevation of about 1,386 m (Yang et al. 2014). The species is distributed from an area of only 150 km^2 (Hernandez 2016).

10. ***T. lizhenchangi*** **Hou, Zhang, Jiang, Li and Lu, 2012.** Microendemic to Hunan Province and adjacent areas surrounded by natural species barriers (Yangtze River and Lake Dongting. Type locality on Mt. Mangshan, Hunan Province, China and the neighboring Ruyuan, Guangdong Province (Hernandez 2016).

11. ***T.*** **ngarsuensis Grismer, Wood, Quah, Thura, Espinoza, Grismer, Murdoch and Lin, 2018.** Endemic to Myanmar, known only from Baw Hto Chang in Ngar Su Village, Ywnagan Township, Taunqgui District, Shan State, Myanmar.

12. ***T. notialis*** **Stuart, Phimmachak, Sivongxay and Robichaud, 2010**. Only known from two localities, one in Laos, Khammouan Province, Boualapha district, Nakai-Nam Theun National Protected Area, between 980 and 1,000 m asl. elevation (Stuart et al. 2010, Phimmachak et al. 2015a), and the other in Viet Nam, Nghe An Province, Que Phong district, Dong Van commune, Pu Hoat proposed Nature Reserve (Yuan et al. 2011, Nishikawa et al. 2013b, Phimmachak et al. 2015a). It has an estimated EOO of 5,944 km^2 (IUCN SSC ASG 2015).

13. ***T. panhai*** **Nishikawa, Khonsue, Pomchote and Matsui, 2013.** From northeastern Thailand, from Phu Ruea, Phu Luang Wildlife Sanctuary and Phu Suan Sai National Park, Loei Province, Phu Hin Rong Kla National Park, Phitsanulok Province between 1,183 and 1,436 m asl. (Nishikawa et al.

2013a), and into Laos, Xaignabouli Province, Botene district, at an elevation of 1,347 to 1,596 m asl. (Phimmachak et al. 2015a). Additional populations from Phu Khe, Doi Phu Kha, Doi Phu Wae, Doi Phi Pan Nam, and Phu Soi Dao, Thailand (Hernandez 2016; Hernandez 2017) are likely to belong to this species, although support from genetic analysis awaits confirmation.

Results from independent working groups (Pomchote et al. 2008, Nishikawa et al. 2013a, Hernandez 2016) seem to point out to three different geographic groups, within this species: Type I in Loei Province, Type II in Sainyabuli Province in Laos, and Type III in Phitsanulok and Phetchabun provinces, without necessarily enough genetic differentiation to separate them on species level (Hernandez, Poyarkov and Pauwels unpubl. data 2015). Type I is characterized by moderate total length, a black ground color and well-developed bony ridges on head (especially on females); Type II is characterized by the longest total length, smaller glandular warts than Type I, and a lighter ground color than Type I; Type III presents the smallest total length, a dark reddish brown ground coloration, with poorly developed reddish colored dorsolateral warts (Hernandez 2016).

14. ***T. podichthys*** **Phimmachak, Aowphol, and Stuart, 2015.** Endemic to Laos, known from Phoukhoun district, Luang Phabang Province, Kham district, Xieng Khouang Province and Viengthong and Xam Neua districts, Houaphanh Province between 1,189 to 1,493 m asl. (Phimmachak et al. 2015a). A reported population in Nam Lieng, Kham district, Xieng Khouang (Sparreboom 2014) is the same as paratype locality in Kham district (Phimmachak et al. 2015a), although no genetic analysis was yet conducted. Estimated EOO of 39,420 km^2 (IUCN SSC ASG 2017b).

15. ***T. pseudoverrucosus*** **Hou, Gu, Zhang, Zeng, Li and Lü, 2012**. Endemic to the Daliang Mountains in Ningnan County, southern Sichuan Province, China at 2,340 m elevation (Hernandez 2016). According to Fei et al. (2012) the species can occur until 2,800 m elevation. It is only known from two large permanent ponds (Hernandez 2016).

16. ***T. pulcherrimus*** **Hou, Zhang, Li, and Lu, 2012.** Endemic to two mountain ranges in the southern Chinese Province of Yunnan, Huanglian and Fenshui Mountains at elevations between 1,450 to 1,550 m asl. (Hernandez 2016).

17. ***T. shanjing*** **Nussbaum, Brodie and Yang, 1995.** Endemic to Yunnan Province, China. Found at elevations between 950 to 2,500 m asl in primary and secondary forests, but also in disturbed habitats like tea plantations and rice paddies (Raffaëlli 2013, Hernandez 2017). It consists of three major groups: 1) central group, including the type locality in Jingdong, from Longling in the West, to Yuanjiang in the East, and Dayao in the North; 2) northern group, found at higher elevations from Dali to Lijiang-Peiliang; 3) southern group, from Xishuangbanna to Mojiang-Jianshui (Hernandez et al. 2017).

18. ***T. shanorum*** **Nishikawa, Matsui and Rao, 2014.** Endemic to Myanmar, currently known only from two populations, one in Taunggyi Township, and the other in Nyaung Shwe Township, Shan State, between 1,393 to 1,457 m asl. (Nishikawa et al. 2014). EOO estimated around 11,058 km^2 (IUCN SSC ASG 2017a).

19. ***T. taliangensis*** **Liu, 1950**. Type locality: Pusakang, Fulinhsien, Sichuan. Native to south-central Sichuan Province, from Zhaojue, Mianning, Meigu, Shimian (Liziping), Hanyuan, Liangsha Yizu, E'bianand Mabian and Daguan between an elevation of 1,200 and 3,500 m (mainly only from 2,000 m up (Raffaëlli 2013, Sparreboom 2014, Hernandez 2016). Estimated EOO of 20,000 km^2 (Liang and Feng 2004).

20. ***T. uyenoi*** **Nishikawa, Khonsue, Pomchote and Matsui, 2013.** Endemic to northwestern Thailand, from Doi Ang Khang, Doi Chang Kien, Doi Inthanon, Doi Pui, and Doi Suthep, in Chiang Mai

Province between elevation of 1,313 to 1,436 m asl (Nishikawa et al. 2013a), Doi Soi Malai, Tak Province at 1,547 m asl. (Hernandez 2017).

21. ***T. verrucosus*** **Anderson, 1871**. Is distributed in the most western regions of Yunnan Province, China (Nussbaum, Brodie, and Datong 1995), along the southwestern reaches of the Gaoligong Mountains, from Nujiang Autonomus Prefecture (Lushui County), via the western parts of Baoshan Prefecture (Baoshan and Tengchong Counties), to south Dehong Autonomous Prefecture (Longchuan and Yingjiang Counties) and can be found between 950 and 1,800 m asl. The species probably also occurs in neighboring northern Myanmar due to the proximity with the border (Hernandez 2016). Types from India, Laos, Myanmar, Thailand or Vietnam were formerly considered relict populations of *T. verrucosus* before molecular and morphological studies identified them as distinct species (*T. himalayanus* from India, *T. uyenoi, T. panhai* from Thailand, *T. shanorum* from Myanmar, *T. anguliceps* from Vietnam, and *T. podichthys* from Laos) (Hernandez 2016, Nishikawa *et al.* 2013a, Nishikawa *et al.* 2014, Khatiwada *et al.* 2015, Le *et al.* 2015, Phimmachak et al. 2015). Types from Bhutan still away taxonomic confirmation, but are more likely to be *T. himalayanus* than *T. verrucosus*.

