

Basic Information and Husbandry Guidelines for *Agalychnis lemur*, Lemur Leaf Frog





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1. Characterisation

Scientific name: *Agalychnis lemur* (BOULENGER, 1882)

Vernacular names: Lemur Leaf Frog, Lemur Leaf Frog (German)

Snout-vent length: males usually 30–38 mm, females 38–45 mm.

CC#Amphibians Category:I

Threat status according to IUCN Red List: Critically Endangered (CR)

Threat status according to CITES: none

Threat status according to EU Species Conservation Ordinance: none

Accommodation: Rainforest terrarium for tree-dwellers

Equipment required: Climbing branches and large-leafed plants;

preferably no natural (crumbly) bottom substrate but rather a

pane of glass (oblique bottom pane with water-filled trench)

or cork sheeting or sculpted polystyrene sheeting;

lighting from fluorescent tubes, LED bars or similar

lamps, possibly with UV emission; normal terraria

or dedicated "rain chambers" for breeding;

spacious plastic containers or aquaria and

small terraria for raising larvae and metamorphs;

aerator and poss. filter system for tadpole tanks;

hose for water replacements; detritus extractor.

Feeding: Feeder animals of appropriate size

(crickets, flies, roaches, bean weevils, aphids,

firebrats etc.) that are dusted with a

vitamin-mineral powder prior to use.





2. Why is *Agalychnis lemur* a Citizen Conservation species?

The Lemur Leaf Frog clearly faces extinction in the wild. According to the International Union for Conservation of Nature (IUCN), this species is classified as “critically endangered” and thus has been given the highest threat status for species that still persist in nature.

On the other hand, *Agalychnis lemur* has been successfully maintained and propagated in private and zoo collections for a long time. Zoos in Europe have therefore established a European Studbook (ESB) for it. With the capacities of zoos being limited, and private keepers with the expertise and experience necessary for propagating it being available in particular for this species, Citizen Conservation #Amphibians is intent on augmenting and consolidating the captive population by incorporating and coordinating private keepers. Zoos and private keepers together are believed to be able to build a sustainable ex-situ population that will preserve this species for future generations.

Aside from this immediate goal of preservation, *Agalychnis lemur* appears particularly suited for Citizen Conservation #Amphibians for other reasons as well. The critical threat status of this species is due for a large part to the spread of the chytrid fungus *Batrachochytrium dendrobatidis* (usually referred to by the abbreviation Bd) that is lethal to many amphibians. Dealing with this infectious fungus is a global challenge, both in the wild and in captive collections in zoos and in private hands. CC aims at increasing awareness of this severe problem in the

broader public and strives to help prevent the further spread of Bd across terrarium populations. CC is therefore committed to adhering to a thorough protocol of bio-safety measures. The populations of *Agalychnis lemur* that have so far survived the chytrid fungus are additionally threatened by the destruction of their natural habitats. The Lemur Leaf Frog therefore is an important ambassador species that can be used to further sensitize the public to the threats arising from the continued destruction of tropical forests.

And not at least, this frog, with its fascinating appearance that many will perceive as particularly aesthetic, is highly suited for improving the understanding of amphibians and the consideration they deserve.



Leaf frog expert Tobias Eisenberg is CC's godfather for *Agalychnis lemur* | Photo: Benny Trapp / Frogs & Friends



3. Biology and Conservation

3.1 Biology

Amongst the tailless amphibians (order Anura), *Agalychnis lemur* forms part of the family of the leaf frogs (Phyllomedusidae).

The Lemur Leaf Frog is a small-sized representative of this group, but a moderately large one in the wider clade of the tree frogs that stands out by having consciously large and protruding eyes. Its females grow to 38–45 mm in length, which will render them a little larger than the males that reach only 30–38 mm. However, specimens larger than that have occasionally been found. Their physique is little massive and muscular, making these frogs appear thin and feeble. This build is in stark contrast to the large eyes – with the two unmatched characteristics providing these frogs with a lemur-like look that is further underlined by their moving about with great deliberation.

These frogs are olive green above during their nocturnal activity period, sometimes with a reddish hue, upon which small, irregularly shaped, reddish to brownish spots can be seen. They turn apple-green to yellow when they sleep during the hours of daylight. Their undersides remain whitish both at night and during the day, though. The flanks, fingers, upper arms, and toes are orange. A white line runs along the outer edges of the legs and down the lower legs. The skin is slightly granular (grainy), and there are no webbing between the fingers and toes. The

toes are greatly enlarged and end in sucker-like terminations.

