

Project Lifescape

8. Amphibians

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Project Lifescape aims to make available user-friendly accounts of a set of about 1500 species and higher taxonomic categories of target taxa to nurture the study of living organisms as a part of teaching biology and other related subjects in India. These accounts would be in a standardised format to promote studies whose results would be comparable and could eventually feed into a nationwide programme of monitoring a range of taxa of conservation and economic significance. These accounts are expected to be as non-technical as possible, the technical terms unavoidably used would be in bold letters. This part includes a few such accounts on amphibians.

Amphibians: Frogs and Toads

Amphibians are vertebrates that lead lives both on land and water. They are poikilothermic or cold blooded animals, implying that they are affected by the temperature in their immediate surroundings. Amphibians survive best within an ambient or surrounding temperature range of 20-30°C. However, unlike birds and mammals, which are considered warm blooded or homeothermic, amphibians are unable to internally regulate their body temperature. As a result, they spend a lot of time hiding or moving about only during the cooler part of the day or in the nights.

Amphibians use their skins to exchange gases (a form of respiration) and thus need to keep their skins moist. For this, all species of amphibians carry skin glands that secrete slimy substances, making them slippery to handle, and seek habitats that are moist. The combination of the amphibian's physiological requirements and environmental factors such as moisture, land and water and tolerable surrounding temperature limits have restricted the distribution of most species of amphibians to the warm and humid tropical parts of the world. Thus, of the nearly 4800 species of amphibians in the world, more than 50% are



India harbours 216 species of amphibians, 200 frogs, toads and treefrogs, 15 caecilians and 1 salamander.

tropical. Exceptionally, we find amphibians in deserts and mountains up to maximum altitudes of 3000-4000 m ASL (Above Sea Level).

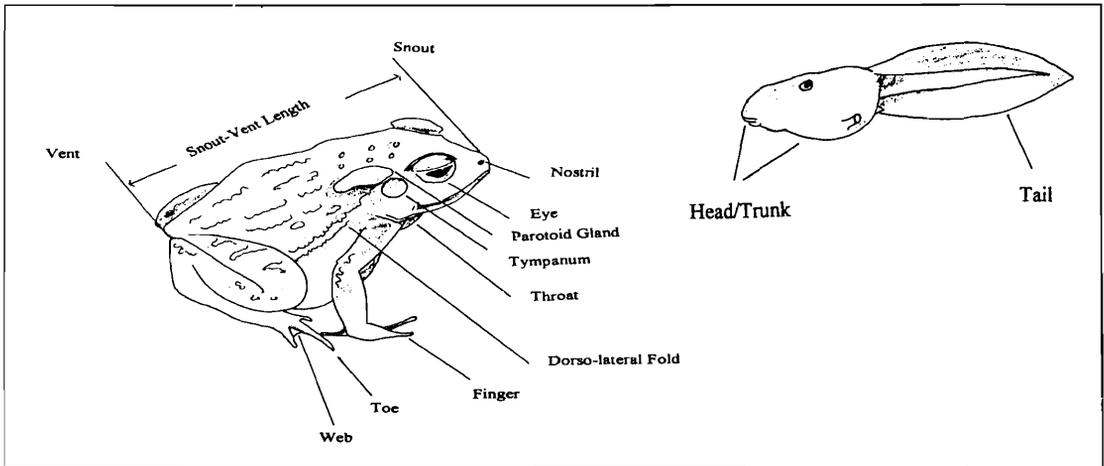
Amphibians are broadly classified into those with limbs and those without. Amongst those with limbs, there are some with tails, while the majority is tail-less. All living species of amphibians are taxonomically treated under three orders viz., Anura (frogs, toads and treefrogs), Caudata (newts and salamanders) and Gymnophiona (caecilians or limbless amphibians). The three orders of amphibians demonstrate distinct patterns of geographical distribution and species diversity too. Anurans, the most diverse of the three with regard to the number of species and ways of living are found all over the world, caudates are largely restricted to the temperate regions and caecilians are exclusive to the tropics.

