

**“TAXONOMIC IDENTIFICATION OF CLASS:AMPHIBIA AND FEW
MINOR PHYLA ”**



Project Work By

SANDRA BABU

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Under the guidance of

DR.SOJA LOUIS

Head of the Department , Zoology,

St.Teresa's College (Autonomous), Ernakulam

Kochi-683011

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CERTIFICATE

This is to certify that the project entitled “**TAXONOMIC IDENTIFICATION OF CLASS: AMPHIBIA AND A FEW MINOR PHYLA**” is an authentic record of dissertation work carried out by Ms. Sandra Babu under my guidance and supervision in fulfilment of the requirements of Bachelor’s Degree in Zoology, St. Teresa’s College(Autonomous), affiliated to M.G. University under the faculty of zoology. This is purely an independent work done by her under my guidance.

Dr. Soja Louis
Head of the department
Department of Zoology
St. Teresa’s College
Ernakulam

Dr. Soja Louis
Assistant Professor
Department of Zoology
St. Teresa’s College
Ernakulam

Examiners

- 1.**
- 2**

DECLARATION

I hereby declare that the project work entitled “**TAXONOMIC IDENTIFICATION OF CLASS: AMPHIBIA AND A FEW MINOR PHYLA**”, is an authentic record of research carried by me under the supervision and guidance of Dr. Soja Louis, Assistant Professor, Department of Zoology, St. Teresa’s College (Autonomous), Ernakulam in partial fulfillment of the requirement of the B.Sc. Degree in Zoology at St. Teresa’s College(Autonomous), Ernakulam and that no part of it has previously formed the basis for award of any degree, diploma or associate ship in any University.

SANDRABABU

REGISTER NO:AB20Z00010

SIGNATURE

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SYNOPSIS

The project is entitled **“TAXONOMIC IDENTIFICATION OF CLASS: AMPHIBIA AND A FEW MINOR PHYLA”**. The aim of this project is to study, identify and classify amphibian and minor phyla. It is done by observing, analysing their morphology, naming and classifying them according to their characteristics. In taxonomic studies, specimens are generally collected from fields and in the case of minor phyla; they can be collected from fresh water or marine sources. There are a lot of constraints in the collection of species especially vulnerable or endangered species due to conservation or ban in certain areas. In this project, specimens were taken from the museum and identified up to species level which is more relevant and convenient for study. The dry specimens were cleaned and kept neatly in bottles and labelled accordingly. The wet specimens were observed, refilled with formalin in the bottles and labelled accordingly. Preserving the specimens also plays an important role. It helps us to store them for several years so that they can be used for studies in the future. Preservation is done by storing the specimens in formalin. It has been found out that most of these specimens were identified only up to genus level. In this project, it mainly focuses on identifying the specimens up to species level. Taxonomy is an important field of Zoology as most of the organisms in this world is not yet identified or registered. The main aim of this project, is to contribute to the ever- growing field of Zoology. This project helped to understand and study the diversity of amphibia and minor phyla and their importance in nature.

INTRODUCTION

Amphibians are four-limbed and ectothermic vertebrates of the class Amphibia. The word 'Amphibia' is derived from two Greek words 'Amphi' which means 'both' and 'Bios' which means 'life'. All living amphibians belong to the group Lissamphibia. They inhabit a wide variety of habitats, with most species living within terrestrial, fossorial, arboreal or freshwater aquatic ecosystems. Amphibians occur widely throughout the world, even edging north of the Arctic circle in Eurasia; they are absent only in Antarctica, most remote oceanic islands, and extremely xeric (dry) deserts.

Frogs and toads show the greatest diversity in humid tropical environments. Salamanders primarily inhabit the Northern Hemisphere and are most abundant in cool, moist, montane forests; however, members of the family Plethodontidae, the lungless salamanders, are diverse in the humid tropical montane forests of Mexico, Central America, and northwestern South America. Caecilians are found spottily throughout the African, American, and Asian wet tropics.

The three living orders of amphibians vary greatly in size and structure. The presence of a long tail and two pairs of limbs of about equal size distinguishes newts and salamanders (order: Caudata) from other amphibians, although members of the eel-like family Sirenidae have no hind limbs. Newts and salamanders vary greatly in length; members of the Mexican genus *Thorius* measure 25 to 30 mm (1 to 1.2 inches), whereas *Andrias*, a genus of giant aquatic salamanders endemic to China and Japan,

reaches a length of more than 1.5 metres (5 feet). Frogs and toads (order Anura) are easily identified by their long hind limbs and the absence of a tail. They have only five to nine presacral vertebrae.

The West African goliath frog, which can reach 30 cm (12 inches) from snout to vent and weigh up to 3.3 kg (7.3 pounds), is the largest anuran. Some of the smallest anurans include the South American brachycephalids, which have an adult snout-to-vent length of only 9.8 mm (0.4 inch), and some microhylids, which grow to 9 to 12 mm (0.4 to 0.5 inch) as adults. The long, slender, limbless caecilians (order Gymnophiona) are animals that have adapted to fossorial (burrowing) lifestyles by evolving a body segmented by annular grooves and a short, blunt tail. Caecilians can grow to more than 1 metre (3 feet) long. The largest species, *Caecilia thompsoni*, reaches a length of 1.5 metres (5 feet), whereas the smallest species, *Idiocranium russeli*, is only 90 to 114 mm (3.5 to 5 inches) long.