Males start exhibiting a mating pad at the basal joint of the first finger from an age of about seven months, which is when they become sexually mature and from which point of time they can be reliably identified.

The Lemur Leaf Frog is an inhabitant of rainforests at moderate altitudes from 440 through 1,600 metres above sea level. Forests altered by human intervention are avoided. These frogs are active throughout the year, and particularly so during the rainy seasons.



Natural habitat of *Agalychnis lemur* in Costa Rica
| Photo: Tobias Eisenberg



Lemur Leaf Frogs are nocturnal, living in the foliage of vegetation in the vicinity of shaded forest ponds. They move about slowly, ambling over branches and leaves, and leaping only rarely. Prey is captured from a distance of up to 6 cm while holding on to the perch. The days are spent sleeping attached to the underside of a large leaf.

The breeding season sees pairs converging on the foliage overhanging a water body. The clutch of eggs is then attached to a leaf and left to develop there without further care. The resulting tadpoles eventually break free of their gelatinous spheres by lashing out with their muscular tails after a few days and drop into the water beneath. If they happen to fall onto dry land, they will be able to propel themselves with their tails across some distance to reach a pond.

The skin excretions of *Agalychnis lemur* are subject to biomedical research for they can trigger the release of insulin and seem to have an inhibitive effect on the chytrid fungus.

The original distribution range of *Agalychnis lemur* used to extend from the border between Panama and Colombia through central Panama to central Costa Rica.



Lemur Leaf Frogs sleep attached to leaves during the day | Photo: Tobias Eisenberg



3.2 Threats

The Lemur Leaf Frog used to be a fairly common sight within its relatively large distribution range in earlier times. Its populations then experienced dramatic declines due to the spread of the chytrid fungus Bd in the 1990', partly by more than 80 % within just a decade. In Costa Rica, this species is today known only from three isolated populations in the province of Limón. At least these frogs have managed to survive here, suggesting that *Agalychnis lemur* was able to develop some resistance to this pathogen before the species had vanished completely. This feeds hope for future developments, but how the situation is going to develop further remains to be seen.

An aggravating factor is that the rainforests that form the natural habitat of *Agalychnis lemur*, like everywhere else, are under pressure from deforestation. At least one of the three remaining Costa Rican populations is immediately threatened by the destruction of its habitat.

The IUCN has classified *Agalychnis lemur* as "critically endangered", which means it is threatened with extinction. This is the gravest threat category for species still persisting in nature.



The deforestation of natural habitats is the most grievous threat factor next to the chytrid fungus Bd.

| Photo: Tobias Eisenberg



3.3 Conservation Efforts

None of the remaining populations in Costa Rica is represented in a declared nature reserve. The situation is somewhat different in Panama, where some populations do occur in protected areas. As far as Colombia is concerned, the natural habitats of *Agalychnis lemur* are not protected by laws. There are no options at present to combat the threats arising from the chytrid fungus in the wild.

The 15th follow-up conference of signatory states to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES CoP15) in Doha in 2010 saw the entire genus *Agalychnis* being added to Appendix II following an application by Mexico. This decision was based on a misunderstanding, however, as Mexico had applied for such status only for five species, namely *A. annae*, *A. callidryas*, *A. moreletii*, *A. saltator*, and *A. spurrelli*. The error was rectified by the CITES Office via the "Notification to the Parties" No. 2011/042 on 4 Oct. 2011 (<https://cites.org/eng/node/1390/>, <https://cites.org/sites/default/files/eng/notif/2011/E042.pdf>), clarifying that only the five mentioned species of *Agalychnis* were now included in Appendix II. Decisions by CITES are by default converted into EU Species Conservation Ordinances, with species listed in CITES Appendix II being incorporated into Annexure B of the EU Ordinance. This automatically compels keepers to have their specimens registered with the authorities by supplying evidence of being in their rightful possession and of their specimens' legal origin. Footnote 8 of the currently valid EU Species Conservation Ordinance points out that only the five mentioned species of *Agalychnis* are considered by CITES. All this boils down to the fact that, in spite of the



Establishing secure populations in human care could make the difference to the survival of this gravely endangered species | Photo: Tobias Eisenberg

maximum threat classification by the IUCN and inclusion in its redlist, *A. lemur* is not currently covered by an internationally valid protection status. It follows that specimens in private care need not be registered, no certification of legal ownership is required, and specimens may be traded freely. Bureaucratic complications may arise from the fact that the databank of protected species used by the Bundesamt für Naturschutz (BfN), WISIA, erroneously shows the entire genus *Agalychnis* as being protected according to Annexure B of the EU Species Conservation Ordinance and thus subject to the stipulations of the Bundesnaturschutzgesetz (Federal Nature Conservation Law).

