

Basic Information and Husbandry Guidelines  
for *Ingerophrynus galeatus*, Bony-headed Toad





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# 1. Characterisation

**Scientific name:** *Ingerophrynus galeatus* (GÜNTHER, 1864)

**Vernacular names:** Bony-headed Toad, Helmeted Toad; Knochenkopfröte (German)

**Snout-vent length:** max. 9 cm

**CC#Amphibians Category:** III, suitable also for beginners in CC#Amphibians

**Threat status according to IUCN Red List:** Least Concern (LC) – not endangered

**Threat status according to CITES:** none

**Threat status according to EU Species Conservation Ordinance:** none

**Threat status in its native country:** "Vulnerable" in Red List Vietnam

**Accommodation:** Humid and warm tropical terrarium with aquatic section (aquaterrarium, paludarium)

**Feeding:** Even adults prefer small feeder animals such as fruit flies, small crickets etc.

**Juveniles:** Micro-crickets, springtails etc.

**Tadpoles:** Fish flakes and algae





## 2. Why is *Ingerophrynus galeatus* a Citizen Conservation species?

The Bony-headed Toad is a typical inhabitant of the tropical lowland rainforests of Southeast Asia. Throughout its distribution range, this type of natural habitat has been becoming ever more threatened by deforestation, growing infrastructure, and expanding land use for agriculture. This petite toad may therefore serve as an ambassador species of a severely threatened, extremely species-rich type of habitat that is under threat on a global scale and in Southeast Asia in particular. Its populations are furthermore continuously reduced through collection for traditional medical purposes. In Vietnam, it is now considered "rare" (Red List Vietnam) and classified as "vulnerable" (Red Data Book Vietnam).

The Bony-headed Toad is at the same time a species that is easily maintained in captivity in that it does not grow very large and proves hardy enough to be suitable also for the beginner in amphibian keeping, thus enabling the keeper to gather enough experience in preparation for keeping more demanding species later. In this capacity, this species personifies both the environmental awareness and capacity-building aims of Citizen Conservation #Amphibians and furthers its quest to expand the husbandry capacities for endangered species.



Anna Rauhaus in the amphibian breeding room of the Cologne Zoo where Bony-headed Toads are kept as well  
| Photo: Benny Trapp / Frogs & Friends



## 3. Biology and Conservation

### 3.1 Biology

The Bony-headed Toad is distributed from Cambodia and Laos through Vietnam probably as far as Yunnan in southern China.

It is a forest-dwelling species that is most commonly encountered in the surroundings of slow-flowing, even temporary, streams and adjacent stagnant water bodies. It has a vertical distribution range from 100 to 1,300 m metres, which classifies it as a typical faunal element of lowland rainforests.

These toads grow to about 9 cm in length, with the females being larger than the males. Bony-headed Toads sport a brownish to olive greenish “military look” that renders them well camouflaged in the layer of leaf litter on the forest floor and on the gravel beds of streams.



A natural habitat of *Ingerophrynus galeatus* in the Phong Nha-Ke Bang National Park in Vietnam

| Photo: Thomas Ziegler



The vernacular name of the Bony-headed Toad makes reference to a well-formed bony ridge that runs from the eye to the parotoid gland on the upper edge of the rear portion of the skull. In large-sized females, this ridge may be continued forward as a distinct structure along the edge of the snout, passing through the nostril to the tip of the snout on either side.

These toads are predominantly crepuscular to nocturnal in their habits, even though they may often show themselves also during daylight hours in the terrarium. They are tightly bound to water bodies and will spend long periods in the water. In nature, they feed mainly on small prey such as termites and ants.

In its natural habitats in Vietnam, the mating season falls into the period from March through September, but deviations from this temporal pattern may be noted in some parts of the distribution range, depending on the climatic conditions of individual regions. At least in the northern parts of its range (including northern Vietnam from where the CC specimens originate), temperatures will decrease significantly in winter.



The sexes are readily told apart in the Bony-headed Toad: A typical female below, and a male on top

| Photo: Anna Rauhaus



## 3.2 Threats and Conservation Efforts

Being an inhabitant of rainforests, the Bony-headed Toad is threatened mainly by the ongoing destruction of its habitats. The forested areas of Southeast Asia are on a continuous decline due to deforestation and fire-clearing, the expansion of human settlements, infrastructure, and land use for agriculture. Additional threats arise from its being used in traditional medicine.