22. ***T. vietnamensis*** **Böhme, Schöttler, Nguyen and Köhler, 2005.** Endemic to North Vietnam and known from three protected areas: Tay Yen Tu Nature Reserve in Bac Giang Province, Yen Tu and Dong Son – Ky Thuong Nature Reserves in Quang Ninh Province and from Mau Son Mountain in Lang Son Province. It can be found at elevations between 181 to 980 m asl. (Böhme et al. 2005; Bernardes et al. 2013; Bernardes et al. 2017b). With an EOO of 1,345 km^2 (IUCN SSC ASG 2016a).

23. ***T. wenxianensis*** **Fei, Ye and Yang, 1984**. Endemic to China. Type locality in Longnan Prefecture, Wenxian County, southern Gansu Province. Consolidates several populations distributed in the Central and northeastern parts of China, that Hernandez (2016) divides in 3 groups: 1) Sichuan Province, Pingwu, Qingchuan, and southern Gansu Province, Wenxian; 2) Chongqing Province, and southwestern Hubei Province; 3) northern, central and southeastern Guizhou Province. Distributed in an elevation from 640 to 2,500 m, but mainly between 950 to 1,400 m asl. (Hernandez 2016). With an AOO smaller than 2,000 km^2 (Liang and Changyuan 2004).

24. ***T. yangi*** **Hou, Zhang, Zhou, Li, and Lu, 2012.** Endemic to South Yunnan Province, China. Type locality Gejiu City, Honghe Hani and Yi Autonomous Prefecture (Hou et al. 2012). Other localities in this prefecture include: Dawei Mountains (including Daweishan National Forest Park), Pingbian Miao Autonomous County (Zhao et al. 2012), Honghe and Hekou Counties and Mengzi City (Hernandez 2016). It can also be find in Wenshan National Nature Reserve, Laojunshan Mountains, Wenshan County in Wenshan Zhuang and Miao Autonomous Prefecture (Sparreboom 2014). It inhabits karstic highlands at elevations above 1,200 m asl. (Sparreboom 2014). Estimated EOO smaller than 20,000 km^2 (Wang et al. 2017).

25. ***T. ziegleri*** **Nishikawa, Matsui and Nguyen, 2013**. Endemic to North Vietnam. Known from Mount Pia Oac in Nguyen Binh district and Bao Lac district in Cao Bang Province, and Mount Ta Boc in Quan Ba district and Bac Quang district in Ha Giang Province. It has an elevational range between 885 to 1,420 m asl. (Nishikawa et al. 2013b, Bernardes et al. 2017). With an estimated EOO of 16,218 km^2 (IUCN SSG 2017c).

Annex III - Morphology

Specific morphological characteristics within the genus *Tylototriton:*

1. ***T. anguliceps*** **Le, Nguyen, Nishikawa, Nguyen, Pham, Matsui, Bernardes and Nguyen, 2015.** Is distinguishable by more prominent dorsal granules than both *T. shanjing* and *T. uyenoi*, prominent middorsal bony ridge and steep and narrow lateral bony edges of the head (vs. less prominent middorsal ridge and gentle and wide lateral bony edges on the head in T*. shanjing* and *T. uyenoi*, and no middorsal ridge and nearly flat lateral bony edges on head in *T. shanorum*), skeletal connection (quadrate) between maxillary and pterygoid, vertebral ridge distinct and slightly segmented (Le et al. 2015, Hernandez 2016). Ground color black, bright to dark orange markings on head, vertebral ridge, rib nodules, limbs, vent region, part of ventral trunk and whole tail (Nishikawa et al. 2013a, Le et al. 2015).

2. ***T. anhuiensis*** **Qian, Sun, Li, Guo, Pan, Kang, Wang, Jiang, Wu and Zhang, 2017.** This species has a head longer than wide, bony ridges on head notable and "necked-in", tail length shorter than snout-vent length, the ventral tail fin fold extends to the posterior margin of cloaca, ground body color dark and the distal digit ends, ventral digits, peripheral area of cloaca and the tail's lower margin orange, relative length of toes: 3>4>2>5>1. Length of dorsal ridge smaller than eye diameter. Females significantly smaller than the ones from *T. broadoridgus* (average 129 cm compared to 145 cm), presence of fine transverse striae laterally between every two tubercles. The main morphological differences between the Yuexi population and the other three closely related species (*T. wenxianensis*, *T. broadoridgus* and *T. dabienicus*) is that the head length greater is than the width.

3. ***T. asperrimus*** **Unterstein, 1930.** This species presents skull width only slightly larger than length, fronto-squamate arch rather stout, body size small, tips of fingers reaching the nostrils when laid forward, dorsal tail fin-fold low, tapering from the base and ending in a blunt point, lateral glands roundish, prominent and well separated from each other, ventral side smoother than the dorsal side, with transverse wrinkles, margin on cloaca with whitish coloration (Fei et al. 1984, Fei et al. 2010).

4. ***T. broadoridgus*** **Shen, Jiang and Mo, 2012.** Diagnostic characters include a dorsal ridge broad and thick, with width approximately equal to eye diameter, tail height greater than width at base of tail, no villous genital papilla found inside the male anal fissure, nodule-like warts, along lateral margin of the trunk, bulge and forming tubercles, and thin and transverse striae present between the tubercle (Shen et al. 2012).

5. ***T. dabienicus*** **Chen, Wang and Tao, 2010**. Moderately large species (growing up to 14.8 cm), head width larger than congeners, short limbs (tips of fingers of fore- and hind-limbs not touching when adpressed against the body), tips of fingers reaching anterior orbital area when forelimbs stretched forward, dorsolateral glands absent, dark ground color with exception of orange finger tips, and margin of cloacal opening (Hernandez 2016).

6. ***T. hainanensis*** **Fei, Ye and Yang, 1984.** This species has a head flat and wider than long, well-developed bony ridges, large body size (males up to 14.8 cm and females up to 12.5 cm), tips of forelimb reaching to eye, dorsal fin-fold high, straight and nearly parallel with the ventral fin, but from last 1/3 to 1/4 gradually converging toward tip of tail and ending in a rounded shape (Fei et al. 1984, Hernandez 2016). Slightly flattened rib nodules (Stuart et al. 2010). Snout-vent length longer than tail length (Nguyen et al. 2009). Rounded snout, distinct and segmented vertebral ridge, small transverse wrinkles on the venter. Dorsal color dark brown and the ventral side greenish gray. Tips of digits, surrounding of cloaca and lower margin of tail colored in orange (Hernandez 2016).

7. ***T. himalayanus*** **Khatiwada, Wang, Ghimire, Vasudevan, Paudel and Jiang, 2015.** Is diagnosable by having a flat and blunt snout (vs. truncate snout in *T. shanorum*), head longer than wider (vs. head wider than longer in *T. shanorum*), greatly separated dorsolateral bony ridges on head (vs. poorly separated dorsolateral bony ridges in *T. shanorum*, *T. verrucosus* and *T. shanjing*), 16 dorsal warts (vs. 14 dorsal warts in *T. shanorum*), distinct grooves on either sides of tail base (vs. absent grooves in *T. verrucosus*, and poorly developed grooves in *T. shanjing*), uniformly blackish, dark brown coloration in dorsal region, with lighter tone in dorsolateral region and creamy coloration in ventral surface (Khatiwada et al. 2015).

8. ***T. kweichowensis*** **Fang and Chang, 1932.** Large newt (with maximum total length in males reaching up to 19.5 cm and in females 21 cm) (Fei et al. 2006), characterized by a triangular and relatively flat head with a depressed crown in the frontal and interorbital areas, with the areas just above and behind the eyes on the sides of the head elevated, rounded snout (Hernandez 2016), dorsolateral ridges less prominent than in *T. shanjing*, prominent glandular vertebral ridge, gular fold prominently present (Liu 1950), dorsolateral warts not round and widely separated, but square, not distinct and almost fused (Nussbaum et al. 1995).