2001 saw the Atlanta Botanical Garden in Georgia/USA kick off a conservation breeding project for this species that was successful. These frogs are also multiplied in the El Valle Amphibian Conservation Center in Panama. Within the European Association of Zoos and Aquaria, EAZA, a European conservation breeding project, a so-called Studbook (ESB), was established for *Agalychnis lemur* after this species had already been part of the first DGHT/EAZA initiative for conservation breeding projects for endangered amphibians starting in 2008. It was and still is thus kept and propagated by private keepers, in zoos, and in breeding installations in Panama, the US, and in Europe.

Citizen Conservation #Amphibians aims at strengthening these zoo initiatives by offering coordinated support to private keepers and has therefore included this species into its conservation breeding programme.



4. Captive Husbandry



Tobias Eisenberg spraying his leaf frog terraria | Photo: Benny Trapp / Frogs & Friends

Agalychnis lemur has been kept in several zoos for years, but is also firmly established in private terrarium collections. It is a most unfortunate observation, however, that the degree of interest in this species, like in so many others, is subject to fluctuation so that the numbers of specimens kept and offspring produced have been declining over the past years in spite of the undiminished severity of its endangerment. Citizen Conservation #Amphibians therefore strives to re-stimulate, secure, and coordinate its conservation breeding in private hands.

The husbandry guidelines presented here are based upon the experiences of a member of the CC Advisory Board, Tobias Eisenberg, who has been studying the leaf frogs of the genus *Agalychnis* for many years and keeping *Agalychnis lemur* for more than twenty years, and who has even authored a highly recommendable book on these animals (EISENBERG & KAESLING 2012).



4.1 Restrictions and Documentation Requirements

As has been outlined in Chapter 3.3, there is no legal obligation for registering captive-kept *Agalychnis lemur* with any German authority.

CC specimens remain the property of the association Frogs & Friends e.V. that manages them for the Project Citizen Conservation #Amphibians. This also applies to all offspring produced from these. The caretaker keeper may thus not pass on or sell any of these on his own accord. These specimens must also never be associated with other *Agalychnis lemur* individuals that do not form part of the CC programme, nor must they be brought into contact with amphibians that are not certified free of Bd, Bsal, Ranavirus and parasites. Keeping them in the company of other amphibians is not permissible as a matter of principle, and exceptions from this rule require prior explicit consent from the CC Office.

Captive-produced specimens should be reported to the CC #Amphibians Office only once they have reached an age of approximately six months and it has become possible to reasonably estimate the number of them that are likely to survive into adulthood. As a general rule, quantitative updates on the population kept are to be supplied to the CC Office at half-yearly intervals (see the Einstellungsvertrag, "Agreement of Temporary Ownership"). Informative observations made, problems encountered, etc. should likewise be made known to the CC Office in order to grow the pool of knowledge relative to the husbandry and propagation of this species.

If a keeper is unable to keep the founder specimens or their offspring any longer or simply does not wish to do so, he or she is to inform the CC Office accordingly as soon as possible so that a successor keeper can be found for them.



4.2 Transport

You will normally receive your founder specimens within the Programme Citizen Conservation #Amphibians right from their breeder or previous owner. You are to take care of organising their transport, the costs of which are for your account.

Each relocation event necessitates that the animals be first examined for possible infections with the chytrid fungi Bd and Bsal as well as Ranavirus and parasites. This means that you will receive specimens that are for a very high degree of probability free of these pathogens. Certain parasites may be present, though, as not every parasite load will require treatment. The possibility that pathogens are present in spite of their having been tested for cannot of course be fully excluded. Specimens received thus can be accommodated in their intended terrarium right away, provided it has been thoroughly disinfected before, and run without animals for a while so that the new arrivals will instantly find suitable climatic conditions.

Lemur Leaf Frogs are transported one by one in small plastic boxes (e.g., cricket boxes). Here it is important that these are furnished with ventilation holes that do not have burrs on their inside walls that could possibly injure their fragile skin. These boxes are outfitted with damp kitchen towels. They are then secured against shifting within a polystyrene or cooling box that will protect the frogs from outside influences that may cause overheating or hypothermia. Transports in winter or summer may necessitate that a cooling element or a heating bottle be included in the transport box. Here, attention must be paid to keeping the elements safely away from the transport containers, e.g., by wrapping them in a towel, as to prevent the frogs from excessive heat or cold from direct contact with these temperature-active elements.