What is most characteristic of amphibians is that they undergo complete metamorphosis from egg to adult stages. With the exception of caecilians, all amphibians have four distinct stages in their life histories. These include an aquatic or terrestrial egg stage, with a few exceptions, a free-living aquatic tadpole/larval stage, a terrestrial/partially aquatic young frog, toad or salamander stage and finally the adult that can reproduce. Further, all anuran adults can produce sounds, which the males effectively use at the time of courtship and reproduction.

In India, there are 216 species of amphibians. This includes one species of salamander which is found only in the Himalayas, 15 species of caecilians, most of which are restricted to the Western Ghats and 200 species of frogs, toads and treefrogs.

Anurans are what we normally see throughout India. The largest amongst Indian anurans is the bullfrog (*Rana tigerina*) exceeding a snout-vent length of 15 cm. The smallest anuran that we know in India is probably *Nannobatrachus beddomi*, a tiny frog endemic to the Western Ghats, with a snout-vent length of around 1.5 cm. The most widespread anurans in India could be





the common toad (*Bufo melanostictus*) and the Indian skipper (*Rana cyanophlyctis*). The latter is also known to reach the highest altitudes in the country.

Anurans are very important components of the earth's ecosystems — natural and man-modified, especially agricultural landscapes. They have also been well exploited by humans as food and as laboratory animals, including in medical research. Even conservative estimates made of the number of frogs and toads that are sacrificed in biology laboratories year after year are astounding. Although formally banned, the number of frogs that were consumed by the frog-leg industry over the years, has taken a heavy toll of some of the larger species. Pesticides and road kills have all contributed to the elimination of anurans not only in India but also worldwide.

Biologists have recently realised that the amphibian populations, especially anuran, are declining rapidly throughout the world and have sounded an alert through such agencies as the Declining Amphibian Population Task Force (DAPTF). Amphibian's roles in the ecosystem as agents of insect-pest control and as living indicators of ecosystem health have been greatly emphasised. In order to monitor the populations of India's amphibian species, we need to learn how to identify them in the field. The following is hence an attempt to describe in simple terms, some of India's common anurans. It is generally more

Figure 1 (left). Externals of an adult anuran.

Figure 2(right). Typical anuran tadpole.

difficult to identify the tadpoles in the field than the adult anurans. We also have so little information on the life histories of most of our amphibians that for many species the tadpoles are not yet known. Species descriptions that follow are hence primarily of adults, with appropriate clues to identify tadpoles, wherever known.

Common Indian Toad

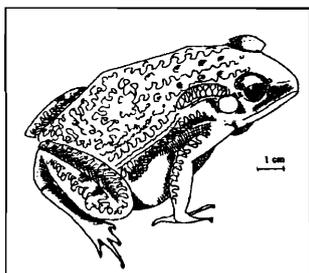
Bufo melanostictus: Bufonidae

A medium to large-sized anuran (maximum snout-vent length 13 cm; female larger), yellow, brown or black with darker markings commonly seen in gardens and human inhabited areas. The dry sand-paper-like warty skin, short limbs and generally slow movements readily identify the species in the field.

Morphological Characters: Adults average around 8 cm in snout-vent length. Colouration is highly variable even within a single population. Individuals varying from plain yellowish brown to almost black, with or without prominent darker markings are commonly seen. The entire dorsal surface of the toad is warty, each wart bearing a black tip (hence the specific name *melanostictus*). The parotid glands, behind the eyes on either side, are large and hardened, appearing like elongated bean seeds. The external ear or **tympanum** is distinct and almost as large as the eye. Fingers are free of webbing. Toes bear feeble webbing. The underside is dirty white, rough in texture and often spotted with brown or black. In breeding males, the throat tends to develop an yellow-orange hue.

Calls are characteristic, loud and monotonous often in chorus after the rains. The typical call is a series of drumming: 'creo-o-o, cro-ro-ro-ro-ro'. When calling males are picked up, individuals utter mild croaks and grunts. Calling males have an external vocal sac that inflates below the chin like a balloon.