Notwithstanding all this, the IUCN currently classifies this species as “Least Concern”, i.e., not endangered, even though exact population sizes are unknown and population trends are regarded as “decreasing”. In Vietnam, which is one of the countries hosting populations, it is thought of as “rare” according to this country’s Red List and classified as “Vulnerable” (RAUHAUS et al. 2018).

(RAUHAUS et al. 2018) state that their comprehensive field research suggests *Ingerophrynus galeatus* to occur only in more or less unaltered forest areas and never in abundance, but only in the shape of individuals.

Conservation programmes beyond the scope of Citizen Conservation #Amphibians do not yet exist for this species. It benefits nevertheless from the establishment and grooming of protected zones within its distribution range, which, at present, is the most important measure for ensuring the continued existence of these animals.



## 4. Captive Husbandry



A view of a section of the amphibian room behind the public domain of the Terrarium of the Cologne Zoo where Bony-headed Toads are kept | Foto: Anna Rauhaus

The first report on the captive propagation of this species was published by RYBOLTOVSKY in 1997. The specimens used in the project Citizen Conservation #Amphibians are based upon captive-bred stock from the Cologne Zoo, more precisely from the fourth filial generation of this species propagated in human care. The Cologne breeding stock in turn was based upon eight captive-bred specimens that reached Germany from the Riga Zoo in 2014. The parental specimens of these toads were for their part captive-breds from one-locality wild-caughts that had made their way from Tam Dao in northern Vietnam to Latvia in 1998.

The recommendations provided here are derived from experiences made with keeping this species at the Cologne Zoo (RAUHAUS et al. 2018) as well as the information published by RYBOLTOVSKY (1997). There are of course various approaches to successfully keeping these animals according to their biological needs, and keepers will have to find out what works best for them. Major deviations from the husbandry conditions suggested here must be discussed upfront with the CC Office, however.





## 4.1 Restrictions and Documentation Requirements

Bony-headed Toads are not subject to any species conservation legislation in Germany and there are no legal registration requirements. Keepers participating in CC #Amphibians are requested to report the sizes of their captive populations and particular observations made to the CC Office at six-month intervals as of 30 June and 31 December.

## 4.2 Transport

Transporting these toads is best effected one by one in small plastic containers (cricket boxes) or plastic terraria (Fauna boxes) that are laid out with damp kitchen towels, Sphagnum moss, or similar materials and furnished with ventilation holes. If ventilation holes have to be made first, you will have to punch them in from the inside out as to prevent the toads from injuring their snouts on sharp-edged burrs. The transport containers are then consolidated and secured in suitably large insulation (e.g., polystyrene) boxes.



Two options for transporting Bony-headed Toads | Photos: Anna Rauhaus



## 4.3 The Terrarium

Husbandry and propagation at the Cologne Zoo was successful in an aquaterrarium of 145 x 60 x 56 cm (length x width x height) that housed eight specimens. Smaller colonies were also kept in standardized tanks of 100 x 60 x 60 cm.

These toads may be kept individually, in pairs, or in groups. In the latter scenario, attention must be paid to not having significantly more males than females in a group in order to prevent the latter from being overly stressed by the former. Otherwise these animals exhibit a peaceful disposition amongst each other.

Recommended minimum terrarium dimensions for keeping one pair based upon the "Allgemeine Haltungsrichtlinien für Anuren" ("General Husbandry Guidelines for Anurans"; Workgroup Anurans of the DGHT) are a floor space of 60 x 40 cm and a height of 40 cm.

With Bony-headed Toads living in the vicinity of water bodies and often sitting in the water, an aquatic section must not be wanting from their terrarium. Their breeding terrarium at the Cologne Zoo therefore sported a zone of 72.5 x 60 cm that was separated with a strip of glass and filled with water to a level of 10–12 cm. Greater depths must be advised against, as subsequent tadpoles may then find it difficult to reach the water surface. As inhabitants of slow-flowing streams, both larvae and adult toads prefer shallow water that should be agitated only lightly and be well oxygenated. Easily scaled exit ramps are of great importance here. A good-sized terrestrial section is required, too, because these toads also like to spend time a little distance away from the water at times. Husbandry and breeding may also be successful using a water bowl of adequate dimensions. Reproduction can be expected to produce the desired results only if there is a large body of water present, however.