4.3 The Terrarium

Lemur Leaf Frogs are kept in a planted rainforest terrarium that will at best be taller than wide and deep. Depending on its dimensions, two or three pairs make for a decent colony. Because the calling of the males has a stimulating effect on them, there should always be at least two males present in the same enclosure. We recommend keeping groups like this in tanks of at least 50 x 50 x 60–100 cm (length x width x height).

A water bowl is an important feature of such a terrarium, and it needs to be kept clean at all times. An alternative to a bowl is a water-filled trench to which the same standards apply. It is best to do without natural soil as a bottom substrate for hygienic reasons. The frogs spend most of their time in the branchwork, on the leaves, or clinging to the terrarium walls anyway.

Essential are suitable plants, the leaves of which should be large and firm enough for these leaf frogs to use for perching. They provide the substrate on which the frogs will move about and perch when they are active at night; the days are usually spent sleeping attached to the undersides. Adequate plants are larger, tropical plants such as *Spatiphyllum*, *Scindapsus* or pothos.

Bromeliads likewise lend themselves to forming part of the vegetation in a terrarium for Lemur Leaf Frogs.



Terraria for keeping *Agalychnis lemur*
| Photo: Tobias Eisenberg



Creating a proper terrarium climate is crucial for keeping the frogs healthy and propagating them | Photo: Tobias Eisenberg



Climbing branches, roots, vines and similar objects provide structure to the tank, serve as substrates to move about on, and create shelters. It may be best to actually attach the plants to these structures and cultivate them without soil in an epiphytic manner – this will simplify keeping the ambience hygienic.

The sidewalls are preferably made as to enlarge the surface area that is effectively usable to the frogs and maybe even provide additional shelters. They can therefore be lined with sculpted polystyrene, peat or cork sheets, for example.

An important factor is that the frogs can access dry spots within their generally tropical moist environment. Ventilation surfaces should therefore be dimensioned so that most plants in the tank will have dried within two hours following a spraying session.



Large-leaved plants make for favourite perches to the frogs | Photo: Tobias Eisenberg

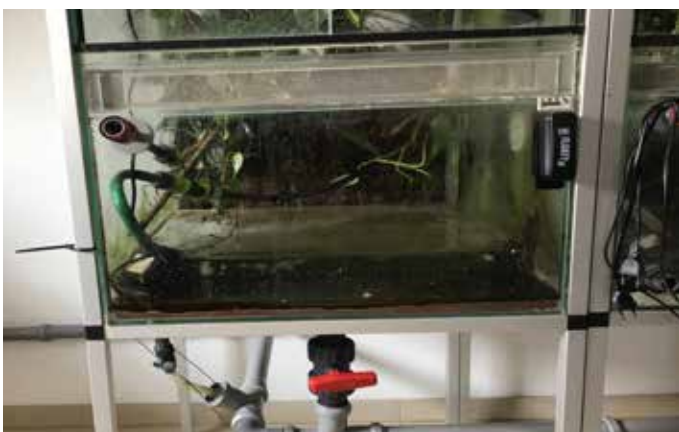


4.4 Water Chemistry, Terrarium Technology, Temperature Management

Using tap water is often possible, but the more dissolved lime it contains the more prominent the whitish deposits will be that form on the plants and glass panes. Highly alkaline water may furthermore become a problem in misting and fogging devices. If your tap water is chlorinated it should be left to mature for two days prior to being used in the terrarium. The terrarium is sprayed with water at regular intervals, i.e., once to twice every day. A fogger or misting system may be employed as an alternative or in addition. Values of relative humidity should normally range from 60 to 80 %, with an average pointer value of 70 % having proved adequate.

Lighting can be provided in the shape of fluorescent tubes, LED or energy-saving lamps. Those with an emission of UV radiation are beneficial to the frogs' health. Experience has demonstrated that one or two fluorescent tubes will suffice for a Lemur Leaf Frog terrarium of the dimensions given above.

Owing to the vertical distribution of *Agalychnis lemur*, their terrarium must not be too warm. Temperatures should in fact range around 24–26 °C during the day and decrease to 18–20 °C at night. Occasionally slightly higher values on some days in summer are tolerated as long as these do not become the rule. These temperatures are easily reached in normal living quarters by the heat emission of the lamps already. Should the terrarium be placed in a cooler spot, a heating mat or heating cable may need to be installed, the best places for which are on one sidewall of the tank or below a portion (!) of the floor pane. A timer is left to take care of unvarying lighting conditions of 12 hours of daylight.



