



Pathfinder Honour: Trainer's Notes

Amphibians 1



Instructions to Trainers / Instructors of this Honour

Thankyou for being involved with this Honour. These notes have been developed to assist in teaching / instructing this honour. We recognise that there is much more information available and we are grateful that you should share your expertise.

Please remember that Honours are designed to develop our Pathfinders in many ways; their interests, their knowledge and their relationship with their Saviour and Creator. Your enthusiasm and creativity will have a huge impact on those doing the honour.

To complete an Honour, the following (where applicable) must be completed satisfactorily:

- Physical and Practical Requirements.
- Honour Workbook.
- Honour Assessment Sheet. *(On SPD Honour Website but Leader's level access is required)*

Additional Reference Material

Please see ADDITIONAL REFERENCES on the final page of these notes.

Acknowledgements

These notes are based on http://en.wikibooks.org/wiki/Adventist_Youth_Honors_Answer_Book/Nature/Amphibians

This is a very useful source, but please be aware that the contents of this and other material is beyond the control of the SPD. Citations are also referenced within the text of these notes.

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REQUIREMENT 1: What are the characteristics of amphibians?

Their name comes from the Greek word “amphibios” which means “living a double life”.

- Amphibians are cold-blooded vertebrates.
- They spend part of their life in water and part on land.
- They go through metamorphosis. Metamorphosis is a major change of structure from one form to another during the life of an animal. Amphibians start as an egg, hatch into a tadpole which has lungs and breathes water and becomes an animal with lungs that breathes air. However, not all amphibians follow this completely.

The above items are the most important, but also:

- Many amphibians are also able to breathe through their skin. Their skin is smooth and must remain moist to allow them to do this.
- Many secrete a special fluid through their skin, which locks in moisture. Their skin can absorb oxygen and water. However, if the skin dries out, these amphibians die.

The main amphibians are frogs (toads are just a type of frog), salamanders and newts. Please see the notes for Requirements 2 and 11 for more details. Most are small, but the largest are the Giant Salamander of China (*Andrias davidianus* which can grow to 1.8m) and the Japanese Salamander (*Andrias japonicas* 1.5m).

REQUIREMENT 2: Name the two main orders of Amphibia and tell how to distinguish between them.

Note: Long hind legs
Protruding eyes
No tail and short front legs

Order Anura (Frogs)

Adult frogs are characterized by long hind legs, a short body, webbed digits, protruding eyes and the absence of a tail. Most have a semi-aquatic lifestyle, but move easily on land by jumping or climbing.

They typically lay their eggs in puddles, ponds or lakes; and their larvae, called tadpoles, have gills and develop in water.



Picture source: <http://www.biology-resources.com/drawing-amphibia-frog.html>

Toads are not separate but are just a type of frog.

Order Caudata (Salamanders)

Caudata have slender bodies, short legs, and long tails. The moist skin of the amphibians fits them to habitats either near water or under some protection on moist ground, usually in a forest. Some species are aquatic throughout life, some take to the water intermittently, and some are entirely terrestrial as adults. Salamanders superficially resemble lizards, but are easily distinguished by their lack of scales. They are capable of regenerating lost limbs.



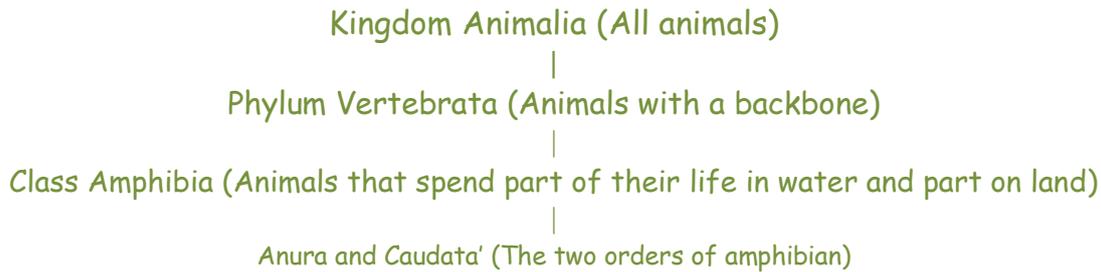
Pictured: Hida Salamander (*Hynobius kimurae*) of Japan

http://upload.wikimedia.org/wikipedia/commons/b/b3/Hynobius_kimurae_%28cropped%29_edit.jpg

Newts are just a small type of salamander as are sirens, which are aquatic salamanders without legs. They all belong to the Order Caudata.