MAJOR CLASSIFICATIONS OF AMPHIBIA:

The Amphibians are classified into three orders, which are listed below:

1. Apoda (Gymnophiona or Caecilia)
2. Urodela (Caudata)
3. Anura (Salientia)

The species in Anura includes frogs, toads, salamanders, and newts. Amphibians like frogs, toads, salamanders - are a critical part of nature as both predator and prey. Many species of amphibians migrate to new habitat and breeding locations during the spring and summer months and often at night. They eat insect pests which is a benefit to agriculture and help control mosquitos which benefits human health. Their moist, permeable skin makes amphibians' vulnerable to drought and toxic substances, so they are

exceptional indicators of ecosystem health. The health of important ecosystems, including forests and wetlands that provide habitat for amphibians, contributes billions of dollars to the economy by supporting the fishing and timber industries and recreation. It aims to highlight the importance of amphibians in the ecosystem and bring awareness about these unique animals. One must note that scientists study amphibians to understand the impact of climate change and environmental issues, as these species of animals are highly sensitive to changing temperatures.

Amphibians are also an important part of the food chain, providing food resources for numerous animals from snakes to raptors. In some parts of the U.S., frogs are also harvested for human consumption and many people enjoy listening to frogs on a summer's night as they are greeted by a chorus of sounds coming from multiple species' frog calls.

The Roles of Climate, Phylogenetic relatedness, introduction effort, and reproductive traits in the establishment of non-native reptiles and Amphibians. The amphibian invitrome: Past, present, and future contributions to our understanding of amphibian immunity.

Most of these phyla comprise inconspicuous and little known animals, which appeared before the two main streams of evolution diverged. They are often grouped together as the 'minor' phyla, presumably because their members are generally too small to be seen with the naked, human eye. In spite of their inconspicuous habits, these animals are both numerous and important, as members of food chains or as parasites of economic, veterinary or medical importance.

The Minor phyla

The minor protostome coelomates include six phyla: Sipunculoidea, Echiuroidea, Priapulioidea, Tardigrada, Pentastomida, and Pogonophora. The lophophorates are a group of four phyla (Phoronida, Brachiopoda, Entoprocta, and Bryozoa) which all share the same type of food collecting organ, the lophophore.

"The minor phyla must play a crucial role in the unravelling of the greatest of all mysteries surrounding the history and fossil record of animal life, the Cambrian explosion," the period when (probably) all extant phyla are thought to have emerged (from 590 to 505 million years ago).

Each minor phyla contains a few species such as *Nemertinea* (Ribbon worms), *Nemotomorpha* (Horse-hair worm) *Rotifera* (wheel animalcule), *Acanthocephala* (Spiny-headed worms), *Chaetognatha* (Arrow-worms) etc. The members that falls under this phylum are generally marine and are sessile and free swimming type. They exhibit the property of bilateral symmetry and are diploblastic type of animals. Phylum Ectoprocta were known as Bryozoa (moss animals) for a long time. Ectoprocts are found both in marine and freshwater and most, with very few exceptions are colonial. Eg. *Tubiporella* spp. 4000 species. Phylum Brachiopoda: The Brachiopoda, or lamp shells, is an ancient group. Fewer than 30 species survive today, but the 30 000 fossil species have been described. Brachiopods are all attached bottom-dwelling marine forms that mostly prefer shallow water. Eg. *Hemithyris*.

In the present scenario taxonomical identification is necessary to find out new specimens and for studying the existing specimens. The present study

focuses on the taxonomy of amphibian and few minor phyla available in the museum.

REVIEW OF LITERATURE

Studies among all vertebrates showed that the amphibians are scientifically sentient, feeling beings (Lambert et al., 2022; Jones, 2012). In this review of the scientific literature, they applied 10 of the 42 sentience keywords and were searched for returned results (stress, pain, distress, suffering, emotion, fear, anxiety etc).

Tan et al, 2023, reviewed and found that no improvement was there in the geographical and taxonomic bias in habitat fragmentation studies for both reptiles and amphibians compared to earlier studies (Fardila et al. 2017). In particular, it has been found that an overall increase in the number of studies measuring species richness and abundance throughout the years while population-level and genetics studies are still lacking in developing countries.

Williams et al, 1963 in their research paper found out that all that the modern amphibia are clearly related. It has been suggested that the three living orders constitute a natural monophyletic group-the infra-class Lissamphibia sensu Gadow. Finally an attempt is made to determine the Paleozoic ancestors of the recent amphibians, but the available evidence is contradictory and inconclusive. In 1920, Watson found out that although fossil of amphibia have long been known and have been the subject of innumerable and often very excellent works, no systematic attempt to determine their relations to one another and to the living amphibia has ever been made.

Liang-Hu et al., 2003, from his paper in the recent years, observed that mitochondrial DNA has been widely used as a useful marker system in numerous phylogenetic analyses of vertebrate relationships because of its maternal mode of inheritance and relative lack of recombination. The complete mitochondrial genomes reported in vertebrates consist of about 70 species of mammals, 32 species of birds and reptiles, and 116 species of fishes (Saccone et al., 1999, Arnason et al., 2002).

Indriani et al., 2023 in their paper studied on amphibians have been consumed as an alternative protein source all around the world due to their delicacy. This review provides a comprehensive discussion on various BPs (bioactive peptides) isolated and identified from different amphibian skins or skin secretion and their biological activities. Additionally, multiple constraints against the utilization of amphibian skin and secretions are reported

Martin et. al., 2023 in their research paper on the hair cells of the inner ear in frogs perform the first step in the active detection of sound, converting mechanical deflections into electric signals that are transmitted to neurons. They contain mechanically gated ion channels, which open upon an increase in the tension of attached protein structures. The goal is to provide insights into the physics behind the remarkable sensitivity of the auditory system.