A terrarium with an oblique bottom pane and fixed drain, as well as a pump that will provide rainy conditions during the breeding season | Photo: Tobias Eisenberg



A "downpour" system for the breeding tank that is activated only for stimulating breeding activity; in "normal" day-to-day operations, a raining system with finer sprayheads is used (see photo p. 12 right) | Photo: Tobias Eisenberg



4.5 Feeding

The commercially available types of feeder insects such as crickets, roaches, bean weevils, aphids etc. have all turned out suitable for feeding leaf frogs. Their sizes must of course match the capabilities of their intended consumers, which means they should be small enough to be overwhelmed with ease. As a general guideline, “not longer than the frog’s mouth is wide” applies. Fully grown Lemur Leaf Frogs are fed once or twice a week, and juveniles daily in the beginning.

All feeder animals are themselves fed well and a varied diet (“gut-loaded”) for at least a while before being offered in order to turn them into a nutritious meal for the frogs. This also means that crickets & Co. are cared for in appropriately spacious containers (e.g., Fauna boxes) and fed with a range of high-quality feeds like fish flakes, cereals, feeder pellets etc. and fresh produce such leafy lettuces, wild herbs, vegetables like carrots, cucumber etc. prior to their being fed to the frogs.

Right before the feeder insects are released into the terrarium, they are dusted with a vitamin/mineral powder by gently shaking them about in a tall slim container filled with some powder until they are completely covered with it. This is an important precaution against deficiency syndromes.



Even well-fed Lemur Leaf Frogs always look a bit emaciated | Photo: Tobias Eisenberg



4.6 Propagation

A precondition for successful breeding is to use only healthy, well-fed specimens.

Even though well-acclimatised specimens may spontaneously decide to reproduce at any point during the course of the year “just like that”, it will usually take a preparatory phase of keeping them cooler than normal to trigger it, in particular in the case of younger breeder specimens. According to EISENBERG & KAESLING (2012), the best results are achieved when the breeder specimens are exposed to lower temperatures of 15–17 °C for a few successive days (up to one week).

Temperature drops like this also occur in the natural habitats of these frogs, usually in conjunction with productive rains, and apparently act as triggers for ovulation. To this end, the frogs may be transferred to a smaller aquarium with no heating in a correspondingly cool room. This tank should sport a low water level into which is placed a large-leafed potted plant on which the frogs can perch. They will typically spend these “cold days” sleeping attached to the leaves also at night.

This period is then followed up with emulating intense and lasting rains, for example by having an aquarium pump cycle the water from the bottom of the tank through a perforated outlet pipe along the lid back into it (see photos on page 14). This phase may be kicked off by raising the water level with cold water first and then gradually warming it by means of an aquarium heater; this would emulate the situation in nature even more closely.