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Following is a family tree for amphibians. It is not necessary for the Pathfinder to understand this, but a simple explanation may help them to see where they fit in God's creation



Anura is all the frogs (which includes the toads).

Caudata has salamanders, axolotls, newts and sirens.

REQUIREMENT 3: Explain the use of the common names 'toad' and 'frog'.

The use of the common names 'frog' and 'toad' has no basis in science. All members of the order Anura are frogs, but only members of the family Bufonidae are considered "true toads".

The use of the term 'frog' in common names usually refers to species that are aquatic or semi-aquatic with smooth or moist skins.

The term 'toad' generally refers to species that tend to be terrestrial with dry, warty skin. An exception is the Fire-Bellied Toad (*Bombina bombina*): while its skin is slightly warty, it prefers a watery habitat.

They are really ALL frogs.

REQUIREMENT 4: How do amphibians protect themselves?

- The first line of defence for amphibians is to not be seen by a potential predator. The small size of many amphibians helps this.
- They are mainly active at night so that fewer predators can target them.
- The colour of many species helps in this regard by camouflaging them.
- Sometimes, rather than blending in, frogs are very brightly coloured. The coloration in this case serves as a warning, for these frogs are poisonous.
- Many frogs contain mild toxins that make them distasteful to potential predators. For example, all toads have large poison glands - the parotid glands - located behind the eyes on the top of the head. Some frogs, such as some poison dart frogs, are especially toxic.
- Salamanders have the ability to detach their tails at will. When a predator captures a salamander by the tail, the salamander detaches its tail and escapes. The tail regenerates or grows back.
- Some frogs bury themselves under ground or live high in the trees away from most predators.

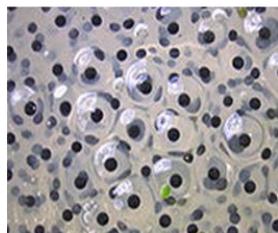
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REQUIREMENT 5: Describe the typical life history of amphibians.

Here is the life history of a common frog as an example.

The pictures are from http://en.wikibooks.org/wiki/Adventist_Youth_Honors_Answer_Book/Nature/Amphibians
They show the stages of the life cycle of most amphibians. They are not to scale.

The life cycle of frogs, like that of other amphibians, consists of four main stages: egg, tadpole, metamorphosis and adult. The reliance of frogs on an aquatic environment for the egg and tadpole stages gives rise to a variety of breeding behaviours that include the well-known mating calls used by the males of most species to attract females to the bodies of water that they have chosen for breeding. Some frogs also look after their eggs and, in some cases even the tadpoles for some time after the laying of the eggs.



Frogspawn



10 days:
Tadpoles



8–12 weeks:
Froglet



12–16 weeks:
Adult frog

Egg:

The life cycle of a frog starts with an egg. Eggs are generally laid in water, and an individual female may lay egg masses containing thousands of eggs. While the length of the egg stage depends on the species and environmental conditions, eggs generally hatch within one week.

Tadpole

Eggs hatch and continue life as tadpoles (occasionally known as polliwogs). Tadpoles are aquatic, lack front and hind legs, and have gills for breathing and tails with fins for swimming. Tadpoles are typically herbivorous, feeding mostly on algae, including diatoms that are filtered from the water through the gills. Some species are carnivorous at the tadpole stage, eating insects, smaller tadpoles and fish. The tadpole stage may be as short as a week, or tadpoles may overwinter and complete metamorphosis the following year in some species such as the Midwife Toad (*Alytes obstetricans*) and the Common Spadefoot (*Pelobates fuscus*).

Some frogs do not have the tadpole stage going from egg to adult shape. For example New Zealand's native frogs (pepeketua) belong to the genus *Leiopelma* and complete the tadpole stage in the egg.

Metamorphosis

At the end of the tadpole stage, frogs undergo metamorphosis, in which they transition into adult form. Metamorphosis involves a dramatic transformation of body shape and function, as tadpoles develop hind legs and then front legs, lose their gills and develop lungs. Their intestines shorten as they shift from an herbivorous to a carnivorous diet.

Adult frog

The final stage of development from froglet to adult frog involves the loss of the tail.