Tadpoles are blackish and seen in large shoals in muddy and green waters. They swim about rapidly shaking the tails. Groups



come to the surface along the sides of pools and feed on floating organic matter. The common Indian toad lays black eggs in long strings characteristically floating amongst vegetation in water, hence easily identified. Similarly, the tadpoles are also easily identified due to their dark colour, short tail and stumpy build, gregariousness and widespread nature. Freshly metamorphosed toads are blackish.

Related Taxa: Sixteen species of *Bufo* are known within Indian limits. Of these, *B. melanostictus* is the most widespread. Juvenile stages of most species are confusingly similar. Calls are the most easy means of distinguishing the adults in the field.

Distribution: All over India, including the islands. The species ascends the hills and is known from over 2000 m ASL in the Western Ghats. Elsewhere the species is seen in Sri Lanka, Nepal, Bhutan, Pakistan, Bangladesh, South China, Southeast Asia and Philippines.

Habitat: Generally an inhabitant of human modified landscapes extending even to beaches as adults. Occasionally enters secondary forests and forest edges, especially in the drier areas.

Adult Behaviour: Adults emerge after dark from their hideouts (flower pots, stones, logs, leaf litter, etc.) and hop about slowly. The general posture is more upright than most other species of anurans keeping the body at an angle of about 45° above the surface. The adults are often attracted to lights where they scramble for live insects, earthworms, etc. On the whole, the species is very clumsy in movement both on land and in water. When held, the adults kick with their hind-legs trying to free themselves, often uttering some chuckling sounds. White secretions ooze out of the skin glands emitting a musty odour. The secretion is toxic and on continuous contact with the human skin can cause itching. In fact, dogs that try to pick the common Indian toads in their mouths quickly drop them and profusely salivate. Breeding adults often change colour to yellow, at least on their throats. Several males call from the waterside or



in gardens. On finding a female, many males cling on to her and scramble about in shallow water. This is a common sight after the rain where the species occurs.

Life Cycle: The common Indian toad is a late breeder compared to many other species of common frogs with which it shares its habitat. After the first rains, most common anurans start calling. The toad calls only after the third or fourth day and in incessant chorus. Many males cling to a female in an attempt to fertilize the string of eggs she lays. This form of physical attachment by the male to a female in anurans is generally known as amplexus. During this time, the successful male kicks away all competing males and fertilises the eggs. Since the amplexing pairs move about in water, the strings of eggs are spread all over the pool. Tadpoles hatch and tend to become free-living after about 48 hours of egg-laying depending on the temperature of water. Young toads emerge from water after 35-50 days. These are less than 1 cm snout-vent length. Large armies of freshly metamorphosed toads can be seen all over the place wherever the species is common. Survival of these young toads to adulthood is very limited. It may take more than a year for the common toad to attain sexual maturity.

Human Significance: A species of Indian anuran widely used in laboratory studies. It is also collected in considerable numbers to feed reptiles in zoos and parks. Common Indian toads being a commensal of humans do a lot of service in consuming insects in and around us. Individuals that choose to take shelter within buildings are often reluctant to leave.

Local Names: Kuno-bang, Kat-kate-bang (Bengali); Chori thavala (Malayalam); Sori Thavalai (Tamil).

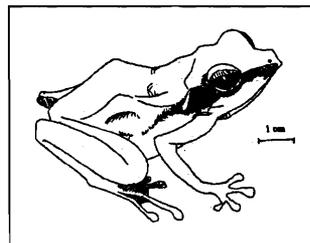
Common Treefrog or Chunam Frog

Polypedates maculatus: Rhacophoridae

A medium sized treefrog (snout-vent length 3.5-8.5 cm; females

larger) commonly seen within human habitation, looking pale and ghostly sticking to windows, walls and other smooth domestic surfaces, including furniture. Laterally placed bulging eyes that really glitter and long, slender limbs with enlarged tips on both fingers and toes readily distinguish treefrogs from all other species of anurans.