Mason et al., 2020 studies based on this module contains information for a three part series introducing the venom system in reptiles and discussing it in an evolutionary context. Streicher et al., 2022 studies were based on the assessment of pupil shape in nearly 1300 extant amphibian species and observed the greatest diversity among anurans. Finally, it has been

suggested that the shape and orientation of a constricted pupil may correspond to the shape and orientation of increased photoreceptor density in the retina (i.e. retinal streaks), but this hypothesis is not supported in the birds, mammals and fishes examined to date (Douglas, 2018). Bentley in 1969 found out that Vasotocin was 40 to 50 times more active than oxytocin in promoting water retention in *Bufo marinus*. The results are discussed in relation to the evolutionary adaption of Amphibia to terrestrial life.

In 1962, Szarski studies on the origin of land vertebrates is still a constant subject of discussion and it was concluded by using all the evidences that it speaks in favor of a monophyletic origin of land vertebrates. Macgregor et al., 1983 was based on the studies of cell volume determined in 18 species of amphibian, ranging in C value from 1.4 pg to 62 pg DNA. These data are discussed in relation to genome expansion and increase in cell cycle time as factors in the evolution of the Amphibia.

Minor Phyla

Brueggeman in 2023 found out that the volume covering the phyla Ctenophora (comb jellies, ctenophores), Nemertea (proboscis worms), Bryozoa (bryozoans), Brachiopoda (brachiopods, lamp shells), Chaetognatha (arrow worms), Annelida (polychaetes, bristle worms, featherduster worms, leeches). This field guide aims to facilitate underwater/topside field identification from visual characters of organisms seen by scuba divers based on Ross Island, Antarctica. Most organisms were identified from photographs with no specimen collection, so these identifications are to the taxonomic level possible from photographs.

Strathmann et al., 1983 at present there are many animal phyla that contain only a few species. The existence of these small phyla can be used to test assumptions about speciation and extinction in multicellular animals. They first model the number of species in a monophyletic clade with a birth and death process that assumes rates of speciation and extinction are constant. The authors also discuss a model in which speciation and extinction rates depend on the number of species in a clade. This alternative model can account for the persistence of phyla with few species to the present and predicts a short duration for phyla that did not exceed a threshold number of species.

Tang et al.,2023 find out that the introduction *Sipunculus nudus* is the most known species in the genus *Sipunculus*, distributed in tropical and subtropical coastal waters. Methods PacBio sequencing and Illumina sequencing were combined for whole-genome sequencing of *S. nudus*. A total of 80391 protein-coding genes are annotated in this genome. Furthermore, gene family evolution analysis shows that *S. nudus* belonged to Mollusca or was close to Mollusca, but distinct with Annelida. Transcriptome analysis indicates the involvement of complex developmental events in larve. Combined transcriptome with LC-MS/MS analysis, the results showed that gene expression and metabolic level involved in the inosine, arginine and proline biosynthesis of *S. nudus* during different growth stages were significantly changed

METHODOLOGY

Materials required:

Formalin, Bucket, Water, Gloves, Bleach, Scale, Thread, Bottle of dry and wet specimens.

Method:

39 specimens placed in the museum classified under phylum Amphibia and Minor phyla were observed. On the basis of their morphological features, specimens are identified and classified into different genus and species. First of all, the specimens were taken out of the museum and their external features were observed and scientific measurements were taken. The old formalin solution of wet specimens were removed and fresh formalin solutions were added in the ratio of 10:1 after cleaning the specimen bottles. The specimens were then put back into the bottle. Finally labels were tagged on each specimen bottles which contain information on their Kingdom, Phylum, Class, Order, Family, Genus and Species.

OBSERVATION AND RESULT

Amphibians are four-limbed and ectothermic vertebrates of the class Amphibia. Total 16 specimens has been identified from the class of Amphibia.

1. *Euphlyctis cyanophlyctis*

Kingdom: Animalia

Phylum: Chordata

Class: Amphibia

Order: Anura

Family: Dicroglossidae

Genus: *Euphlyctis*

Species: *E. cyanophlyctis*



Habitat:

This frog is a very aquatic species found in marshes, pools and various other wetlands.

Description:

Head moderate; snout scarcely pointed; canthus rostralis indistinct; interorbital space much narrower than the upper eyelid; tympanum distinct, about two-thirds the size of the eye. Fingers slender, pointed, first not extending beyond second; toes webbed to the tips, which are pointed, fourth

not much longer than third or fifth; outer toe strongly fringed; subarticular tubercles small; inner metatarsal tubercle small, conical, much like a rudimentary toe. The tibiotarsal articulation usually reaches a little beyond the eye. Skin with small tubercles and units above, and with more or less distinct rows of pores. Brown or olive above, dark spotted or marbled; two blackish streaks on the hinder side of the thighs, seldom absent; beneath often speckled with blackish. Male with two external vocal vesicles, opening by two slits beneath the angles of the mouth. They have the ability to leap out of the water from a floating position. Cross section of the phalanx bones shows annual growth rings which may be used for determining age.

Geographical occurrence:

Euphlyctis cyanophlyctis is a common microglossid frog found in South Asia. It is known under numerous common names, including Indian skipper frog or skittering frog. They are often seen at the edge of bodies of water with their eyes above the water. They noisily move away from the shore when disturbed, giving them their common name. They are rarely seen outside water.