9. ***T. liuyangensis*** **Yang, Jiang, Shen and Fei, 2014.** This species has a dorsal surface completely black, with nodule-like warts distributed evenly along the lateral margin of dorsum, and there is no transverse striae between the warts, interorbital space wider than that of *T. wenxianensis* and *T. broadoridgus*, bony ridge on head extend through upper eyelids (vs. bony ridge on head extend across the inner side of eyelids in *T. wenxianensis* and *T. broadoridgus*), the distance between axilla and groin accounts for more than 50 % of the SVL (vs. less than 50 % in *T. wenxianensis* and *T. broadoridgus*), and absence of villous genital papilla inside the cloacal fissure of males during the breeding season (vs. presence of villous genital papilla in males of *T. wenxianensis* during breeding season) (Yang et al. 2014). *T. liuyangensis* (males measure up to 13 am and females up to 15.5 cm) is smaller than *T. lizhenchangi* (males can reach up to 17.3 cm and females 15.6 cm) (Hernandez 2016).

10. ***T. lizhenchangi*** **Hou, Zhang, Jiang, Li and Lu, 2012.** This species presents robust body with relatively smooth skin, head longer than wide, prominent bony ridge surrounding the upper side of head, glandular warts indistinct, but inconspicuous, on each side of the trunk, forming sharp-edged, distinctly raised dorsolateral ridges (dorsal warts a little more pronounced in males), mostly back with only finger tips, cloacal region and the underside of the tail yellowish to reddish. The rear parts of the parotoids may be red in males, but this character is not always present (Hernandez 2016).

11. ***T. ngarsuensis,*** **Grismer, Wood, Quah, Thura, Espinoza, Grismer, Murdoch and Lin, 2018.** This species differs from others in the genus by the combination of a shorter head, larger size, different rib nodule morphology, and overall dark coloration.

12. ***T. notialis*** **Stuart, Phimmachak, Sivongxay and Robichaud, 2010.** Distinct knob-like rib nodules, glandular warts on most of the remaining dorsal and ventral surfaces, very dark brown to black ground coloration, and bright orange coloration on rib nodules, cloacal region continuing to ventral ridge of tail and finger tips (Stuart et al. 2010). The population from Laos has orange coloration on posterior end of parotoid, feature not observed in the population from Viet Nam (Nishikawa et al. 2013b). This species can be distinguished by having a rougher dorsal skin than *T. lizhenchangi*, *T. vietnamensis*, and *T. wenxianensis*; by having a smoother skin than *T. ziegleri*; larger eyes, and a thinner and shorter tail than *T. asperrimus*; and a shorter tail and longer limbs than *T. hainanensis* (Nishikawa et al. 2013b).

13. ***T. panhai*** **Nishikawa, Khonsue, Pomchote and Matsui, 2013**. Is characterized by wide dorsolateral bony ridges on head, prominent and large rib nodules, spine not quadrate, vertebral

ridge distinct and not segmented (Nishikawa et al. 2013a, Hernandez 2016). Exceptionally this species is a member of the *Yaotriton* subgenus that has additional color markings (yellow, orange or reddish brown) on head, parotoids and lips, vertebral and dorsal tail ridge, and rib nodules (Nishikawa et al. 2014), looking similar to most of the species of the subgenus *Tylototriton*, especially *T. shanjing*, *T. uyenoi*, *T. pseudoverrucosus* and *T. pulcherrimus* (Nishikawa et al. 2013a). However, it differs by having widely developed dorsolateral bony ridges on head, black limbs and tail except the edges (vs. narrow dorsolateral bony ridges on head, yellow or orange limbs and whole tail in *T. shanjing*, *T. uyenoi*, *T. pseudoverrucosus* and *T. pulcherrimus*) (Nishikawa et al. 2013a).

14. ***T. podichthys*** **Phimmachak, Aowphol, and Stuart, 2015.** Is characterized by presenting an indistinct glandular ridge on midline of crown (vs. distinct ridge on midline of crown in *T. verrucosus*, *T. shanjing*, *T. uyenoi* and *T. anguliceps*), distinct rib nodules with diameter equivalent to or greater than that of eye (vs. small, slightly elongated rib nodules in *T. shanorum*), parotoid oriented parallel to body axis in lateral view (vs. parotoid oriented obliquely downward relative to body axis in lateral view in *T. verrucosus* and *T. uyenoi*), thick, glandular vertebral ridge (vs. distinctly narrower and less glandular in *T. shanorum*), rough, glandular skin on cranial crest (vs. smoother in *T. verrucosus*), orange markings separated between rib nodules and dark coloration on ventral surfaces of limbs and finger tips (Phimmachak et al. 2015a).

15. ***T. pseudoverrucosus*** **Hou, Gu, Zhang, Zeng, Li and Lü, 2012.** Exhibits the following characteristics: connected color markings on rib nodules, forming dorsolateral lines (Nishikawa et al. 2013a), head depressed and longer than broad, snout square, 12 to 15 indistinct glandular warts, black ground color with exception of orange to red coloration on cephalic and vertebral ridges, most of head, dorsolateral lines (~rib nodules), whole tail and limbs (Hernandez 2016).

16. ***T. pulcherrimus*** **Hou, Zhang, Li, and Lu, 2012**. Is a medium size species with tail size corresponding to 70 to 100 % of snout-vent distance. The total size in males has been reposted as larger than those of females (14.48 cm in males vs. 13.94 cm in females). It resembles *T. verrucosus* or *T. shanjing*, but more vividly colored, with reddish brown to dark brown - black on upper side with yellow to orange markings on head edges, vertebral ridge, glandular warts, limbs, whole tail and lateral to ventral parts (Hernandez 2016).

17. ***T. shanjing*** **Nussbaum, Brodie and Yang, 1995.** Robust looking newt, with bigger sizes achieved by females (Fei et al. 2006). Dark-brown to black dorsal ground color, with color markings in yellowish orange to bright yellow in bony edges of the head, vertebral ridge, dorsolateral glandular warts, limbs, tail and most of ventral side (Nussbaum et al. 1995). *T. shanjing* has ossified structures on the median part of the frontals more developed than *T. verrucosus* (Haller-Probst, 1998). The posterior end of the dorsolateral crests reach the exoccipital in *T. shanging* (vs. do not reach in *T. anguliceps* and *T. uyenoi*) (Le et al. 2015).

18. ***T. shanorum*** **Nishikawa, Matsui and Rao, 2014.** It is one of the largest species (total length around 17.6 cm in females and 18.7 cm in males). Head wide, truncate snout, dorsolateral bony ridges on head not very steep or narrow, presenting a rough-like surface, rib nodules moderately prominent, vertebral ridge narrow and weakly segmented, dorsal ground color dark brown to black, anterior head, parotoid, vertebral ridge, rib nodules, limbs, and lateral side of tail dull reddish brown, upper and lower lips, palm and sole, vent region, and ventral side of tail dark yellow (Nishikawa *et al.* 2014).

19. ***T. taliangensis*** **Liu, 1950**. This species presents indistinct dorsal glandular warts, an uniformly black ground color, with the exception of orange to red colored marking on the posterior end of the cephalic edge, including laterally the parotoids, the cloacal region, the lower edge of the tail and

finger tips (Hernandez 2016). Some specimens can also have completely back heads (M. Hou pers. com. 2015, Hernandez 2016).

20. ***T. uyenoi*** **Nishikawa, Khonsue, Pomchote and Matsui, 2013**. Characterized by its large size (total length = 17.5 cm in females and 15 cm in males), rounded snout, dorsolateral bony ridges on head prominent but narrow, vertebral ridge distinct and slightly segmented, dorsolateral glandular warts distinct and prominent, shallow vomerine tooth series. Ground color dark brown, orange to reddish brown color markings on anterior half of head, vertebral ridge, rib nodules, limbs, vent region, and whole tail. (Nishikawa et al. 2013a, Nishikawa et al. 2014, Hernandez 2016). Differs from *T. shanjing* by having darker markings, wider head, longer and higher tail, wider and longer vomerine teeth series (vs. narrower head, shorter and lower tail, and narrower and shorter vomerine teeth series in *T. shanjing* (Nishikawa, et al. 2013a).