Morphological Characters: The adult common treefrog averages around 5.0 cm snout-vent length. Although variable in colour and with the ability to change colours blending with the different backgrounds, the treefrog most commonly appears sandy brown with a few darker markings when active. A prominent black band runs from the nostril over the **tympanum** to behind the fore-limb. The rear surface of the thigh is a mixture of brown and yellow patterned beautifully with spots and streaks. Undersides are generally a delicate pinkish white. When at rest, especially on walls within human residence, the treefrog appears pale and almost white, thus earning its common Indian name 'chunam frog' which literally means 'limestone frog'. Fingers are free of webbing, whereas the toes are half-webbed. The **tympanum** is a little smaller than the eyes.



Calls are loud. The most typical call is a series of 'ta-ta-tak-tak' or 'da-da-da-da' or 'do-do-do-do'. When several males call in chorus, it may sound like the distant noise of fireworks.

Tadpoles are grey with a black mouth and laterally placed eyes. They have suctorial mouths enabling them to stick to surfaces under water. The long filamentous tail aids quick movement of the tadpoles.

Related Taxa: Four species of *Polypedates* are known within the Indian limits. *Polypedates leucomystax* is rather similar in overall appearance to *P. maculatus*. *P. leucomystax* however is larger and has its toes almost fully webbed.

Distribution: Throughout India, up to about 2000 m ASL in the Western Ghats. The species is also known from Sri Lanka, Nepal and Bangladesh.

Habitat: Human habitation, cultivated areas and secondary forests. Urban dwellings including multi-storied buildings have become favourite habitats of the common treefrog.

Adult Behaviour: Like the common Indian toad, the common treefrog is a commensal of man often deciding to take permanent residence inside buildings, especially bathrooms. Attempts to get rid of the common treefrog from its residence can be rather difficult. Homing instincts are very strong in the species. Adults generally rest with legs drawn under the body, making them look like dry leaves or just patches of dirt. When active, the long sticky limbs, bulging eyes and flexible body enable the treefrog to move about much more like a lizard than an anuran. Movement on ground is clumsy, yet the animal leaps with grace and agility from heights. Breeding males call in chorus from low bushes or fences bordering pools of water. A single male clings to the back of the female while in **amplexus** and the female goes about with him on board till she finds a suitable place to build a nest and lay eggs.

Life Cycle: The common treefrog breeds with the first rains. The species builds a foam nest, which is like a globe (6-9 cm diameter) above water and the eggs are deposited within this nest while the male simultaneously fertilizes them. The number of eggs deposited within each nest may be around 500. Tadpoles drop from the nest into the water in about 4-5 days. They develop rapidly and metamorphose after 50-60 days. Freshly metamorphosed treefrogs are about 1.6 cm snout-vent length.

Human Significance: A commensal of humans and can be useful as much as geckos are in ridding our living spaces of insect pests. Due to its lean and lanky nature, it is believed widely in India that if the common treefrog leaps on a child, the child will contract polio.

Local Names: Gecho-bang, Kath-bang, Shepo-bang, Ashapa-bang (Bengali); Maragappe (Kannada); Mara thavala (Malayalam); Therai (Tamil).



Indian Pond Frog or Green Frog

Rana hexadactyla: Ranidae

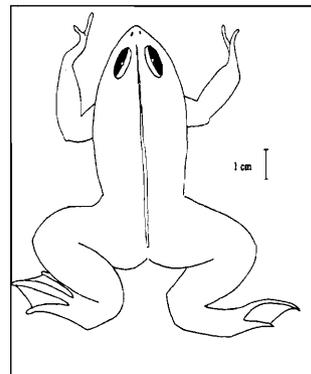
A medium to large sized olive green-green frog (snout-vent length 5-14 cm; females larger), commonly seen in ponds and tanks with dense growth of aquatic plants. White undersides and fully webbed toes are further clues to identify the species in the field.