Males competing for the right to mate
| Photo: Tobias Eisenberg

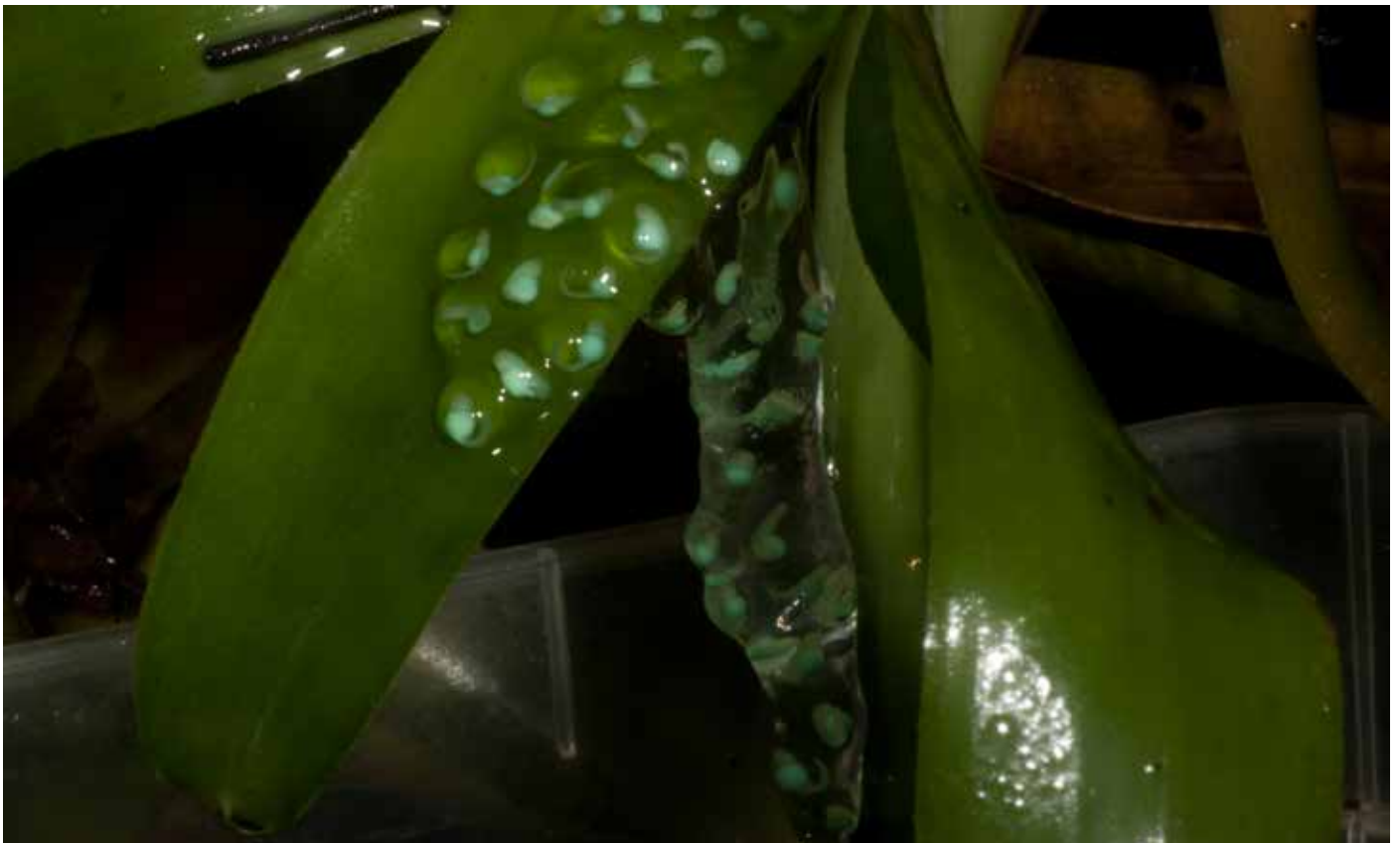


A clutch attached to a branch in the natural habitat
| Photo: Tobias Eisenberg



Following one or two nights of being rained on and water temperatures that have by now risen once more to 23–25 °C the frogs will be ready and eager to mate. The males croak with the aid of a small vocal sac in the throat that is hardly apparent otherwise. Their calls are easily heard (“tlack” or “plick”), but are hardly perceived as noisy or too loud for the human ear. Aside from the mating and advertisement calls, there are also “rain” or “wake-up” calls, and the males may furthermore emit “aggressive” calls addressed at each other, all of which can be told apart rather easily. The latter indicate that the competing males have clearly turned territorial (see the top photograph), and they can now be seen amplexing competitors or pushing them out of the way. The keeper at this stage needs to ensure that no physically inferior males are “run down” by superior ones and remove from the breeding tank specimens that clearly suffer from being suppressed thus. However, letting the males stimulate each other in this manner in general has a positive effect on them and may even be a precondition for successful reproduction.

Oviposition takes place by pairs engaging in an amplexus in which the male will hold on to the female’s back. The eggs are attached to a leaf in clusters of transparent jelly spheres. One pair may in this manner produce one to three clutches in one night, comprising altogether some 30–70 eggs. The individual eggs measure 3–3.5 mm in diameter, and the jelly envelopes surrounding them have diameters of 5–6 mm.



The clutches of eggs are commonly attached to leaves overhanging water | Photo: Tobias Eisenberg



4.7 Raising the Larvae

The clutches may now be left in the breeding tank, or the carrier leaves can be cut off and transferred to a separate “incubation tank”. The latter is better suited to the purposeful and controlled propagation that is aimed at by Citizen Conservation #Amphibians, as it will prevent the adult specimens from causing the clutches to slip off into the water beneath, or feeder insects from consuming them, or exposing the eggs to damages that may favour their becoming infected with fungi. It will furthermore reduce the risk of undetected parasites being transmitted from the adults to the later offspring. Another advantage will be that the intake of food by the juveniles is more readily monitored if they are accommodated in a separate tank. On the other hand, this species is not known to have cannibalistic tendencies, for which reason it will be safe to try and raise the young in the company of adults.