2. *Ranoidea splendida*

Kingdom:	Animalia
Phylum:	Chordata
Class:	Amphibia
Order:	Anura
Family:	Hylidae



Genus: *Ranoidea*

Species: *R. splendida*

Habitat:

Magnificent tree frogs are native to the Kimberley region of Western Australia, and enter caves and rock crevices during the day. Much like the other large tree frogs in Australia, White's tree frog and the giant tree frog, they inhabit areas near humans, and can be found around buildings and in toilets, showers, and water tanks. They are nocturnal, and will hunt and breed at night. Breeding probably takes place during the wet season.

Description:

The magnificent tree frog is a relatively large tree frog, with the males reaching a length (SVL) of 10.4 cm (4.1 in) and the females 10.6 cm (4.2 in).[1] They have olive to bright green dorsal surfaces with white ventral surfaces. The undersides of the feet and legs are bright yellow. Most specimens have white or sulphur-coloured dots on their backs, of varying densities. The older magnificent tree frogs can be distinguished from White's tree frogs by the presence of very large parotoid glands, which cover the entire top of their heads and droop over their tympana. The tympanum is large, almost the size of the eye, and partially obscured by the parotoid gland.

Geographical occurrence:

It has a limited range, only occurring on the north-western coast of Australia in the Northern Territory and Western Australia.

3. *Uraeotyphlus oxyurus*

Kingdom: Animalia

Phylum: Chordata
Class: Amphibia
Order: Gymnophiona
Clade: Apoda
Family: Ichthyophiidae
Genus: *Uraeotyphlus*
Species: *U. oxyurus*



Habitat:

Uraeotyphlus oxyurus is a fossorial species that is associated with humus-rich, loose, moist soil. It has been recorded from moist evergreen forest, agricultural land, and rural gardens at elevations up to 1,500 m (4,900 ft) above sea level. It is probably oviparous and has terrestrial eggs and aquatic larvae.

Description:

This species has a relatively thick body, a narrow head, and a short tail. It can grow to 300 mm (11.8 in) in total length, including the tail (up to 7.5 mm (0.3 in)). Its body is dark brown with a whitish tail tip. The chin and throat are light brown. Its eyes are very small but distinct and surrounded by a white ring. The tentacles are placed close to and below the nostrils, which are visible from above.

Geographical occurrence:

It is endemic to the Western Ghats in Kerala and Tamil Nadu, southern India.

4. Ichthyophis longicephalus

Kingdom: Animalia
Phylum: Chordata
Class: Amphibia
Order: Gymnophiona
Clade: Apoda
Family: Ichthyophiidae
Genus: *Ichthyophis*
Species: *I. longicephalus*



Habitat:

The species is found in Kerala (known from Silent Valley National Park).

Description:

Ichthyophis longicephalus, the long-headed caecilian, is a species of caecilian in the family Ichthyophiidae. The body is dark violet-brown, and lighter ventrally. A yellow lateral stripe starts at the neck and reaches the tip of the tail. Small, yellow patches are also found on the sides of the neck. A midventral line formed by the breaking of annuli ventrally extends from the neck to the vent. The long head has distinct eyes, and the tentacles are close to the lip and eye. The nostrils are at the tip of the snout and visible from above. The upper jaw overhangs the lower jaw.

Geographical occurrence:

The species is found in Kerala (known from Silent Valley National Park).

5. *Desmognathus ochrophaeus*

Kingdom: Animalia
Phylum: Chordata
Class: Amphibia
Order: Urodela
Family: Plethodontidae
Subfamily: Plethodontinae
Genus: *Desmognathus*
Species: *D. ochrophaeus*



Habitat:

Its natural habitats are temperate forests, rivers, intermittent rivers, freshwater springs, and rocky areas.

Description:

Desmognathus ochrophaeus is a medium-sized salamander that can grow to about 10 cm in length. Adults are brownish and can have a widely variable coloration pattern. Usually, it has a light stripe down the back, with a row of dark spots on the centre and flanked by dark pigments. As in all members of the genus, the hind legs are larger and stouter than the front legs. This species belongs to the "lungless salamander" family (Plethodontidae), whose adults must keep their skin moist to breathe. It is a somewhat terrestrial salamander that can be found under stones, logs, and bark near springs, streams, and other areas where the ground is saturated with water.

Geographical occurrence:

It is found in the eastern United States, as well as in the Niagara Glen Nature Reserve adjacent to the lower Niagara River in southern Ontario, and a single disjunct population in southern Quebec, Canada.

6. *Uperodon systoma*

Kingdom:	Animalia
Phylum:	Chordata
Class:	Amphibia
Order:	Anura
Family:	Microhylidae
Genus:	<i>Uperodon</i>
Species:	<i>U. systoma</i>



Habitat:

Uperodon systoma is a fossorial species that buries itself in soil. These frogs have been observed in a number of habitats, such as dry forests, plains, gardens, and agricultural areas. Adults are only seen during the summer monsoons; otherwise they retreat into the soil. Feeding may be concentrated to rainy nights during the monsoon when termites emerge to swarm. Breeding takes place during the monsoon rains when the males call from the banks of streams and paddy fields. Eggs are laid in water where they float.

Description:

Uperodon systoma have a very stout appearance with a relatively small head. They grow up to 64 mm (2.5 in) in snout-vent length. *Uperodon systoma* lack

teeth. This unusual feature is probably related to their diet that (after metamorphosis) consists mainly of termites and ants, with other insects appearing in smaller numbers. It is suggested that in capturing such small but spatially clustered prey items teeth would not be very useful; instead, the prey are gathered using their tongue.

Geographical occurrence:

Uperodon systoma is a species of narrow-mouthed frog found in Pakistan, India, Nepal, and Sri Lanka.