21. ***T. verrucosus*** **Anderson, 1871.** This species has an all brown ground color, with tail and soles of feet slightly lighter than dorsum, pale coloration restricted to ventral ridge of tail, with strongly developed cranial crests (vs. weakly developed cranial crests in *T. asperrimus*) (Nussbaum et al. 1995). Differs from *T. shanjing* by lacking the bright color on head and dorsolateral nodules, and by having no ossified structures on the median part of the frontals (Haller-Probst 1998).

22. ***T. vietnamensis*** **Böhme, Schöttler, Nguyen and Köhler, 2005**. This species is characterized by a truncate snout in dorsal view, skin covered with relatively small warts and glands, three tubercular dorsal ridges, slightly flattened and only moderately developed rib nodules, dorsal and ventral fin developed, dorsal color uniformly greyish tan or light brownish without larger orange or red dorsal markings, except ventral tail fin, tips of fingers (Böhme et al. 2005). Tip of forelimb reaching to nostril, snout-vent length shorter than tail length (Nguyen et al. 2009).

23. ***T. wenxianensis*** **Fei, Ye and Yang, 1984.** This species presents margins of cloacal slit dull black, rib nodules nearly indistinct, vertebral ridge smooth and wide, ventral granules developed and isolated from each other (Nishikawa et al. 2013b). Head length equal to head width, tail height less than the width at the base, the peripheral area of the cloaca is blackish-brown and similar to body color (Fei et al. 1984, Qian et al. 2017).

24. ***T. yangi*** **Hou, Zhang, Zhou, Li, and Lu, 2012**. This species shows distinctively warty skin, laterally protruding quadrate regions, rounded snout, prominent vertebral ridge, isolated dorsolateral glandular warts, reddish-orange markings on posterior end of dorsolateral ridge on head, dorsal ridge of head, posterior half of parotoid, jaw angle, dorsal ridge, dorsolateral knobs on body, ventrolateral sides of trunk, cloacal region, tail, and fingers and toes, but lacked marking on the limbs or on the anterior half of head (Nishikawa et al. 2013a, Nishikawa et al. 2015, Hernandez 2016).

25. ***T. ziegleri*** **Nishikawa, Matsui and Nguyen, 2013.** This species differs from other members of *Yaotriton* sub-genus by its medium-sized body (13.2 cm males and 14.2 cm females); distinctly rough skin with fine granules, vertebral ridge prominent and segmented, forming a row of tubercles, very prominent rib nodules showing a knob-like appearance, large eyes, very well developed bony ridges on head and low and narrow tail. Coloration is characterized by blackish ground color with bright orange coloration on finger and toe tips, parts of soles and palms, and vent continuing to the ventral ridge of the tail (Nishikawa et al. 2013b). Animals appear generally constant, except for the absence or presence of orange markings on palm and sole, around vent, vertebral ridge and rib nodules (Nishikawa et al. 2013b and M. Bernardes per. com.).

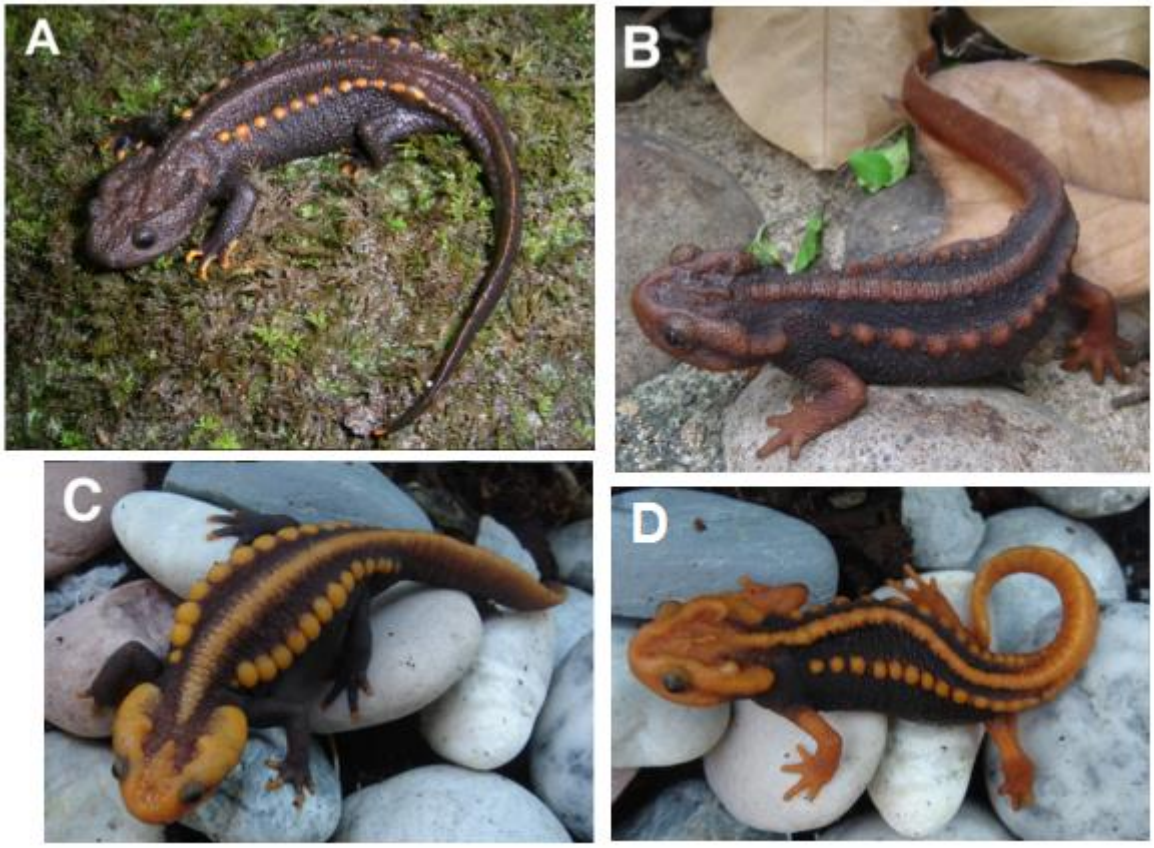

Figure 1. Dorsal view of four different *Tylototriton* species, showing evidence of morphological similarities: A) *T. notialis*, B) *T. uyenoi*, C) *T. panhai*, D) *T. anguliceps.*(Source Nishikawa et al. 2013a, Phimmachak et al. 2015b).

Figure 2. Example of phenotipical variation within individuals of the same species of *Tylototriton:* A) holotype and B) paratype of *T. podichthys*. (Source Phimmachak et al. 2015b).