A large breeding terrarium for Bony-headed Toads at the Cologne Zoo | Photo: Anna Rauhaus



The breeding terrarium at the Cologne Zoo is described in detail and sketched in RAUHAUS et al. (2018).

Various moisture-resistant substrates are suitable for outfitting the terrestrial portion. Cologne Zoo installed a drainage layer from gravel first, and topped it up with a mix of pine bark chips (sized 8–16 mm), fertilizer-free potting soil, and leaf litter humus. It must in general be ensured that the substrate will be free of any fertilizers.

For its part, the bottom substrate of the aquatic section at the Cologne Zoo consists of sand and pebbles of various sizes. Rocks of various dimensions here create underwater zones that vary in depth. Connections between the aquatic and terrestrial sections have been made from rocks, cork tubes, and imitation roots so that the toads will find it easy to exit the water. The terrarium may be furnished with tropical plants. Cologne Zoo opted for bird's-nest fern (*Asplenium nidus*), amongst others, and moss cushions.

It is important to give the terrarium structure as to enable the animals to find shelters, overlooking perch sites, as well as cover from prying eyes. This is best achieved by sensibly arranging cork tubes, roots and the like. Once accustomed to their surroundings, the toads will select their favourite spots, e.g., on certain pieces of cork, where they may also spend time during the day and enable their keeper to make observations.



A smaller terrarium (100 x 60 x 60 cm) for keeping subadult and adult Bony-headed Toads at the Cologne Aquarium  
| Photo: Anna Rauhaus