If you opt for incubating the eggs separately, the leaf carrying the clutch is cut off and placed in a box or a small aquarium with a low level of water. The leaf is mounted a few centimetres above the water surface, for example by pegging it to a halved plastic bottle (EISENBERG & KAESLING 2012). The air temperature within the “incubation box” should be about 24 °C. Placing a pane of glass at a slight angle over the top of the tank will help to keep humidity levels high while at the same preventing water condensing on the glass from dripping onto the clutch. If a clutch has not been firmly attached, its leaf may also be positioned horizontally in the incubation tank, or it may even be removed entirely, so that the eggs cannot slip into the water. Eggs falling into the water will not develop any further.



An aquarium for raising larvae
| Photo: Tobias Eisenberg



A comparison of sizes: A young and a much advanced tadpole
| Photo: Tobias Eisenberg



The larval development commences inside the egg. Just 2–3 days into it, you can see the embryo as a rod-like larva, with external gills appearing a little later. The tadpoles hatch after 7–14 days by freeing themselves from the surrounding jelly with the aid of their muscular tails and dropping into the water below. If you mist the clutch with lukewarm water at this point, you can animate the tadpoles to hatch in an almost synchronised manner. This makes sense in the wild, because the tadpoles will have the best chances of survival in the often only temporary and usually predator-infested water bodies right during rain events. It is also for this reason why you should avoid exposing the clutches to vibrations, as this could cause premature hatching and leave you with not optimally developed and thus less vital tadpoles. In nature, this premature hatching is triggered by the patter of rain and for one serves to fully exploit the favourable time right after precipitation events. For the other, it acts as an early warning system against clutch raiders such as snakes that will try to reach the eggs by crawling over the leaf and in the process create vibrations, too. In the latter scenario, it is still better for a tadpole to land in the water a little too early than to end up in the stomach of a predator.

When dropping into the water, the external gills will normally already have been resorbed, leaving the tadpole to breathe via its internal gills instead and subsequently to an ever-increasing extent via their developing lungs.

Newly hatched tadpoles are left in their “incubation tank” for the first one to two days. Its water level is gradually raised, maintaining the water temperature at ca. 24 °C. They can then be split up into larger groups and transferred to aquaria or plastic containers for further raising. Here, each larva should have 0.5–1 litre of water available to itself as a general rule. These containers do not really require illumination as long as there is some light from the surrounding room. On the other hand, if you provide artificial lighting, algae will form that the tadpoles like to graze upon. It has proven beneficial to occasionally expose the latter to the light of fluorescent tubes with a spectrum that extends into the UV range.



The tadpoles are omnivorous, but have no cannibalistic tendencies. They can often be seen positioning themselves at an angle of 45° to the water surface in search of edible matter floating on it, but will also scour the bottom for food. They are fed with ordinary commercial fish flakes, but will just as well readily take grated feeder pellets for small mammals and spirulina tablets, pollen, or pulverized stinging nettle. A vitamin and mineral preparation may be scattered in small amounts right onto the water surface where the tadpoles will consume it directly. As a general pointer, the amount of food per feeding session is right when the larvae can finish it off within a few minutes. It is therefore advisable to feed them smaller amounts several times a day rather than one large meal a day.

The quality of the water requires your close attention. Essential here are an aerator (membrane pump) for oxygenating the water and an aquarium heater that will keep the water temperature at about 24°C if this value is not reached through the room's air temperature. If the density of larvae per tank is low enough, you may come right without a filter system, but it has been found to be of advantage to oxygenate the water during filtration by employing a so-called air-lift or a sponge filter that are connected to an air pump via a hose. Replacing some of the water is required at regular intervals, and depending on the density of larvae in a tank, this may need to be done daily, every few days, or weekly. These opportunities should then be used to also remove faeces and other detritus from the bottom of the container and clean the filter. Sucking the old water off can be done as is common practice for aquaria, i.e., by means of a hose. You need to watch out for not accidentally sucking in tadpoles in the process, as they may respond to your disturbing them by frenziedly shooting about through the aquarium. A sieve at the inlet end may prevent this from happening. Also, the pore or slit width of the suction pipe of the filter must be chosen so small that no tadpoles can end up in the filter or suffer damage otherwise!