Annex IV - Trade

1. Addition information on Legal trade

A current market analysis in non-range states using internet platforms with history recordings showed trade data for *Tylototriton* species available from 2003 on and only related to supply during the first two years. An interest/ demand for *Tylototriton* spp. in the trade seems to have started around 2005 with very low frequencies until 2008. Through 2009 and 2010 the demand showed for the first time higher frequencies than the offer, with a peak in 2008. A second peak in the supply market of *Tylototriton* spp. was registered in 2012 to 2013, followed by an "historic" drop, where no supply has been recorded. The demand for *Tylototriton* species has been increasing since 2014, and in 2017 doubled the frequencies recorded for the offer (Annex IV, Tab. 2, Fig. 3). Commercial prices depend on numerous variables, like type of species, life stage and sex. Usually the price for adults is higher than for juveniles, and females may reach higher prices than males. In 2018 the prices practiced in reptile fairs was lower than the prices on online shops, for example, on the reptile fair in Hamm, Germany, juveniles of *T. shanjing* cost around 40€ – 45€, and juveniles of *T. shanorum* cost 20€, while adults cost 30€; in comparison with online prices for *T. shanjing* of 60€ and for *T. shanorum* of 100€. The price for eggs seems to have increased in the last year, following the data for three offers of *T. verrucosus* in Europe in 2008 and 2012 the price per egg was 0.5€, and 2017 it increased to 0.7€. The market prices practiced in the US for *Tylototriton* spp. are also usually higher than in Europe. The most commonly advertised species were *T. yangi*, *T. verrucosus*, *T. shanorum*, *T. shanjing*, *T. kweichowensis*, *T. asperrimus* and in a smaller degree also *T. lizhenchangi*, *T. panhai*, *T. pulcherrimus*, *T. taliangensis*, *T. vietnamensis, T. wenxianensis*, *T. ziegleri;* and *T. hainanensis* (Pasmans et al. 2014). There was evidence of *T. yangi* being advertised for sale in the US (as wild caught) only one year after its description (Hernandez 2016).

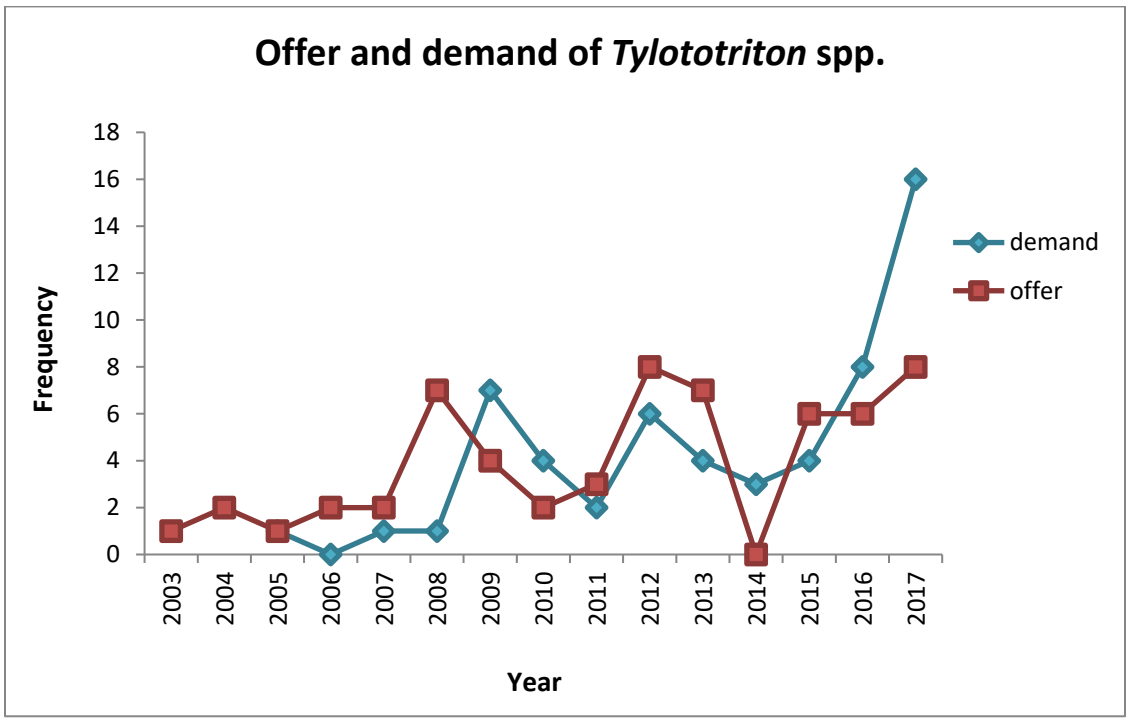

Figure 3. Offer and demand tendencies for *Tylototriton* spp. based on the data from Table 2 for a period between 2013 and 2017.

Table 2: Trade in the genus *Tylototriton* spp. based on a recent internet survey and interviews with dealers.

Date	Country	Trade type	Species	No. Ind.	Cost	Purpose	Source	Comment
04.06.2018	Germany	offer	*T. shanjing*		40 €		Terraristika Messe Hamm	juveniles
04.06.2018	Germany	offer	*T. shanorum*		30 € adults, 20 € juveniles	private	Terraristika Messe Hamm	
04.06.2018	Germany	offer	*T. shanjing*		45 €	private	Terraristika Messe Hamm	adults
03.03.2018	Germany	offer	*T. asperrimus*			private	Terraristikmesse Karlsruhe	S. Altherr in lit. 2018
March. 2018	Viet Nam	offer	*T. vietnamensis*		15 $ to 25 $ each	shop	Pet shop in Bien Hoa, Dong Nai Province	No stock at the moment. "W" collected by local hunters in type locality (Bac Giang Province, Viet Nam)
March. 2018	Viet Nam	offer	*T. ziegleri*		15 $ to 25 $ each	shop	Pet shop in Bien Hoa, Dong Nai Province	No stock at the moment. "W" collected by local hunters in type locality (Ha Giang Province, Viet Nam)
10.3.2018	Germany	offer	*T. shanorum*		30 € adults, 20 € juveniles	private	Terraristika Messe Hamm	
10.3.2018	Germany	offer	*T. shanjing*		45 € each	shop	Terraristika Messe Hamm	juveniles
10.3.2018	Germany	offer	*T. shanjing*		40 € each	shop	Terraristika Messe Hamm	juveniles
6.02.2018	Germany	offer	*T. shanorum*			private	www.terraristik.com	personal add; CB2017
4.02.2018	Netherlands	demand	*T. shanjing, T. pulcherrimus*			private	Facebook	
4.2.2018	Germany	offer	*T. shanorum*	0.0.6	30 € adults, 20 € juveniles	private	Reptilien Boersen Fair in Dortmund	
2.2.2018	Switzerland	demand	*T. verrucosus, T. shanorum*			private	Facebook	
31.01.2018	Germany	offer	*T. verrucosus*		99 €	shop	www.luckyreptile.com	online shop that usually has stock to sell
31.01.2018	Germany	offer	*T. shanorum*		99 €	shop	www.luckyreptile.com	
31.01.2018	Germany	offer	*T. shanjing, T. yangi, T. lizhenchangi*			shop	www.luckyreptile.com	not available at the moment, but available care sheet online
31.01.2018	Germany	offer	*T. kweichowensis*		69,90 €	shop	www.terra-tropiczoo.de	middle size

