From Tadpoles to Frogs

[Year/Subject] 2nd Year, Science
[Course Name] Various Animals

Objectives

- Increase the pupil's awareness of the body structure of animals by observing tadpoles and frogs that live nearby.
- Ensure that the pupils are aware that the major changes seen in the body structure of tadpoles and frogs is a way that the animal adapts to its living environment.

Optimum Season

Of all larva at the Sera Yume Kouen, Nature Observation Field, the Japanese brown frog, montane brown frog, common toad and other species that are undergoing metamorphosis relatively latey, and the black-spotted frog, tree frog and other frogs that are undergoing metamorphosis relatively early, can be observed at the start of July. This period is one in which all species of frog living within the park are most active, and thus the optimum time to observe them.

Major changes in body structure during the optimum period for metamorphosis

Further information on this topic is provided in the reference materials on pages 25 to 28. Please make use of these reference materials.

Items to Prepare

- Spoon-net: to catch tadpoles or frogs
- White plastic tray: to observe tadpoles that have been caught
- Breeding case: To observe frogs, and to observe and raise tadpoles

① It is recommended to observe tadpoles that are developing rear legs as shown in the pictures on the right page.

② The buds (primodia) of a tadpole's rear legs develop between the upper areas of the anus and the base of the tail. Have pupils observe these areas.

① Frogs are vertebrates, so have pupils check for the presence of spine (backbone) in both frogs and tadpoles.

② Discuss the fact that there is a strong relationship between the area the animals live in, their method of movement and their body structure.

③ By noting the differences in food they eat, you can indicate to the pupils that there are differences with their inner organs.

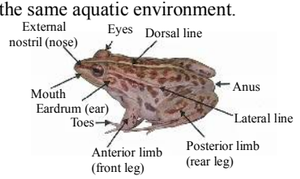
④ Amphibians such as frogs differ to reptiles, avian species and mammals in that they cannot completely live away from water. Ensure that pupils are aware that in deposits and growth of larva requires the presence of water.

Example answers (partially entered)

From Tadpoles to Frogs

Most animals obtain the nutrients required to live through food, and move around their environment accordingly in search of this food. Yet, their behavior differs depending on the type of animal because the places that they live, the way they eat, move and how they are aware of their surroundings are different. This is also related to the way their bodies are constructed.
Amphibians in particular make immense changes to the area they live when they move from water to land, and undergo immense changes to their body structure as they metamorphose from tadpoles to frogs. Let's have a closer look to see what changes there are, and make comparisons with fish, which live in the same aquatic environment.

● Observation date & time:
● Observation area:
● Weather:
● Temperature:



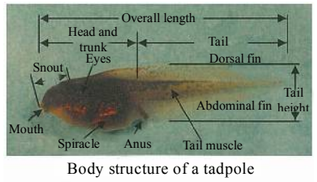
1. Compare the differences in living areas and body structure of tadpoles and frogs

		Tadpoles	Frogs
Living area		In water	Land around water, grass and trees
Method of movement		Swim with tail	Jumps with front and rear legs
Parts used to move		Tail	Front and rear legs
Tail		Present	No present
Fins		Present (dorsal fin, abdominal fin)	No present
Legs	Front	Not visible as they are under the skin	One pair behind its head
	Rear	Developing externally. Becomes bigger and more complex as the body grows longer.	Better developed than the front legs, thick, long
Mouth		Small as they eat algae and microbes (plant-based)	Large as they eat animals such as insects
External nostril (nose)		Present (1 pair)	Present (1 pair)
Eardrum (ear)		Not present	Behind their eyes
Body color or patterns		Earth-colored in grey or black with no pattern	Varies with species, green or brown is most common
Skin condition		Faint	Quite thick, moist surface
Spine (backbone)		Present	Present

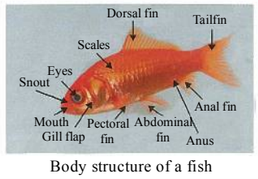
2. Observe how each body part changes with metamorphosis
Catch some wild tadpoles that already show development in their rear legs, and record what you observe from the day their front legs appear to the day their tail completely disappears (the metamorphosis period varies with ambient temperature and room temperature).

	State of metamorphosis	Observations
1st day		- Front legs start appearing - Jagged mouth remains
2nd day		- Mouth edges extending laterally, positioned between the front edge of the nostrils and mouth - Tail has become black, not as transparent - Abdominal fin and dorsal fin becoming shorter - The tail has become shorter, however is longer than the rear legs
3rd day		- Mouth edges have extended to the center of the eyes - Tail has darkened further, abdominal fin and dorsal fin have disappeared - Tail is shorter than rear legs
4th day		- Mouth edges extended to the rear edge of the eyes - Jagged mouth has disappeared completely - Tail has become even shorter, however some darkness remains - Ear drums have become visible between eyes and front legs
5th day		- Tail has disappeared completely, now in the form of a baby frog.

3. Compare tadpoles with fish, which live in the same aquatic environment



Body structure of a tadpole



Body structure of a fish

- Five types of fins: dorsal fin, abdominal fin, pectoral fin, anal fin, tail fin
- One pair of gill flaps to discharge water sucked in through the mouth in order to extract oxygen in the water
- Body surface covered with tough scales
- Lives its entire life within water

① A large number of sample responses have been provided here, however this corresponds to the many different observations that pupils could have during this exercise.
② Changes to body structure in order to live on land also include changes to internal organs, and accordingly, metamorphosis actually refers to the period between the larva stages where the rear legs are not visible, until the tail disappears. The fascinating period from after the appearance of front legs until the tail disappears is referred to as the "metamorphic climax".
③ The start of metamorphosis is defined as the appearance of the front legs, and ends when the tail disappears completely.
④ The metamorphic climax varies between frog species and temperature, however continues for approximately one week.
⑤ The photos show the metamorphosis process of the Japanese tree frog as a way of outlining metamorphosis.
⑥ The end of metamorphosis is shown by the photo taken on day five on the left. The rear tip of the rear legs extends past the anus.
⑦ During the metamorphic climax, the tadpole's digestive system is undergoing structural change, and accordingly will not eat any food.
⑧ Placing approximately seven sheets of kitchen paper into the breeding case during the metamorphic climax will keep the area moist with water, making it easier to raise and observe the tadpoles.

Discussion key points

Have pupils compare the body structure of tadpoles and fish.
Amphibians and fish do have several similarities, however despite living in the same aquatic environment, both species display different characteristics. This is the reason why these two species are classified as different vertebrates.

Observation key points

① Sketches and descriptions are used so that pupils can check for a shortening of the tail, fin conditions, changes in tail color, shape of the front portion of the head, structure of the eyes and mouth, position of edges when the mouth spreads open laterally, the appearance of eardrums, colors of certain species and speckles or patterns in the dorsal skin.
② Species that live amongst leaves, such as the Japanese tree frog or Schlegel's green tree frog, have rounded toes on their front and rear legs as suckers developed.
③ The larger opening in a frog's mouth is so that they can catch small animals quickly following their change from an herbivorous to a carnivorous diet after metamorphosis is complete.