To keep the required maintenance work at a minimum, Eisenberg (2003) recommended raising the larvae in a self-made "tadpole tea" rather than in ordinary tap water. This tea is brewed by adding 28 g elder cones and 28 g peat fibres to 1.9 litres of rainwater and letting this infusion for 20 minutes. The resultant liquid is then filtered and mixed with matured tap water at a ratio of 1 : 100. This mix facilitates raising a small number of larvae without the necessity of a filter and with few water replacements.

The tadpoles take about 70–100 days before metamorphosing. During this period, they will change their colouration from an initial pale green via silvery grey when they swim about freely, to olive green at the time of metamorphosis. By the time they exit the water, they will have grown to 19–24 mm in length. The larval development is portrayed in detail in EISENBERG & KAESLING (2012).



As soon as the tadpoles have formed their front legs, they will be able to leave the water by scaling vertical surfaces such as the glass panes of the aquarium. It is therefore an absolute necessity to securely cover their tank now at the very latest. Fresh metamorphs are now also at a point where they will be at risk to die from drowning. To forestall this possibility, there must be exit aids from the water, or you may want to collect metamorphing individuals and place them in separate tanks, like a container that is positioned at an angle so that only half of the bottom pane is under water whereas the other will be dry.

Because there is always a possibility that well-acclimatised Lemur Leaf Frogs may mate without prior transfer to a "mating tank" and exposure to a cold phase of heavy "rain", it may so happen that a clutch will go unnoticed in the actual keeping terrarium. The keeper may then be surprised one day to discover small tadpoles swimming in the water bowl. If the larvae happen to fall from the leaf onto dry land rather than into the water, they will often still be able to reach its safety by whipping their muscular tails and thus propelling themselves into it. The entire raising procedure from tadpole to froglet may also be successful without major losses in the normal terrarium if only the latter is large enough and offers favourable conditions. Cannibalism has never been noted in *Agalychnis lemur*.



Tadpoles with developing hind legs
| Photo: Tobias Eisenberg



Freshly metamorphosed froglets in the company of their parents
| Photo: Tobias Eisenberg



4.8 Raising the Juveniles

Once the froglets have exited the water, they will typically stay near it for the first two to three days, first gradually resorbing what will be left of their tails. Day two or three then sees them starting to forage for food. Suitable “starter feed” exists in the shape of 1-2 day old crickets, aphids and bean weevils, and soon they will be capable of overwhelming small crickets, firebrats and the like. Baby frogs should be fed daily, and if you opt for using fruitflies, these should not be their exclusive diet. Raising the froglets necessitates high-quality food, and it is therefore all the more important that all feeder insects are fed well themselves and are fortified with a vitamin/mineral powder before they are made available.

Raising may be undertaken in small colonies in terraria that correspond both in climate and outfitting to those used for keeping the adults. Suitable nursery tanks can be fashioned from containers measuring 40 x 40 x 60 cm to 60 x 40 x 60 cm (length x width x height) for 20–40 juveniles each. Hygiene is of utmost importance at this stage, not at least because the density of specimens will be relatively high by comparison. Faeces and perished feeder insects therefore need to be removed often, and the water must be replaced at regular intervals, too. The former will be much easier if there is no bottom substrate. Instead, you may want to install a glass pane at an angle and a drain at the deepest point so that your regular spraying will already flush most detritus away.



Right after exiting the water and going onto land, the baby Lemur Leaf Frogs will first resorb their tails
| Photo: Tobias Eisenberg



4.9 Husbandry Challenges

Spoiled eggs: Infertile or perished eggs identify themselves by turning opaque, and may after a while turn mouldy. They will not normally compromise healthy eggs of the same clutch, though. It is therefore not necessary in most instances to “surgically extract” non-developing eggs.

Matchstick-legs: The dreaded under-development of the skeleton and muscles in the limbs, and the front legs in particular, is caused by a complex mix of detrimental factors. Its exact causes and processes are not fully understood to this day, and the phenomenon has also been observed in nature. Consequently, there are no failsafe prophylactic measures you could possibly take and there is no therapy either. The likelihood of this syndrome raising its ugly head can be significantly reduced by providing both the breeder specimens and the froglets with an optimised diet, though; chances are that exposure to some UV radiation also has a positive effect in the prevention of matchstick-legs.



Every relocation of specimens within the CC Programme requires the frogs to be tested for diseases to which end swabs are taken with a dry pad and submitted to a pathology laboratory

| Photo: Tobias Eisenberg



5. Further Reading

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Agalychnis lemur | Photo: Tobias Eisenberg