31.01.2018	Germany	offer	*T. shanjing*		59,90 €	shop	www.terra-tropiczoo.de	
31.01.2018	Germany	offer	*T. verrucosus*		29,90 €	shop	www.terra-tropiczoo.de	
31.01.2018	France	offer	*T. shanorum*		49 €	shop	http://www.lftshop.com/	
30.01.2018	U.S.A	demand	*Tylototriton* spp.			private	Facebook	eggs
25.01.2018	Netherlands	demand	*T. pulcherrimus, T. shanjing*			private	Facebook	
31.12.2017	Germany	demand	*Tylototriton* spp.			private	www.terraristik.com	personal add
29.12.2017	Spain	offer	*T. yangi*	0.1.0	100 €	private	Facebook	
17.12.2017	France	demand	*T. shanjing*	1.2.0		private	Facebook	"Looking for 'big form' "
15.12.2017	England	offer	*T. shanjing*		20 £	private	http://www.caudata.org/forum/	
15.12.2017	England	offer	*T. kweichowensis*		20 £	private	http://www.caudata.org/forum/	
15.12.2017	UK	offer	*T. verrucosus*		15 £	private	http://www.caudata.org/forum/	juveniles
7.12.2017	Spain	demand	*T. pulcherrimus*			private	Facebook	looking to buy in Hamm (and later replies he was not lucky)
6.12.2017	Germany	offer	*T. shanorum*		59 €	private	www.terraristik.com	Commercial add Import Export Peter Hoch GmbH (special pre-orders for Hamm); CB
6.12.2017	Germany	offer	*T. shanorum*	0.0.50		private	www.terraristik.com	personal add; CB2017
13.11.2017	Netherlands	offer	*T. verrucosus*			private	Facebook	CB2017; the dark variant
13.11.2017	Germany	offer	*T. verrucosus*			private	www.Enimalia.com	juveniles
1.11.2017	Hungary	demand	*T. verrucosus*			private	Facebook	
20.10.2017	U.S.A	demand	*Tylototriton* spp.			private	www.faunaclassifieds.com	
31.08.2017	Poland	demand	*T. verrucosus*			private	Facebook	juveniles CB
14.08.2017	Italy	demand	*T. yangi, T, kweichowensis, T. shanjing*			private	www.terraristik.com	personal add; adult/ sub-adult
26.05.2017	Germany	demand	*T. shanjing*			private	Facebook	Tierpfleger from Zoo Frankfurt
6.5.2017	U.S.A	demand	*Tylototriton* spp.			private	http://www.caudata.org/forum/	
5.05.2017	UK	offer	*T. verrucosus*		20 £ for 25+ eggs	private	http://www.caudata.org/forum/	eggs
1.05.2017	U.S.A	demand	*Tylototriton* spp.			private	www.faunaclassifieds.com	

15.04.2017	Italy	demand	*T. shanjing*, *T. verrucosus*			private	Facebook	Interest to buy animals in Langarone Trade fair
15.04.2017	U.S.A	demand	*Tylototriton* spp.			private	www.faunaclassifieds.com	
8.04.2017	U.S.A	demand	*Tylototriton* spp.			private	www.faunaclassifieds.com	
5.04.2017	France	demand	*T. yangi*, *T. vietnamensis*, *T. ziegleri, T. panhai, T. lizhenchangi*			private	Facebook	
20.02.2017	Germany	demand	*Tylototriton* spp.			private	www.terraristik.com	personal add; adult/ sub-adult
2.01.2017	Spain	demand	*T. yangi*			private	www.terraristik.com	personal add - search for male
15.12.2016	Canada	demand	*T. verrucosus*			private	http://www.caudata.org/forum/	
24.11.2016	Portugal	demand	*T. shanjing*			private	Facebook	
8.11.2016	England	demand	*T. asperrimus*	10 to 20		private	Facebook	Young; CB; same dealer from 1.09.2016
5.11.2016	Belgium	demand	*T. kweichowensis*			private	www.terraristik.com	personal add
16.10.2016	France	demand	*T. shanjing*			private	http://www.caudata.org/forum/	can pick up in Gersfeld or Arras France
11.10.2016	UK	offer	*T. verrucosus*	0.0.6	15 £ each	private	www.faunaclassifieds.com	1 year old
7.09.2016	Portugal	offer	*T. verrucosus*	0.0.1		private	Facebook	CB2015
5.09.2016	Switzerland	offer	*T. shanjing*	0.0.2		private	www.terraristik.com	personal add - landfase, small to be delivered in Hamm Sep.
1.09.2016	England	offer	*T. verrucosus*	0.0.22		private	Facebook	CB2016
4.07.2016	England	offer	*T. asperrimus*	1.3.0	130 € for all	private	Facebook	
4.06.2016	England	offer	*T. shanjing*	2.1.0	120 € for all	private	Facebook	same dealer from 1.09.2016
2.03.2016	Italy	demand	*T. kweichowensis*			private	Facebook	
25.02.2016	Italy	demand	*T. kweichowensis*			private	Facebook	
18.01.2016	U.S.A	demand	*T. verrucosus*, *T. shanjing*			private	www.faunaclassifieds.com	
3.11.2015	Germany	demand	*T. yangi, T. verrucosus, T. shanjing*			private	Facebook	adults
31.10.2015	Spain	offer	*T. wenxianensis*			shop	Reptilmania.com	

30.10.2015	UK	offer	*T. verrucosus*		15 £	private	http://www.caudata.org/forum/	CB2015 juveniles
30.09.2015	Scotland	offer	*T. yangi*		25 £ each	private	http://www.caudata.org/forum/	
21.09.2015	U.S.A	demand	*T. shanjing*			private	www.faunaclassifieds.com	
19.09.2015	Netherlands	offer	*T. shanjing*		20 € each	private	http://www.caudata.org/forum/	sending possible in Europe as long as temperatures allow it; CB2015
22.08.2015	Netherlands	offer	*T. shanjing*	4.5.42	20 € each	private	http://www.caudata.org/forum/	+ shipping; CB2015
7.07.2015	U.S.A	offer	*T. yangi*	4.1.0	375 $ for all	private	www.faunaclassifieds.com	WC
7.06.2015	France	demand	*T. shanjing*			private	http://www.caudata.org/forum/	
24.05.2015	U.S.A	demand	*Tylototriton* spp.			private	www.faunaclassifieds.com	
25.02.2015	UK	offer	*T. verrucosus*		15 £	private	http://www.caudata.org/forum/	CB2014 juveniles
13.11.2014	U.S.A	demand	*Tylototriton* spp.			private	http://www.caudata.org/forum/	
23.10.2014	China	demand	*Tylototriton* spp.			private	http://www.caudata.org/forum/	
29.03.2014	U.S.A	demand	*T. shanjing*	2.0.0	150 to 200 $ each	private	http://www.caudata.org/forum/	
14.12.2013	U.S.A	offer	*T. verrucosus*		25 $	private	http://www.caudata.org/forum/	+ Overnight shipping
14.09.2013	Poland	offer	*T. kweichowensis*	2.2.0	200 € all	private	http://www.caudata.org/forum/	
4.09.2013	U.S.A	offer	*T. verrucosus*			private	http://www.caudata.org/forum/	
4.09.2013	Scotland	demand	*T. verrucosus*			private	http://www.caudata.org/forum/	
29.07.2013	England	offer	*T. verrucosus*	2	for both	private	http://www.caudata.org/forum/	1 adult and 1 juvenile
21.06.2013	Portugal	demand	*T. shanjing*, *T. wenxianensis*			private	http://www.caudata.org/forum/	
9.05.2013	Scotland	offer	*T. shanjing*		50 £	private	http://www.caudata.org/forum/	CB2011
21.03.2013	USA	demand	*T. shanjing*			private	http://www.caudata.org/forum/	
10.03.2013	Norway	offer	*T. shanjing*	2.0.1	170 € all	private	http://www.caudata.org/forum/	
8.02.2013	England	offer	*T. shanorum*	0.0.4	15 £ each	private	http://www.caudata.org/forum/	
3.02.2013	USA	demand	*Tylototriton* spp.			private	www.faunaclassifieds.com	
16.12.2012	Netherlands	offer	*T. shanjing*	0.0.10	25 € each	private	http://www.caudata.org/forum/	CB F2 2011
16.10.2012	England	offer	*T. verrucosus*	0.0.7		private	http://www.caudata.org/forum/	
29.09.2012	USA	offer	*T. verrucosus*		30 $ each	private	http://www.caudata.org/forum/	
19.09.2012	England	offer	*T. verrucosus*	0.2.0	20 £ both	private	http://www.caudata.org/forum/	
24.07.2012	Scotland	offer	*T. verrucosus*		50 eggs for 30 £; juveniles 15 £ each	private	http://www.caudata.org/forum/	
23.07.2012	England	offer	*T. verrucosus*	0.0.15	20 £ each	private	http://www.caudata.org/forum/	larvae