Trainers please note: Your students may like to may like to research salamanders or one of the unusual frogs such as the Gastric Brooding Frog, the Goliath Frog of Africa or the tree dwelling frogs of Fiji.

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REQUIREMENT 6: Explain the economic value of amphibians.

- Amphibians are insect eaters, so they are very valuable for controlling mosquito populations.
- They are also the preferred dinner for several mammal, bird, fish, and reptile species.
- Amphibians are valuable for medical research. They are raised and sold to research institutions.
- Many frogs such as the Poison Arrow Frogs may contain chemicals to help us with pain management or new drugs.
- The Gastric Brooding Frog was of great interest as it may have held a cure for stomach ulcers.
- The Holy Cross Frog secretes a 'goo' which may be used to glue broken bones together. It is stronger than any non toxic glue.
- The larvae of newts and salamanders are sold as fish bait.
- Amphibians are closely monitored by ecologists, because they are among the first animals affected by environmental problems such as pollution and the destruction of the ozone layer.
- Axolotyls are popular pets.
- Frogs are eaten by some people.

REQUIREMENT 7: Where do some frogs go when it is dry or cold?

- Some toads burrow below the frost line and hibernate for the winter. Plant matter actually generates a bit of heat as it decays, so toads prefer areas with plenty of leaf litter and fallen logs.
- Burrowing frogs are specialised burrowers that emerge mainly to breed. They are all short and round. One member is the Holy Cross Frog. The picture will show why it is so named.



Picture: New South Wales (Australia) Government Natural Resources
http://www.dnr.nsw.gov.au/water/wetlands_facts_other_frogs.shtml#CrucifixFrog

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REQUIREMENT 8: How do frogs sing? What makes the noise so loud?

Frogs call by passing air through the larynx in the throat. In most calling frogs, the sound is amplified by one or more vocal sacs, membranes of skin under the throat or on the corner of the mouth that bulge out during the amplification of the call.

Some frogs lack vocal sacs, but these species can still produce a loud call. Their mouths are enlarged and dome-shaped, acting as a resonance chamber that amplifies their call. The body of an acoustic guitar does much the same thing, having a large hollow section that causes the sound to resonate inside before escaping to the outside atmosphere.

REQUIREMENT 9: Frogs feature prominently in the Bible. Give three examples.

- Exodus chapter 1 to 15, the plague of frogs.
- Psalms 105 verse 30
- Revelation 16 verse 13

REQUIREMENT 10: In many places, the number of amphibians (especially frogs) is decreasing alarmingly. Give reasons why this is so, especially where you live and explain what you can do about it.

In the 1990's, amphibian populations in the United States and Canada began a sudden, rapid and mysterious decline. Many frogs were discovered in Minnesota with unexplained deformities such as extra limbs, missing limbs, deformed limbs, and missing eyes. As a result:

- Many species of amphibians are now protected by state and federal laws.
- When observing wild amphibians, it is extremely important that they not be handled. Doing so can spread disease to these creatures, causing further decline.
- Before venturing out, make sure your Pathfinders understand and appreciate the danger facing amphibians today.
- Do not allow your group to capture or otherwise harass them, and do not destroy their environment. Check the laws in your country and state before keeping amphibians. It is recommended that you do not capture wild amphibians.
- Do not return captive (pet) amphibians to the wild.

The same thing has been happening in Australia where sadly a number of species have become extinct in recent years.

In Australia there have been a number of factors in these deaths.

- Loss of good places for the frog to live.
- Pollution of land, air and water.
- The spreading of a deadly fungus (called chytrid) that is highly contagious to frogs.
- Over collecting of some frogs such as the Platypus Frog.

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REQUIREMENT 11: Make brief notes on at least four (4) amphibians. You must include at least one example each of a frog/toad, salamander and newt. Include a description, where found, food, breeding habits and an interesting fact.

Teachers, we have provided several examples as an illustration. With the exception of the Platypus Frog, there is more information that would be expected from a young Pathfinder. Please use your judgement to assess whether an 'honest' effort has been done.

Please ensure that your students choose different examples to those shown here. It is OK to use amphibians 'seen' in Requirement 12. Hint. Check out the Cane Toad (*Bufo marinus*)

American Bull Frog (*Rana catesbeianus*)

Picture: http://en.wikibooks.org/w/index.php?title=File:Bullfrog_-_natures_pics.jpg&filetimestamp=20060822084505

Description: The bull frog can grow to a length of 150mm (6 inches) with a weight of up to 750g (1.5 lb). Females are typically larger than males. They are generally varying shades of green or brown, with dark brown, dark green, or black blotching and a yellow or white underside.