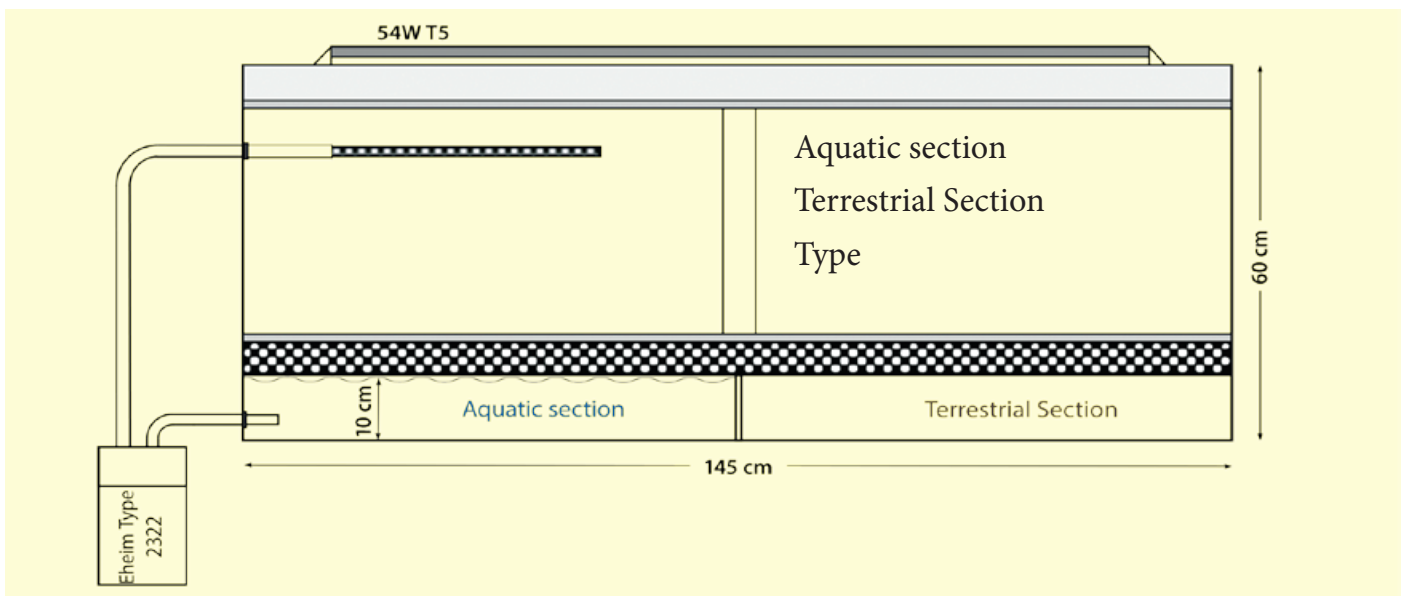


Bony-headed Toads like to perch together on elevated perches in their aquaterrarium | Photo: Anna Rauhaus



## 4.4 Terrarium Technology, Water, Temperature & Humidity Management

As has been mentioned above, the water in the aquatic section should be well oxygenated and lightly animated. At the Cologne Zoo, the water is purified by means of an external filter packed with filter mats and fleece material (Eheim Type 2322, 500 l/h). The filtered water is returned to the terrarium via a perforated outlet pipe that is mounted to the rear wall so that the water will run down that wall into the aquatic section. This will create the necessary light animation of the water and aerate it adequately. The water is topped up if and when required and replaced when its degree of pollution calls for doing so. Replenishment water here has the following attributes: pH 7.5, carbonate hardness 3, total hardness 8, conductivity 324  $\mu$ Siemens, and nitrite 0.0 mg/l (RAUHAUS et al. 2018).



Schematic plan of the breeding terrarium, complete with filter and return pipe, at the Cologne Zoo | Drawing: Ulrich Manthey / Sauria

In addition to the high levels of humidity created by the aquatic section and water trickling down the rear wall, the terrarium at the Cologne Zoo is manually misted several times each day.

Air temperatures should range between about 24 and 26 °C during the day (values of up to 28 °C are easily tolerated in the summer months), and decrease by about 1–2 °C at night. A period of drier conditions and lower temperatures during the winter months will see the toads being temporarily less active and have a stimulating effect on their subsequent reproduction.

Water temperatures at the Cologne Zoo are maintained at 23–24 °C.

The required temperatures can be reached by either placing the tank in a room that will offer the necessary conditions, or by means of the standard techniques used in terrarium and aquarium keeping (e.g., with heating mats, aquarium heaters). At the Cologne Zoo, the tank is illuminated with a 54-W T5-type fluorescent tube that will be on for 11 hours every day.



## 4.5 Feeding

Bony-headed Toads can be fed with the standard live feeder animals for amphibians. They will exhibit a predilection for relatively small prey. At the Cologne Zoo, they are fed a diet based on crickets, added to which are field crickets, *Drosophila*, and small tortrix, the latter of which may not be taken quite readily, though. All feeder animals are fed a high-quality diet before ("gut-loaded") and dusted with a vitamin-mineral powder prior to being made available for consumption. Cologne Zoo uses for this purpose: Korvimin ZVT, CalcaMineral, Nekton-MSA, Nekton-Rep, as well as Herpetal. Prey is offered twice a week. Established specimens feed readily and greedily even during daylight hours.



Bony-headed Toads are attentive hunters | Photo: Anna Rauhaus



Even adult Bony-headed Toads feed preferably on small feeder animals such as fruit flies (*Drosophila melanogaster*) | Photo: Anna Rauhaus



## 4.6 Propagation

Reproduction-related behaviour is triggered by the end of a period with drier and possibly cooler conditions of several weeks in duration during winter, after which misting must be increased in both frequency and intensity for a while.

The males will then be heard advertising after the illumination has switched off, usually from perches on rocks in or next to the water. Their calls are clearly audible to the human ear, but are not regarded as particularly noisy or “bothersome” so that there is no risk of upsetting co-inhabitants or neighbours even in an apartment.



A calling male (right) trying to attract the interest of a female | Photo: Thomas Ziegler

If a calling male succeeds in attracting a female, he will amplex her by clinging to her back. The male may sometimes remain in this position for several weeks on end, both on land and in the water. Mating is not strictly bound to a certain season so that amplexed pairs can be seen all

year round.