18.07.2012	Portugal	demand	*T. verrucosus*	1.1.0		private	http://www.caudata.org/forum/	
4.06.2012	Scotland	offer	*T. verrucosus*		15 £ each	private	http://www.caudata.org/forum/	juveniles
2.06.2012	Madeira	offer	*T. wenxianensis*	0.0.1	45 €	private	http://www.caudata.org/forum/	CB2011
22.05.2012	USA	demand	*Tylototriton* spp.			private	http://www.caudata.org/forum/	
28.04.2012	England	offer	*T. verrucosus*	2.0.0	56 £ pair	private	http://www.caudata.org/forum/	
22.04.2012	USA	demand	*T. shanjing*			private	www.faunaclassifieds.com	adults
27.03.2012	USA	demand	*T. kweichowensis*			private	http://www.caudata.org/forum/	
24.01.2012	England	demand	*Tylototriton* spp.			private	http://www.caudata.org/forum/	
13.01.2012	Scotland	demand	*T. verrucosus*			private	http://www.caudata.org/forum/	male
13.10.2011	Scotland	demand	*T. taliangensis*			private	http://www.caudata.org/forum/	
1.10.2011	USA	offer	*T. shanjing*	0.0.3	35 $ each	private	http://www.caudata.org/forum/	offer at the Repticon Show, Maryland
28.09.2011	Madeira	offer	*T. kweichowensis*	0.0.2	60 € all	private	http://www.caudata.org/forum/	
20.06.2011	USA	demand	*T. shanjing*			private	http://www.caudata.org/forum/	
2.03.2011	Scotland	offer	*T. verrucosus*	1.2.0	50 £ all	private	http://www.caudata.org/forum/	
22.12.2010	USA	offer	*T. verrucosus*		30 $ each	private	http://www.caudata.org/forum/	
11.12.2010	USA	demand	*T. verrucosus, T. shanjing*			private	http://www.caudata.org/forum/	
1.12.2010	USA	demand	*T. shanjing*			private	http://www.caudata.org/forum/	
9.10.2010	USA	offer	*T. verrucosus*		25 $ + shipping	private	http://www.caudata.org/forum/	metamorphs
1.05.2010	England	demand	*T. wenxianensis, T. taliangensis*			private	http://www.caudata.org/forum/	
6.3.2010	Portugal	demand	*T. kweichowensis, T. shanjing*			private	http://www.caudata.org/forum/	
1.11.2009	USA	offer	*T. shanjing*		25 $ each	private	http://www.caudata.org/forum/	metamorphs
1.11.2009	USA	demand	*T. shanjing*			private	http://www.caudata.org/forum/	
24.10.2009	Ireland	demand	*T. verrucosus*		25 $ each	private	http://www.caudata.org/forum/	metamorphs
17.10.2009	USA	demand	*T. verrucosus*			private	http://www.caudata.org/forum/	
26.09.2009	England	offer	*T. kweichowensis*		100 £ all; 3 for 60 £	private	http://www.caudata.org/forum/	adults…
22.08.2009	USA	demand	*T. shanjing, T. verrucosus*			private	http://www.caudata.org/forum/	
7.07.2009	USA	demand	*T. verrucosus*			private	http://www.caudata.org/forum/	female
12.06.2009	USA	demand	*T. shanjing*			private	http://www.caudata.org/forum/	
14.03.2009	USA	offer	*T. shanjing*		30 $ each	private	http://www.caudata.org/forum/	small juveniles CB
4.02.2009	England	offer	*T. verrucosus*	1.1.0	40 £ pair	private	http://www.caudata.org/forum/	

29.01.2009	Canada	demand	*T. shanjing*, *T. hainanensis*, *T. taliangensis*			private	http://www.caudata.org/forum/	
29.12.2008	England	offer	*T. verrucosus*	15-20	8 £	private	http://www.caudata.org/forum/	only pick up; metamorphs
17.11.2008	USA	offer	*T. shanjing*		30 $	private	http://www.caudata.org/forum/	
28.08.2008	Belgium	offer	*T. verrucosus*		15 € each	private	http://www.caudata.org/forum/	CB2008
5.08.2008	England	offer	*T. verrucosus*	1.1.0	40 £ pair	private	http://www.caudata.org/forum/	
29.07.2008	England	offer	*T. verrucosus*		5 £ for 15 eggs	private	http://www.caudata.org/forum/	eggs
3.07.2008	USA	offer	*T. kweichowensis*	0.0.2	30 $ each	private	http://www.caudata.org/forum/	CB2007
2.06.2008	USA	demand	*Tylototriton* spp.			private	http://www.caudata.org/forum/	
10.05.2008	England	offer	*T. kweichowensis*		10 £ for 15 eggs	private	http://www.caudata.org/forum/	eggs
23.12.2007	Spain	demand	*T. shanjing*			private	http://www.caudata.org/forum/	
29.10.2007	England	offer	*T. kweichowensis*		15 £ for 3	private	http://www.caudata.org/forum/	metamorphs
1.08.2007	Netherlands	offer	*T. verrucosus*		15 € each	private	http://www.caudata.org/forum/	CB2006
22.10.2006	Germany	offer	*T. kweichowensis*			private	http://www.caudata.org/forum/	being sold at the Hamburg show
20.07.2006	USA	offer	*T. kweichowensis*	3.4.0	150 $	private	www.faunaclassifieds.com	personal add - price for the group
12.07.2004	USA	offer	*T. shanjing*		25 $ each	shop	http://www.caudata.org/forum/	member reporting from Michigan Reptile Show
28.06.2005	USA	offer	*T. shanjing*, *T. kweichowensis*			shop	http://www.caudata.org/forum/	member reporting pet shops; WC
26.06.2005	England	demand	*T. shanjing*	1.1.0		private	http://www.caudata.org/forum/	
22.06.2004	USA	offer	*T. shanjing*, *T. kweichowensis*		30 $ each	private	www.faunaclassifieds.com	adults
15.05.2003	China	offer	*T. verrucosus*		3 $ each	shop	http://www.caudata.org/forum/	member reporting another internet site

2. Additional information on Illegal trade

Wongratana (1984) reported evidence of *Tylototriton* spp. being sold in pet shops in Bangkok for 100 – 150 Baht (US$2 – US$4) without locality data of specimens. Back then the population from Thailand was considered to be *T. verrucosus*, but these specimens most likely refer to *T. uyenoi* and *T. panhai* instead (Nishikawa et al. 2013a), supporting that these species were in the trade at least three decades prior to their scientific description. Nishikawa et al. (2014) in their description paper of *T. shanorum* report the species in pet-shops from Japan from captive bred parental lineages, showing that new species were entering the pet-trade before scientific description, and that breeding techniques were already established. In fact the case of *T. shanorum* is likely traced down to extensive importations in 1980's, when this species was commercialized as *T. verrucosus* (Hernandez 2016).

Species are commonly sold locally, e.g. *T. vietnamensis* was recorded to be collected at the type locality in the Tay Yen Tu Nature Reserve (Bac Giang Province) and subsequently sold at the Yen Tu pagoda to local tourists and again in Lang Son Province for about 50.000 VN Dong (US$2) (M. Bernardes pers. com.).

Rowley et al. (2016) used Viet Nam as a case study to assess the local trade in Southeast Asian newts for the pet - and the traditional medicine -trade. Their research concluded that in Hanoi, nine out of 25 surveyed stores had information about newts as pets. Several traders offered that they could buy wild newts from local residents, if newts were being ordered. One trader from Hanoi referred to Tay Yen Tu Nature Reserve (type locality of *T. vietnamensis*) as the origin of his newts. The price of purchasing newts as pets in Hanoi was around US$13 to US$22.