7. *Necturus lewisi*

Kingdom:	Animalia
Phylum:	Chordata
Class:	Amphibia
Order:	Urodela
Family:	Proteidae
Genus:	<i>Necturus</i>
Species:	<i>N. lewisi</i>



Habitat:

Neuse River waterdogs prefer streams with a flow >10 cm/s and streams which are >15 m wide, and 1 m deep, in areas with a hard clay or soil bottom, as well as areas covered with leaf bed. Larvae are found in leaf beds of quieter waters which provide cover and foraging sites. Males have a greater range than females, and both males and females increase their range after moderate rains, but decrease it after large rains (>40 mm). During winter,

adults mostly reside in burrows in banks or under granite rocks. During the spring, the adults move to large bedrock outcrops or beneath large boulders in relatively fast current where nesting occurs. Home ranges contain animal burrows or rock overhangs, large flat rocks on sand gravel substrates, and slack-water areas with detritus mats of leaves. Adults create retreats by shoveling sand and gravel with their snouts, forming a cavity beneath cover objects.

Description:

N. lewisi has a rusty-brown dorsal side with many large, bluish-black spots. The ventral side is dark brown to grey and also spotted. The snout is compressed dorsally and truncated. The tail is compressed laterally and ridged. Each hind limb has four toes, and the gills are dull red and bushy. Sexually active males have swollen cloacae and two enlarged cloacal papillae that point to the rear. Males and females are of a similar size. Adults measure 16.5–28.0 cm from the tip of snout to tip of tail. The young possess a dorsal stripe along their length along with a dark lateral stripe. Males and females become sexually mature after reaching 102 mm and 100 mm, respectively, measured from tip of the snout to the posterior end of the cloaca. This size is reached at 5.5 years in males and 6.5 years in females.

Geographical occurrence:

The range of the Neuse River waterdog is limited to the Neuse and Tar-Pamlico River basins in the eastern Piedmont and Coastal Plain of North Carolina.

8. *Bufo bufo*

Kingdom: Animalia

Phylum:	Chordata
Class:	Amphibia
Order:	Anura
Family:	Bufo
Genus:	<i>Bufo</i>
Species:	<i>B. bufo</i>



Habitat:

The common toad is found at altitudes of up to 2,500 metres (8,200 ft) in the southern part of its range. It is largely found in forested areas with coniferous, deciduous and mixed woodland, especially in wet locations. It also inhabits open countryside, fields, copses, parks and gardens, and often occurs in dry areas well away from standing water.

Description:

The common toad can reach about 15 cm (6 in) in length. Females are normally stouter than males and southern specimens tend to be larger than northern ones. The head is broad with a wide mouth below the terminal snout which has two small nostrils. There are no teeth. The bulbous, protruding eyes have yellow or copper coloured irises and horizontal slit-shaped pupils. Just behind the eyes are two bulging regions, the paratoid glands, which are positioned obliquely. They contain a noxious substance, bufotoxin, which is used to deter potential predators. The head joins the body without a noticeable neck and there is no external vocal sac. The body is broad and squat and positioned close to the ground. The fore limbs are short with the toes of the fore feet turning inwards. At breeding time, the male develops nuptial pads on the first three fingers. He uses these to grasp the female when mating. The hind legs are short relative to other

frogs' legs and the hind feet have long, unwebbed toes. There is no tail. The skin is dry and covered with small wart-like lumps. The colour is a fairly uniform shade of brown, olive-brown or greyish-brown, sometimes partly blotched or banded with a darker shade. The common toad tends to be sexually dimorphic with the females being browner and the males greyer. The underside is a dirty white speckled with grey and black patches. Common toads can live for many years and have survived for fifty years in captivity. In the wild, common toads are thought to live for about ten to twelve years. Their age can be determined by counting the number of annual growth rings in the bones of their phalanges.

Geographical occurrence:

After the common frog (*Rana temporaria*), the edible frog (*Pelophylax esculentus*) and the smooth newt (*Lissotriton vulgaris*), the common toad is the fourth most common amphibian in Europe. It is found throughout the continent with the exception of Iceland, the cold northern parts of Scandinavia, Ireland and a number of Mediterranean islands. These include Malta, Crete, Corsica, Sardinia and the Balearic Islands. Its easterly range extends to Irkutsk in Siberia and its southerly range includes parts of northwestern Africa in the northern mountain ranges of Morocco, Algeria and Tunisia. A closely related variant lives in eastern Asia including Japan.

9. *Duttaphrynus melanostictus*

Kingdom: Animalia

Phylum: Chordata

Class: Amphibia



Order:	<u>Anura</u>
Family:	<u>Bufo</u> nidae
Genus:	<u>Duttaphrynus</u>
Species:	<i>D. melanostictus</i>

Habitat:

They have been recorded from sea level up to 1,800 m (5,900 ft) altitude, and live mostly in disturbed lowland habitats, from upper beaches and riverbanks to human-dominated agricultural and urban areas. They are uncommon in closed forests.