Morphological Characters: A typical smooth skinned frog averaging around 7.5 cm in snout-vent length. The colour varies from blackish-olive green (almost like fresh cow-dung) to bright leaf green. The latter form is more common on the east coast of India. Younger individuals show black, white and yellow longitudinal streaks along the green dorsal surface. This pattern usually disappears with age. Many individuals bear an yellow dorsal stripe. Fingers are devoid of webbing. The web on toes in adults is often bright yellow. **Tympanum** is distinct and almost equal in diameter to the eye. The green frog spends more time in water partially submerged amidst aquatic vegetation. When resting on land it adopts a rather flat posture. A clumsy head-first dive into water when disturbed is a characteristic of the species.

Calls are low and characteristically jerky sounding 'pui-ta-tak'. This call accompanied by sounds of splashing water helps in identifying the species even in darkness.

Tadpoles possess slender and long tails. They are olive green with black markings on the trunk. These markings may also be silvery in individuals. The underside is whitish and the tail less boldly marked than the trunk. Being bottom feeders, the tadpoles are not often seen unless in clear water.

Related Taxa: The family Ranidae is one of the largest families of anurans. In India there are about 90 species included in the family. Due to taxonomic inconsistencies and frequent revisions, the exact number of species that can be treated under the genus *Rana* is not certain. Generally, the most closely related taxon is



Rana cyanophlyctis. *R. cyanophlyctis* can however be differentiated from *R. hexadactyla* by size, colour, call (most important) and behaviour.

Distribution: Throughout India excluding the northern and northwestern states. Elsewhere the species occurs in Sri Lanka and Bangladesh. The species is not found at higher altitudes. It may occur at elevations of around 700 m ASL.

Habitat: Most freshwater bodies that sustain submerged aquatic plants, paddy fields, canals and rainwater ditches.

Adult Behaviour: The adults are largely aquatic, floating amongst plants with the lower half of body and hind limbs submerged in water. The green frog dives under water when disturbed often staying beneath for long durations. Populations along the east coast of India, especially around the city of Chennai are known to subsist largely on a vegetarian diet consisting of aquatic plants. Calling males are territorial, chasing away other males in their vicinity (hence the splashing noise when calling). Breeding behaviour is not fully known.

Life Cycle: Adults lay eggs after the first rains and throughout the rainy season. Females may lay as many as 2000 eggs in ponds or paddy fields. Metamorphosed frogs are 1.7-2.7 cm snout-vent length. They are normally more aquatic than the adults staying within clumps of floating plants.

Human Significance: A species most persecuted by humans in laboratories, especially in undergraduate colleges in south India. The green frog was also much in the frog-leg trade in the past. Adults are known to consume fish and hence treated as a nuisance in fish hatcheries and rearing ponds.

Local Names: Sabuj-bang, Angule-bang (Bengali); Pachca thavala (Malayalam); Thavalai, Pachchai Thavalai (Tamil).

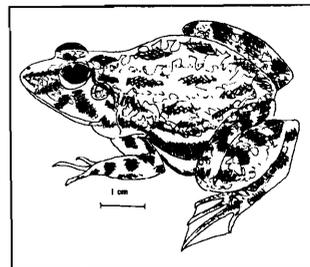
Water Skipper or Skipper Frog

Rana cyanophlyctis: Ranidae



A medium sized aquatic frog (2-7 cm snout-vent length; females larger) readily identified by its ability to float placidly in water, widespread nature and incessant calling more or less throughout the year.

Morphological Characters: Adults average around 4 cm in snout-vent length. The general colouration is olive brown with occasional patches of green especially around the head and sides. Bold black spots are distributed throughout the dorsal surface being more intense on the hind limbs. The most characteristic feature is a white band along the sides and along the rear margin of the thighs. Underside is white. Very rarely, individuals bear a pale mid-stripe along the back. Skin is generally smooth. Eyes are more dorsally placed than being lateral. **Tympanum** is prominent and as big as the eye. Fingers are free of webbing. Toes fully webbed.