If a period of drier husbandry conditions is provided in winter, eggs may be laid on several occasions between February and October. The clutches are deposited in the water, usually at night or in the early morning hours and only rarely during the day.

Many clutches will typically develop only partially or fail altogether. In some rare instances, a female may also produce eggs without a male perched on her back.



Bony-headed Toads in amplexus | Photo: Thomas Ziegler

Clutches are arranged in strings of eggs when they are deposited in the water, and slung around submerged rocks. Such a string may contain as many as 2,000–3,000 individual eggs. The latter are dark grey initially, and a visible larva will develop during the course of the



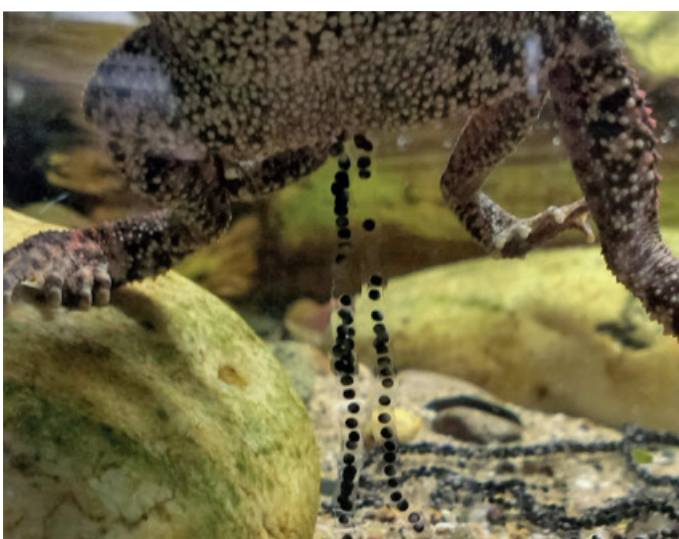
first day and be ready to hatch already on the second. Once hatched, the larvae will typically lie on their sides or on the back on the ground for about three days before starting to swim about in an active manner. They will start feeding and display first signs of growing hind legs after about six days. The tadpoles are grey in the beginning and gradually darken until they will be almost black. The coils of their guts can be seen through the translucent ventral skin.



An amplexant pair depositing eggs | Photo: Anna Rauhaus



Tadpoles with formed hind legs that are already used for walking | Photo: Anna Rauhaus



As is typical of toads, the eggs are arranged in strings | Photo: Anna Rauhaus



A toadlet in the making: A tadpole with developed front legs | Photo: Thomas Ziegler



The first baby toads go onto land after roughly one to one and a half months. They will then still have a stub of a tail and measure some 4–5 mm in length. Their skin will at this stage be relatively smooth, with the toad-specific skin structure and colour pattern forming only over the following weeks. A detailed account of the larval development can be found in RAUHAUS et al. (2018).

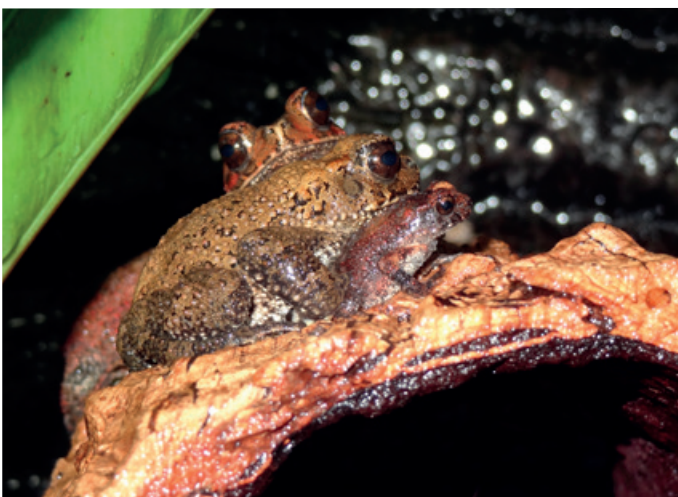
The speed of the larval development may vary greatly even under identical terrarium conditions, with some specimens taking twice as long to reach the stage of metamorphosis as their siblings from the same clutch. The juvenile toads likewise grow at vastly different paces. At Cologne Zoo, some reached lengths of ca. 2 cm within the space of just two months, whereas some siblings were still less than 1 cm at this point of time.