Description:

The top of the head has several bony ridges, along the edge of the snout (canthal ridge), in front of the eye (preorbital), above the eye (supraorbital), behind the eye (postorbital), and a short one between the eye and ear (orbitotympanic). The snout is short and blunt, and the space between the eyes is broader than the upper eyelid width. The ear drum or tympanum is very distinct and is at least as wide as two-thirds the diameter of the eye. The first finger is often longer than the second and the toes are at least half webbed. A warty tubercle is found just before the junction of the thigh and shank (subarticular tubercle) and two moderate ones are on the shank (metatarsus). No skin fold occurs along the tarsus. The “knee” (tarsometatarsal articulation) reaches the tympanum or the eye when the hind leg is held parallel along the side of the body. The dorsal side is covered with spiny warts. The parotoids are prominent, kidney-shaped, or elliptical and elongated, and secrete milky white Bufotoxin. The dorsal side is yellowish or brownish and the spines and ridges are black. The underside is

unmarked or spotted. Males have a subgular vocal sac and black pads on the inner fingers that help in holding the female during copulation.

Geographical occurrence:

Asian common toads occur widely from northern Pakistan through Nepal, Bangladesh, India Bangladesh, India including the Andaman and Nicobar Islands, SriLanka, Myanmar, Thailand, Laos, Vietnam, Cambodia, southern China, Taiwan, HongKong and Macau to Malaysia, Singapore, and the islands of Sumatra, Java, Borneo, Anambas and Natuna Islands.

10. *Rhacophorus lateralis*

Kingdom: Animalia

Phylum: Chordata

Class: Amphibia

Order: Anura

Family: Rhacophoridae

Genus: *Rhacophorus*

Species: *R. lateralis*



Habitat:

The species has been reported from sholas in Eravikulam National Park and Kudremukh National Park, plantation in Kodagu and Chikkamagaluru in Karnataka and Wayanad in Kerala and adjoining subtropical evergreen forests in the southern Western Ghats. It is endemic to this region. It has often been reported in association

with *Rhacophorus malabaricus*.

Description:

The frog is slender with a short head and snout and a distinct canthus rostralis. The nostrils are nearer to the tip of the snout than to the eye. The eyes are large with the tympanum half the diameter of the eye and a distinct supratympanic fold. The fingers and toes have an enlarged disc possessing circummarginal grooves. The upper portion (dorsum) is smooth, the belly is granular and a characteristic dorsolateral yellow streak on either side of the upper body from the nostril to the groin is distinctive. Colour variations even within the same individual have been reported and have been attributed to stress. Repeated handling reduces colour change. Green and brown colour variations have been described. Individuals with green upperparts have the green colour interspersed with fine, sky-blue spots. The individuals with brown dorsal have darker brown spots; no demarcating blue line borders the yellow stripe from the eye to the groin.

Geographical occurrence:

Found in many parts of the Western Ghats around southern Karnataka and northern Kerala.

11. *Amphiuma tridactylum*

Kingdom:	Animalia
Phylum:	Chordata
Class:	Amphibia
Order:	Urodela
Family:	Amphiumidae



Genus: *Amphiuma*

Species: *A. tridactylum*

Habitat:

Often is found in bottom land marshes and lakes, bayous, cypress sloughs, and streams in hilly regions. Frequently occupies crayfish burrows.

Description:

The three-toed amphiuma looks rather eel-like, with an elongate, dark gray-black, or brown colored body, and tiny vestigial legs. A large salamander, one record sized individual was recorded at 41.25 inches [106 cm.], but 18-30 inches [45.7-76 cm.] is the typical size of an average adult. They have small, lidless eyes, and gill slits. They have four tiny legs each with three toes and an average of 62 costal grooves.

Geographical occurrence:

The three-toed amphiuma is found in the United States, along the Gulf of Mexico states, from Alabama to Texas, and north to Missouri, Arkansas, Tennessee and Kentucky.

12. *Rhacophorus malabaricus*

Kingdom: Animalia

Phylum: Chordata

Class: Amphibia

Order: Anura

Family: Rhacophoridae

Genus: *Rhacophorus*



Species: *R. malabaricus*

Habitat:

It is found in various habitats such as primary forests, secondary forests, plantations, and urban habitats. It can be found on leaves of trees near stream or river banks. During the breeding season, they move to trees hanging above water bodies into which their tadpoles drop.

Description:

This frog has a body length of about 10 cm (4 in), making it one of the largest moss frogs. Males are smaller than females. In preserved specimens, the back turns purplish blue. The belly is more coarsely granulated – particularly under the thighs – and pale yellow. There are skin fringes between and along the long limbs, and a triangular skin extension at the heel. The webbing between fingers and toes is large and orange-red. The vomerine teeth are arranged in two straight or slightly oblique series touching the inner front edge of the choanae. The snout is rounded but not very wide, about as long as the diameter of the orbit, the canthus rostralis is bluntly-angled, and the loreal region is concave. The nostrils are located nearer to the end of the snout than to the eyes. The interorbital space is broader than the upper eyelid. The tympanum measures about 60–70% of the diameter of the eye. The disks of fingers and toes are large, about the size of the tympanum; the subarticular tubercles are well-developed, also. The tibio-tarsal articulation reaches at least to the eye, at most top the nostril.

Geographical occurrence:

The Malabar gliding frog is found in the Western Ghats of India and has been described in the states of Tamil Nadu, Kerala, Karnataka, Goa, and Maharashtra.

15. *Amblystoma tigrinum*

Kingdom: Animalia

Phylum: Chordata

Class: Amiphibia

Order: Urodela

Family: Ambystomatidae

Genus: Ambystoma

Species: A.Tigrinum



Habitat:

Their habitat is like that of most neotenic species—a high altitude body of water surrounded by a risky terrestrial environment. These conditions are thought to favor neoteny. However, a terrestrial population of Mexican tiger salamanders occupies and breeds in the Axolotl's habitat.