Call is very typical and frequently heard throughout the year wherever the species occurs. It is a series of sharp and loud 'pit-ti-ti-ti-ti-ti' followed by 'prik-prik..'. The latter is heard more often when rival males keep chasing each other in water. While calling from water, the external vocal sacs are visible on the sides of the throat.

Tadpoles are rather stoutly built, sandy to olive brown with a large number of black spots on the trunk and long tail. They are bottom feeders and can be easily seen in clear flowing waters.

Related Taxa: On the whole, the skipper is very similar in appearance to the green frog from which it is differentiated by its ability to float in deep water (for instance wells) with all the limbs on the surface and in level with the body.

Distribution: Throughout India up to over 3000 m ASL in the Himalayas. Also found in Sri Lanka, Pakistan, Afghanistan, Iran, Saudi Arabia, Nepal, Bangladesh, Myanmar, Thailand and the Malay Peninsula.

Habitat Preference: A widespread species inhabiting all sorts of freshwater habitats including wells, streams, paddy fields, etc., in the forest as well as urban landscapes. Unlike other species of anurans, the skipper freely floats even in deep and open waters.

Adult Behaviour: Adults most commonly float placidly in open water. When disturbed they tend to 'skip' along the surface with a splashing noise. This behaviour has given the species its common English name. The species is very aggressive and territorial while in water. On land it adopts a low and flattened posture at rest. Many skippers can be seen along the edges of tanks and ponds, sometimes even on the backs of buffaloes that wallow in such waters. On disturbance, many frogs leap and skip across the water surface to safety.

Life Cycle: Breeding starts with the first shower and can continue throughout the rainy season. Pairs in amplexus can be seen in water surfacing and submerging together. The eggs are deposited as a slimy mass amidst the grass and along the edges of muddy pools. While the tadpole stage of the species is known, the time taken for development and metamorphosis is not known. Metamorphosed frogs are 1.5-2 cm and resemble the adults.

Human Significance: Larger individuals were harvested by the frog-leg industry and are being used in laboratories. Being an inhabitant of paddy fields, the skipper can be of considerable help in controlling insect pests. Tadpoles are known to compete for food with prawns and fish in outdoor fish hatcheries and ponds.

Local Names: Jal-bang, Kati-kati-bang (Bengali); Kinattu thavala, Makri, Koopa Mandookam (Malayalam); Thavalai, Kinatru Thavalai (Tamil).

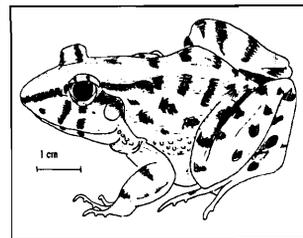
Paddy Field or Cricket Frog

Rana limnocharis: Ranidae

A small to medium sized semi-aquatic frog commonly seen in fields, meadows, lawns, swamps and other wetlands all over the

country. Most individuals bear a prominent pale yellow-white mid-dorsal band on the back.

Morphological Characters: Adults average about 3 cm in snout-vent length. The general colour is sandy to olive brown with a number of black stripes and spots on the body and limbs. A pale mid-dorsal stripe is frequently seen in many populations. Underside is white, the throat in adult males being blackish. Snout is long and pointed. Eyes are laterally placed. **Tympanum** is noticeably smaller than the eye. Dorsal skin is folded and wrinkled longitudinally and is quite obvious when the frog is resting in drier situations. Fingers and toes are long. While the fingers are free of webbing, toes have variable amount of webbing often reaching half their lengths. Cricket frogs are probably the most variable of Indian frogs in colour, size and morphological features.



Calls are shrill and insect-like sounding as ‘creak-creak-creaka-creaka-creaka..’ in quick succession and rather incessantly. Commonly heard in the nights around paddy fields and wetlands. External vocal sacs, which are blackish, visible when males call.