A more recent market analysis in Viet Nam during March 2018 found evidence of both endemic *T. vietnamensis* and *T. ziegleri* in the trade. Animals are only available on stock from May to August, during breeding season. A pet shop in Bien Hoa, Dong Nai Province (South Viet Nam) for US$15 to US$25, both wild caught from Bac Giang and Ha Giang provinces about 1,400 and 2,000 km away from collection site, respectively (Annex IV, Fig. 4). This shop has a large online advertisement site offering *T. notialis*, *T. vietnamensis* from Mau Son Mountain wrongly advertised as *T. asperrimus*, and a series of Chinese species mistakenly identified as *T. verrucosus*, but comprising at least: *T. yangi*, *T. shanjing*, *T. pulcherrimus* and possibly *T. uyenoi* (Thailand) and/or *T. shanorum* (Myanmar) (Annex IV, Fig. 5). These animals were not only traded in Viet Nam, but also mainly exported to Thailand. In addition to pet shops *Tylototriton* species are traded using Reptile forums, social media platforms (like Facebook) and Application Programs (like the Zalo Online App.).

There is also trade within range countries, which is known to take place mostly in the direction towards China to meet the demands for traditional medicine. For example, individuals from populations of *T. ziegleri* distributed close to the border with China are collected during the breeding season and sold in large numbers to Chinese poachers (M. Bernardes pers. com.); the trade of *T. shanorum* from Myanmar to China represents a threat to this species (Wogan 2014); local people accounted for foreign visitors that collected or purchased *T. podichthys* for the pet and the medicine market 7 to 8 years before the species description (Phimmachak et al. 2015b). These "transactions" in native ranges are made for relatively low prices (less than US$1 per animal) (Rowley et al. 2010, Rowley et al. 2016). This demand is unlikely to diminish due to continual human population growth and the increased purchasing power that accompanies growing economies (Stuart et al. 2008).

The nature and scale of the trade in salamandrids has been largely unmonitored (Rowley et al. 2010). Some information comes indirectly from big sized seizures that make it into the news, like "In the confiscation from 2011 when more than 500 amphibians and reptiles were seized on their way from Asia to Hamm in Cologne, there were more than 30 *T. taliangensis* among them." (T. Ziegler pers. com.).

Figure 4. Wild caught specimens of *Tylototriton ziegleri* for sale in a pet shop in Viet Nam (Photo by H. N. Ngo).

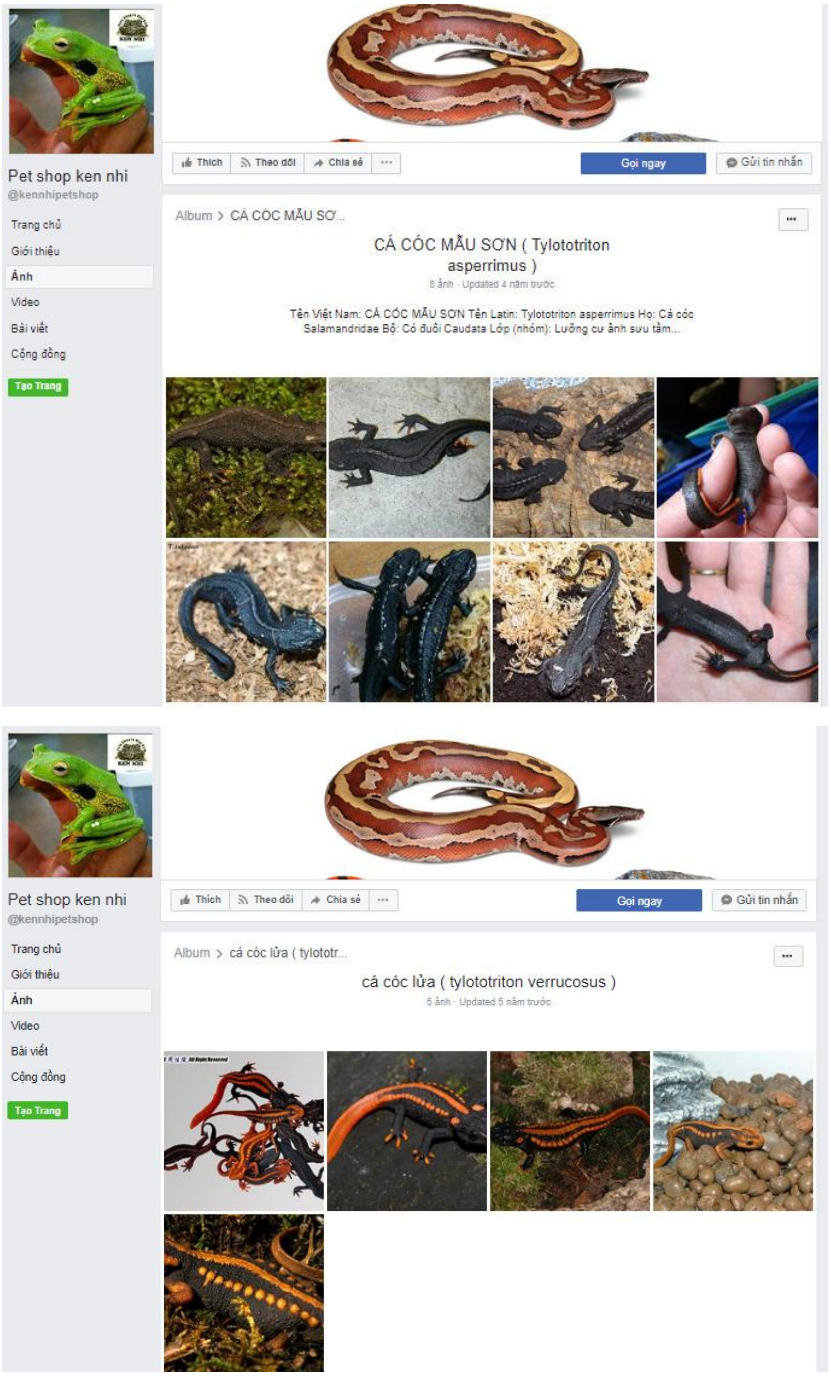

Figure 5. Online advertisements from a pet shop in Bien Hoa, Dong Nai Province, Viet Nam, offering for sale (above) *Tylototriton vietnamensis* from Mau Son Mountain, Lang Son Province mistakenly advertised as *T. asperrimus* and (below) a series of Chinese species including *T. yangi*, *T. shanjing* and *T. pulcherrimus* (the most colorful forms) and possibly *T. uyenoi* from Thailand or *T. shanorum* from Myanmar (the most darker forms) all advertised under the morphological complex *T. verrucosus*. Assessed on March 2018.

3. Additional information on Actual or Potential trade impacts

A survey on the incidence of *Bsal* and *Bd* in *Tylototriton* species across 44 breeding habitats distributed in eight provinces from North Viet Nam, revealed the presence of these pathogens in one population of *T. vietnamensis* (*Bsal* prevalence up to 1.6 %; no evidence of *Bd*), two populations of *T. ziegleri* (*Bsal* prevalence up to 6.7 %; *Bd* prevalence up to 13.3 %) and one population from *T. asperrimus* (*Bsal* prevalence up to 1.6 %; no evidence of *Bd*). The overall low prevalence of these infectious pathogens associated with the fact that there were no signs of disease in the infected populations indicates endemism of both pathogens with *Tylototriton* salamanders, supporting the hypothesis that these chytrid fungus may be endemic to Asia and Asian salamanders constitute reservoirs for naïve regions (Laking et al. 2017).