Description:

As salamanders (member of the amphibian order Caudata), axolotls lack scales and claws, have the presence of a tail in all larvae, juveniles, and adults, and have forelimbs and hindlimbs that are typically about the same size and set at right angles to the body (Larson et al., 2006). They have the characteristically slender bodies, short legs, long tails, and moist, smooth skin of salamanders. Salamanders generally have a biphasic life cycle, typified by an aquatic larval stage with external gills and a terrestrial adult form that utilizes lungs or breathes through moist skin (Larson et al. 2006). However, axolotls typically remain aquatic throughout life, not undergoing metamorphosis to a terrestrial adult but retaining their juvenile

features. They can undergo transformation to the adult form under certain experimental and environmental conditions. Axolotls are members of the *Ambystoma tigrinum* (Tiger salamander)-complex, along with all other Mexican species of *Ambystoma*. *Ambystoma*, the mole salamanders, is a genus of salamanders endemic to North America. The genus has become famous due to the presence of axolotl, widely used in research, and the tiger salamander (*Ambystoma tigrinum*, *Ambystoma mavortium*). A sexually-mature adult axolotl, at age 18–24 months, ranges in length from 15–45 cm (6–18 inches), although a size close to 23 cm (9 inches) is most common and greater than 30 cm (12 inches) is rare. Their heads are wide, and their eyes are lidless. Their limbs are underdeveloped and possess long, thin digits. Males are identified by their swollen cloacas lined with papillae, while females are noticeable for their wider bodies full of eggs. Adult axolotls possess features typical of salamander larvae, including external gills and a caudal fin extending from behind the head to the vent. Three pairs of external gill stalks (rami) originate behind their heads and are used to move oxygenated water. The external gill rami are lined with filaments (fimbriae) to increase surface area for gas exchange. Four gill slits lined with gill rakers are hidden underneath the external gills. Axolotls have barely visible vestigial teeth, which would have developed during metamorphosis. The primary method of feeding is by suction, during which their rakers interlock to close the gill slits. External gills are used for respiration, although buccal pumping (gulping air from the surface) may also be used in order to provide oxygen to their lungs. Axolotls have four different colours, two commonly occurring colours and two mutants. The two naturally occurring colours are wildtype (varying shades of brown usually with spots) and melanoid (black). The two mutants colours are leucistic (pale pink with black eyes) and albino (golden, tan, or pale pink with pink eyes).

Geographical Occurrence:

Axolotls commonly are kept as pets in the United States, Great Britain (under the spelling *Axlotl*), Australia, Japan, and other countries. Axolotls should not be confused with waterdogs, the larval stage of the closely related tiger salamanders (*Ambystoma tigrinum* and *Ambystoma mavortium*), which is widespread in much of North America which also occasionally become neotenic.

16. *Pseudacris ocularis*

Kingdom:	Animalia
Phylum:	Chordata
Class:	Amphibia
Order:	Anura
Family:	Hylidae
Genus:	<i>Pseudacris</i>
Species:	<i>P. ocularis</i>



Habitat:

This species occurs in a wide variety of ephemeral and semi-permanent wetlands in the southeastern Coastal Plain and favors grassy areas in and around cypress ponds and similar sites. It is commonly found on lower tree trunks and foliage up to a height of 1 m or more; males prefer these sites as calling perches. This species possesses the ability to rotate its head and neck more than other frog species, which is thought to aid in searching for prey or looking for a more suitable perch before leaping. The majority of food items

consist of arthropods that are associated with leaf litter and/or soil—springtails, ants, thrips, palpigrades, etc.

Description:

P.ocularis is the smallest frog in North America, only reaching a maximum head-body length of 19 mm (0.75 in). It is normally pale brown, but can have a green or pink tinge. This species is further characterized by a variable dark stripe which runs through each of the frog's eyes and down the sides of its of its body. The Latin term *ocularis* translates to "of the eye" in reference to this bold ocular stripe.

Geographical occurrence:

It is currently the smallest North American anuran and occurs in a wide variety of ephemeral and semi-permanent wetlands.

MINOR PHYLA

Most of these phyla comprise inconspicuous and little known animals, which appeared before the two main streams of evolution diverged. They are often grouped together as the 'minor' phyla, presumably because their members are generally too small to be seen with the naked, human eye. Out of these only 4 classes has known to been identified.

Phylum Bryozoa:

1. *Bowerbankia imbricate*

Phylum: Bryozoa

Class: Gymnolaemata

Order: Ctenostomatida

Family: Vesiculariidae

Genus: Bowerbankia

Species: Bowerbankia
imbricata



Habitat:

Commonly grows on algal substrata, but is also frequently found on the underside of boulders or rocks, or on concrete constructions. *B. imbricata* is known to range from the intertidal zone down to depth of ~ 55 m. In sheltered areas, large erect colonies may develop. This species is tolerant of fluctuations in salinity and is known to occur, often in abundance, in brackish water.

Description:

NE Atlantic, Mediterranean and east coast USA. Colonies are often very dense and typically between 25-80 mm in length. They appear transparent, white, cream or yellowish in colour. In the creeping form, colonies closely adhere to the substrate, whereas erect colonies are raised off the substrate. The zooids form feathery or bushy clusters along a thick cylindrical stolon. The species is commonly found in the lower intertidal and shallow subtidal on algal or hard substrata throughout.

Geographical occurrence:

Common throughout the NE Atlantic and Mediterranean. Range extends north to the Barents Sea and it has been reported from the Black Sea.

3.Membranipora membranacea

Phylum: Bryozoa

Class: Gymnolaemata
Order: Cheilostomatida
Family: Membraniporida
Genus: *Membranipora*
Species: *M. membranacea*



Habitat:

M. membranacea prefers shallow marine habitats between the mid intertidal to the shallow sublittoral. It may also be found in brackish water. It is typically found attached in colonies to seaweed, shells, or artificial substrates.