Tadpoles are bottom-feeders. They are whitish with small black spots on the trunk and tail. Tadpoles turn darker at the time of metamorphosis. They are slender with a blunt tail that is black-tipped.

Related Taxa: *Rana limnocharis* is considered by taxonomists as a member of a complex group of very similar species. Many species in the forests and hills of India closely resemble *limnocharis* making field identification very difficult. *Rana keralensis*, *Rana nilagirica*, *Rana andamanensis*, *Rana mysorensis* and *Rana sahyadrensis* are some of the species, which closely resemble *Rana limnocharis*.

Distribution: Throughout India ascending the hills to over 2000 m ASL in the Western Ghats. Elsewhere the species occurs in Sri Lanka, Pakistan, Nepal, Bangladesh, Myanmar through South-east Asia till the Philippines.

Habitat: It occurs in all forms of wetlands and moist grasslands, both in forests and urban landscapes. The species has a great preference for moist grass.

Adult Behaviour: Adults generally rest during the day amidst the grass and leaf litter and leap to safety when disturbed. If along the edge of water, they jump in only to surface elsewhere. The species does not like to stay submerged in water for long. Unlike the former two species of ranid frogs, *R. limnocharis* is well adapted to terrestrial life and can move very fast on ground leaping unexpectedly fast and high when pursued. During breeding, besides calling males, many pairs can be seen in amplexus beside the water.

Life Cycle: The species breeds with the rains. In the hills, one may see tadpoles of the species more or less throughout the year. The eggs are in floating masses appearing as black spots in a clear jelly. Egg masses may contain as many as 1000 eggs. Freshly metamorphosed frogs are 1-1.5 cm snout-vent length. The time taken for metamorphosis may be around 60 days.

Human Significance: Larger individuals are collected as food locally in many parts of India, especially in the north-east. Being an inhabitant of paddy fields, this frog can be of use in control of insect pests.

Local Names: Ji-ji-bang (Bengali); Kappe (Kannada); Vayal thavala (Malayalam); Thavalai (Tamil).

Methods of Survey: Adult anurans can be surveyed in the night and most easily after the rains. The following can be simple means of estimating species diversity and populations locally.

Visit ponds where frogs are calling during the early part of the night with battery operated lamps and tape recorders. Mark a small area and count the number of anurans within this area. If this is repeated over a few days through the breeding season at the same location, a fair estimate of the diversity and population of breeding anurans can be obtained. Repeated visits are

necessary as some frogs appear late during the season. Taped calls will be helpful in confirming the identities of the species in the site.

Walk along paddy fields, streams and tanks during the day and record the anurans resting along the edges.

During the first rains, a large number of anurans attempt to cross roads in search of appropriate breeding places. These can be counted while riding a vehicle in the nights. Many of these unfortunately get crushed under the wheels. These may be counted in the mornings.

Tadpoles can be counted in clear water by submerging grids of wooden or metal frames at the bottom. After allowing them to settle, the tadpoles that feed within can be counted periodically. In clear waters, groups of tadpoles can also be photographed from above. If so, it may be helpful to place a scale at the bottom. When many such photographs are compared, average densities can be estimated. However, in most cases, tadpoles live in murky waters and will have to be fished out using dip nets.

Tadpoles of the same batch metamorphose simultaneously. Large armies of freshly metamorphosed toads and certain species of frogs emerge from water over a couple of days. At such sites, counting will be possible.

Suggested Students Projects: Students may visit ponds where anurans are breeding. The calls may be recorded without any special devices than merely a portable tape recorder. Courtship and amplexus can be easily observed under battery operated lamps. Students may also study anurans under street lamps. When there is a mass emergence of winged termites, many species of burrowing anurans come to feed. Mud pots furnished with aquatic plants kept in good light can serve as simple aquariums where tadpoles can be reared. Eggs or tadpoles may be collected and reared in these. Tadpoles readily feed on cooked rice, bread, hard-boiled egg yolk, boiled fish and meat.

Suggested Reading

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