Natural Habitat / Where Found: The American Bull Frog is native to North America. They are found in the United States, Canada and Mexico, east of the Rocky Mountains, but have been introduced to many other localities throughout the world. In Europe and the western U.S., measures are often taken to control its spread because it competes with, and often drives out, native species.

Food: Bull frogs are carnivorous and will consume almost anything that fits into their mouth which they can overpower, including insects, small mammals, fish, snakes, and even other frogs. They tend to eat more dragonflies than flies.

Breeding Habits: Lays eggs that become tadpoles then frogs.

Interesting Fact: The adult frog can live up to 13 years.

Platypus Frog or Gastric Brooding Frog. (*Rheobatrachus silus*)

Picture: Birth of a Gastric Brooding Frog by Photo Mike Tyler
<http://www.environment.gov.au/soe/2006/publications/emerging/frogs/index.html>

Description: These frogs have large protruding eyes and webbed feet. The webbed feet led to the name Platypus Frog.

Where Found: They are found in only two small areas of Queensland, Australia. As they have not been seen for over twenty years they are presumed extinct.

Food: Small water creatures.

Breeding Habits: These frogs lay eggs and then the mother frog swallows the eggs and keeps them in her stomach until they are small frogs when she spits them out.



Interesting Fact: The mother raises babies in her stomach.

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Chinese Giant Salamander (*Andrias davidianus*)

Picture: Ken Lucas / www.ardea.com

Notes are based on: <http://www.arkive.org/chinese-giant-salamander/andrias-davidianus/facts-and-status.html>

Description: The Chinese giant salamander is fully aquatic. It grows up to 1.8 metres in length, though most individuals found today are considerably smaller (2). The skin is dark brown, black or greenish in colour and irregularly blotched. It is also rough, wrinkled and porous which facilitates respiration through the skin as this large amphibian lacks gills (4). This species has an elongated body, and two pairs of legs which are roughly similar in size. The snout is less rounded than that of the related Japanese giant salamander and the tail is a little longer and broader (4).



Where Found: This species occurs in the mountain streams of China below 1,500 metres above sea level in the tributaries of the Pearl, Yellow and Yangtze Rivers. It inhabits cold, fast running mountain streams and lakes, occupying hollows and cavities under water (4).

Food: It is generally active at night, when it relies on smell and touch to locate its prey. It lives in muddy, dark rock crevices along riverbanks and feeds on fish, smaller salamanders, worms, insects, crayfish and snails, catching them with a rapid sideways snap of the mouth (2, 5).

Breeding Habits: Mating behaviour has been described for the Japanese giant salamander (*Andrias japonicus*) and is probably similar for the Chinese giant salamander (4). Reproduction appears to take place from late August to September, when hundreds of individuals congregate at nest sites (4) (6). Males occupy breeding cavities which are aggressively guarded against intruders (6). Males compete viciously, with many dying from injuries (6). Females enter the cavities, lay between 400 and 500 eggs that are held together like a thread of beads and then leave immediately (4) (6). The male fertilises the eggs, and protect them from predators such as fish, until they hatch 12 to 15 weeks later in the early spring (4) (7).

Interesting Facts: Chinese Giant Salamanders are the largest of the world's salamanders and can reach 1.8m in length. Despite this, their tadpoles are only 30 mm long.

Both the Chinese and Japanese giant salamanders are long lived, with one specimen in captivity living for 52 years (4)

References used for Chinese Giant Salamander

1. IUCN Red List (November, 2007) <http://www.iucnredlist.org>
2. Cogger, H. (1999) Reptiles and Amphibians. Time Life Books, London.
3. CITES (November, 2003) <http://www.cites.org>
4. Amphibia Web (November, 2003) <http://elib.cs.berkeley.edu/aw/index.html>
5. Halliday, T. and Adler, K. (2002) The New Encyclopedia of Reptiles and Amphibians. Oxford University Press, Oxford.
6. Smithsonian National Park (Nov 2003) <http://natzoo.si.edu/Animals/AsiaTrail/GiantSalamanders/>
7. Xiao-ming, W., Ke-jia, Z., Zheng-huan, W., You-zhong, D., Wei, W. and Song, H. (2004). The decline of the Chinese giant salamander *Andrias davidianus* and implications for its conservation. *Oryx*, 38: 197 - 202.