A juvenile toad right after going onto land, with remnants of the former tail still being evident | Photo: Thomas Ziegler



A fully metamorphosed toadlet | Photo: Thomas Ziegler



A toad family: The juveniles can be kept in the company of the adults | Photo: Anna Rauhaus



A three-month old toad with the typical juvenile colour pattern | Photo: Anna Rauhaus





## 4.7 Raising Larvae & Juveniles

If the aquaterrarium of the adults is suitably outfitted, the tadpoles may be left in the aquatic section. They may alternatively be raised in a separate aquarium that should likewise sport a gentle current, well-oxygenated water, and a water level not exceeding 12 cm. Its bottom substrate should consist of gravel, pebbles and rocks.

The tadpoles are fed with commercial fish feed (Cologne Zoo uses mainly "Sera VIPAN" and "Sera MICRON", added to which is Repashy "Soilent Green"), and Spirulina algae; they will also graze upon the algae growing on various surfaces of the aquatic section or aquarium.

It will be about four weeks before the front legs start appearing and the restructuring of the oral disc begins in the first specimens. Soon after, the first elements of the colour pattern will be noted. It is also now that skin tubercles will appear and the head become more and more "toad-like" in shape.

The baby toads may be collected and placed in small nursery containers (e.g., Fauna boxes) shortly before or after metamorphosis and later be transferred to small glass aquaria that are basically miniature copies of the tank for the adults. Alternatively, the toadlets may also be left to metamorphose together in a larger tank and be raised in a colony through the initial stage.

The depth of the water should be kept very shallow after metamorphosis and raised only once the toadlets have grown a bit. At Cologne Zoo, baby toads were also left in the terrarium of the adults, which proved that they could also be raised under these circumstances.

Freshly metamorphosed toadlets are first fed with springtails until they will have grown large enough to overpower *Drosophila* and micro-crickets as well.



Juvenile toads can be raised easily in plastic terraria like this "Fauna box" during their first week on land



A 60 x 45 x 30-cm terrarium for raising baby Bony-headed Toads | Photos: Anna Rauhaus



## 4.8 Husbandry Challenges

The fact that entire clutches fail to develop can possibly be ascribed to their not having been fertilised. Experiences made with other anurans have revealed that one plausible reason for this to be so can be an inadequate synchronisation of the sexes through the absence or a suitably distinct annual rhythm (in this case, a temporarily drier and slightly cooler environment).

Some of the toads produced at Cologne Zoo were noted to have deformed vertebral columns, which did not appear to compromise them, however. This could possibly be attributed to a disturbed bone metabolism (“metabolic bone disease”), as is observed not too rarely in the ex-situ keeping of anurans; however, the absence of typical accompanying symptoms renders this explanation rather unlikely. Options for countermeasures against problems with the bone metabolism include an improved supply with vitamins and minerals both to the breeder specimens and the tadpoles, and possibly employing lighting with UV emission. No information on the effectiveness of these measures exists as yet, though. It is also possible that genetic factors play a role here.





## 5. Further Reading

HENDRIX, R., W. BÖHME & T. ZIEGLER (2009): The tadpole of the helmeted toad, *Ingerophrynus galeatus* (Günther, 1864), from Vietnam (Anura: Bufonidae). – Herpetology Notes 2: 155–160.

OHLE, A., T.Q. NGUYEN, M.W.N. LAU & S. HAITAO (2009): *Ingerophrynus galeatus*. – The IUCN Red List of Threatened Species. Version 2014.3. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 6 May 2019.

RAUHAUS, A., C. NIGGEMANN & T. ZIEGLER (2018): Haltung, Reproduktion und Larvalentwicklung der Knochenkopfkroete *Ingerophrynus galeatus* (Günther, 1864) aus Vietnam. – Sauria 40(1): 3–24.

RYBOLTOVSKY, E. (1997): A note on the wild status and captive management of the mountain toad (*Bufo galeatus*) of Vietnam. – The Vivarium 8(6): 18–20.

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A captive-bred Bony-headed Toad  
| Photo: Benny Trapp / Frogs & Friends