Description:

Membranipora membranacea colonies consist of individual organisms called zooids, each with a chitinous exoskeleton which is secreted by the epidermis. This exoskeleton, hardened with calcium carbonate, is known as the zooecium, which not only serves to protect the internal structures of the organism, but also keeps the individual permanently attached to the substrate and neighboring zooids. Zooids within a colony can communicate via pores in their interconnecting walls, through which coelomic fluid can be exchanged. The internal, living portion of the zooid is known as the polypide, whose walls are formed by the outer epidermis and inner peritoneum. The lophophore, a ring of ciliated tentacles, protrudes from the polypide to feed. When not feeding, the lophophore retracts into the polypide through the tentacular sheath. The lophophore is controlled by the zooid's nervous system, which consists of a ganglion at the lophophore base. This ganglion is

responsible for motor and sensory impulses to and from the lophophore, as well as the epithelium and digestive tract. The lophophore retractor is the muscle which controls the movement of the lophophore.

Geographical Occurrence:

Northeast Atlantic including the Baltic Sea, English Channel, Mediterranean Sea and North Sea. Also native to the North Pacific coastline of North America from Alaska to California.

3. *Crisia occidentali*

Kingdom:	Animalia
Phylum:	Bryozoa
Class:	Gymnolaemata
Order:	Cyclostomata
Family:	Crisiidae
Genus:	<i>Crisia</i>
Species:	<i>Crisia occidentalis</i>



Habitat:

Attached

Description:

This bryozoan has an erect, branching colony with tubular, lightly calcified zooecia. The zooecia lie in 2 rows (biserial) against one another, and have a circular aperture and no operculum. The oocistoistome is straight. The branches of the colony are jointed and curved slightly inward. Colour is white or light tan.

Geographical occurrence:

Abundant in San Francisco Bay. Found at least from Los Angeles to Puget Sound.

4. *Bugula neritina*

Kingdom: Animalia
Phylum: Bryozoa
Class: Gymnolaemata
Order: Cheilostomatida
Family: Bugulidae
Genus: *Bugula*
Species: *B. neritina*



Habitat:

It is invasive with a cosmopolitan distribution.

Description:

Bugula neritina is a cryptic species complex of sessile marine animal in the genus *Bugula*. *Bugula neritina* is of interest from a drug discovery perspective because its bacterial symbiont, *Candidatus Endobugula sertula*, produces the bryostatins, a group of around twenty bioactive natural products. The bryostatins are under investigation for their therapeutic potential directed at cancer immunotherapy, treatment of Alzheimer's disease, and HIV/AIDS eradication, due to their low toxicity and antineoplastic activity. *Bugula neritina* is also of interest in materials science, where it is used as a model organism in biofouling studies.

Geographical occurrence:

It has been widely identified in fouling communities and is known to be introduced to higher latitudes and more isolated oceanic regions, including the coast of Northern Europe, the Southwest Atlantic, the Northeast Pacific, the Southwest Pacific and Haw

CONCLUSION

Taxonomic keys are used for the taxonomic identification where they provide the unique characteristics of species with written descriptions and pictures. They are also capable of conveying natural variation in the morphology of species, nor the small yet characteristics morphological features of a species. Museum specimen observation is very interesting since every specimen is different from others and species change with minute difference like shape, color, patterns etc so taxonomic work is carried out and proper cataloguing is done. They promote proper learning and understanding of biology through comparative study. Even though many specimens of amphibian and minor phyla observed in the museum were originally distributed in water bodies around India some were from region other than India like the Pacific ocean especially some of the sea slugs were from Coasts of Europe and Spain, so these maybe invasive. A species is regarded as invasive if it has become introduced to a location, area or region where it did not previously occur naturally and become capable of establishing a breeding population in the new location.

DISCUSSION

The Amphibians are four-limbed and ectothermic vertebrates of the class Amphibia. All living amphibians belong to the group Lissamphibia. They inhabit a wide variety of habitats, with most species living within terrestrial, fossorial, arboreal or freshwater aquatic ecosystems. Amphibians use their skin as a secondary respiratory surface and some small terrestrial salamanders and frogs lack lungs and rely entirely on their skin. The three modern orders of amphibians are Anura (the frogs), Urodela (the salamanders), and Apoda (the caecilians). The number of known amphibian species is approximately 8,000, of which nearly 90% are frogs.

The Origin of the Amphibia entitled article discuss mainly about the origin of land vertebrate and also mentioned that all the evidence spoken were in favor of a monophyletic origin of land vertebrates. Among them, the important differences between amphibians on the one side and the reptiles and their descendants on the others are emphasized. The probable sequence with which the various tetrapod features have accumulated, the reasons which prevented the emergence of terrestrial forms from fishes from being ever repeated, and the evolution of the amphibian ontogeny are discussed.

The research paper "*Sipunculus nudus* genome provides insights into evolution of spiralian phyla and development" was based on introduction *Sipunculus nudus* is the most known species in the genus *Sipunculus*, distributed in tropical and subtropical coastal waters. It has been report that 1.75 Gb complete genome assembly with a contig N50 size of 450 kb of the *S. nudus* based on a strategy combining third-generation long-read

sequencing and Illumina sequencing. A total of 80391 protein-coding genes are annotated in this genome. It shows that the genome assembly provides an important genome resource and new insight into the relationships of *Sipuncula* to other spiralian phyla.

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