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California Newt also called Orange Bellied Newt (*Taricha torosa*)

Picture: http://upload.wikimedia.org/wikipedia/commons/9/9f/Taricha_torosa.jpg

Notes are based on: http://en.wikipedia.org/wiki/California_Newt

Description: A newt is an amphibian of the Salamandridae family, although not all aquatic salamanders are considered newts. Newts are found in North America, Europe and Asia. Newts metamorphose through three distinct developmental life stages:



aquatic larva, terrestrial juvenile (called an eft), and adult. Adult newts have lizard-like bodies and may be either fully aquatic, living permanently in the water, or semi-aquatic, living terrestrially but returning to the water each year to breed. Adult length can range from 130 to 200mm (5 to 8 inches).

Where Found: California newts exist primarily on the California coastline and in the Sierra Nevada. This is because they prefer less humid climates than the rough skinned newts. During the non-breeding season the newts are land dwelling, preferring rock crevices and logs.

Food: Earthworms, snails, slugs, sow bugs, bloodworms, mosquito larvae and other invertebrates are among the California newt's prey. In the Sierras, the newt will also consume trout eggs.

Breeding Habits: Reproduction occurs generally between December and early May. Typically the adult newts will return to the pool in which they hatched. After a mating dance, the male mounts the female and rubs his chin on her nose. He then attaches a spermatophore to the substrate, which she will retrieve into her cloaca.

The egg mass released by the female contains between 7 and 30 eggs, and is roughly the consistency of a thick gelatine dessert. Typically the egg masses are attached to stream plant roots or to rocky crevices in small, slow moving pools. But they have also been known to be attached to underwater rocks or leaf debris.

Adult newts will stay in the pools throughout the breeding season, and can be occasionally found well into the summer. Larvae hatch sometime in early to mid summer, depending on local water temperature. Larvae are difficult to find in streams as they blend in well with the sandy bottom, which they usually stay close to.

Interesting Facts: Like other *Taricha* members, the glands in the skin of *T. torosa* secrete the potent neurotoxin tetrodotoxin, which is hundreds of times more toxic than cyanide. This is the same toxin found in puffer fish and harlequin frogs. Researchers believe that bacteria synthesize tetrodotoxin and the animals that employ the neurotoxin acquire it through consumption of these bacteria. This neurotoxin is so strong that it is enough to kill most vertebrates, including humans. However, they are dangerous only if ingested.

Due to their toxicity, the California newt has few natural predators. Garter snakes are the most common, and some species have developed a genetic resistance to tetrodotoxin.

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Requirement 12: Do one of the following. Remember; do not handle frogs and toads.

- a. Visit a place where amphibians live in their natural state and write a brief report on your visit describing the amphibians found, their number and the sounds they make. A night time visit may allow you to identify them by sound.**
- b. Make a list of amphibians found in your area. Include their common names, where they live and interesting facts in your report.**
- c. Visit a place where amphibians are exhibited; for example museum, zoo, nature reserve etc and write a report on your visit.**

Teachers, you'll have to rely on local knowledge for this requirement.

ADDITIONAL REFERENCES

Australia

Frogs Australia Network: <http://www.frogsaustralia.net.au/>

- An excellent sight with plenty of pictures and details of Australian Frogs.
- Download frog calls

ARC (Amphibian Research Centre): <http://frogs.org.au/arc/index.html>

- Information on raising 'approved' frog species.
- An overview of the strict legal requirements for keeping / raising frogs as applicable to each of the Australian States. NB this is a guide only and the site recommends checking the relevant legal requirements prior to any action.

Frogs of Australia: <http://frogs.org.au/frogs/>

- Plenty of pictures and details of Australian Frogs plus location maps where found.
- Just click on your State / location

Frogland: All About Frogs: <http://allaboutfrogs.org/>

- A 'fun' website on frogs, with some fascinating information on frogs

New Zealand

NZ Frog: <http://www.nzfrogs.org/>

- Plenty of pictures and details of New Zealand Frogs

General

Newts: <http://en.wikipedia.org/wiki/Newt>

- Interesting information on Newts. They are not native to Australia

List of Amphibians: http://en.wikipedia.org/wiki/List_of_amphibians

- An extensive list of amphibians