

Parental Care in Amphibia

Looking after the eggs or the young until they are independent, to defend from predators, is known as *parental care*. It is a very important factor for survival. Animals exhibit a great diversity in caring for their eggs and young during their development. Perhaps, no group shows more diversity than to the amphibians, especially those living in tropical regions. Anurans show much greater diversity than urodeles and apodans. The methods of caring by Amphibia generally fall under two broad categories : (i) Protection by nests, nurseries or shelters and (ii) Direct caring by parents (Figs. 2 & 3).

[I] Protection by nests, nurseries or shelters

Amphibians have evolved countless interesting methods to give protection to their defenceless eggs and larvae from predators.

1. **Selection of site.** Many amphibians lay eggs in protected, moist microhabitats on land. Many tropical frogs and toads lay eggs on land near water. Many tree frogs lay their eggs not on land but on leaves and branches overhanging water. Species of *Phyllomedusa*, *Rhachophorus*, *Hylodes*, etc. glue their eggs to foliage hanging over water. *Rhachophorus malabaricus* in India and

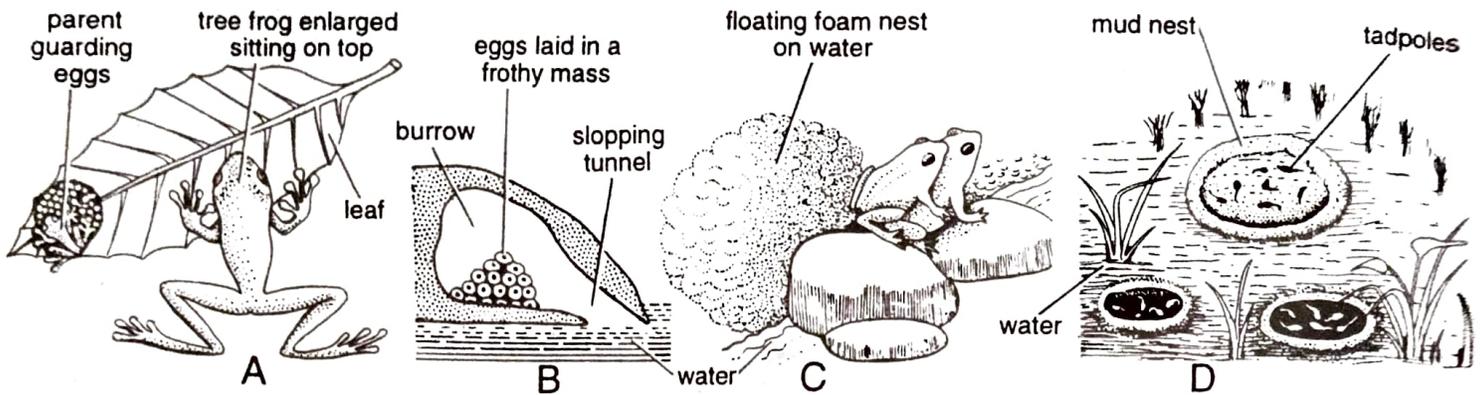


Fig. 2. Parental care in Amphibia. Protection by nests, nurseries or shelters. A—A tree frog guarding eggs glued to a leaf overhanging water. B—Foam nest of *Rhacophorus schlegeli* in a slopping burrow near water. C—Foam nest floating on water. D—Mud nest of *Hyla faber*.

Chiromantis of Africa also deposit their spawn on trees. Many tree frogs deposit eggs in water that accumulates in epiphytic tropical plants. Free from reach of aquatic egg predators in their microhabitats, the tadpoles on hatching drop into water beneath to complete their metamorphosis.

2. Defending eggs or territories. Males of green frog *Rana clamitans* and other species maintain territories and attack small intruders to defend eggs. Male or female even guards the eggs. In *Mantophryne robusta*, the male actually sits over and holds with hands the elastic gelatinous envelope containing eggs numbering 17. Some tree frogs laying eggs above water may sit beside the eggs or rest on top of them. Removal of guarding frogs may result in desiccation or death of eggs.

3. Direct development. In some terrestrial or tree frogs, such as *Eleutherodactylus*, *Arthroleptis*, *Hylodes* and *Hyla nebulosa*, the eggs hatch directly into little frogs thus avoiding larval mortality. In the red backed salamander, *Plethodon cinereus*, the hatchlings are miniatures of the adults.

4. Foam nests. Many amphibians convert copious mucous secretions into nests for their young. In the Japanese tree frog, *Rhacophorus schlegeli*, the mating couple digs a hole or tunnel into which eggs are left in a frothy mass to avoid desiccation. During rains, hatching tadpoles are washed down the slopping tunnel into pond or river water for further development. The female of South American tree frog, *Leptodactylus*

mystacinus, stirs up a frothy mass of mucus, fills it in holes near water and lays eggs in them. The tadpoles developing in these improvised nests can readily enter water. Some anurans lay eggs in nests of foam floating on water. The female emits huge mucus that she beats into a foam with her hindlegs to lay eggs. When tadpoles hatch they drop from foam into water.

5. Mud nests. In Brazilian tree frog, *Hyla fabre*, the male digs a little crater-like hole or nursery in mud in shallow water, in which the female lays her eggs. The nest is 30 cm in diameter and 5 to 8 cm deep. Tadpoles hatch within this relatively safer barrier and develop until they are large enough to fend themselves.

6. Tree nests. The South American tree frog, *Phyllomedusa hypochondrales*, lays eggs in a folded leaf nest with margins glued together by cloacal secretion. The tadpoles when formed fall straight into water below. Another tree frog, *Hyla resinifictrix*, lines a shallow tree cavity with bees wax obtained from the hives of certain stingless bees. Female lays eggs when this cavity is filled with rain water. Here, the young develop relatively free from predators.

7. Gelatinous bags. In *Phrynilaxalus biroii* large eggs are enclosed in a sausage-shaped transparent gelatinous membranous bag, secreted by female and left in mountain streams. *Salamandrella keyserlingi*, a small aquatic salamander also deposits 50 to 60 small eggs in a gelatinous bag which is fastened to aquatic plants.

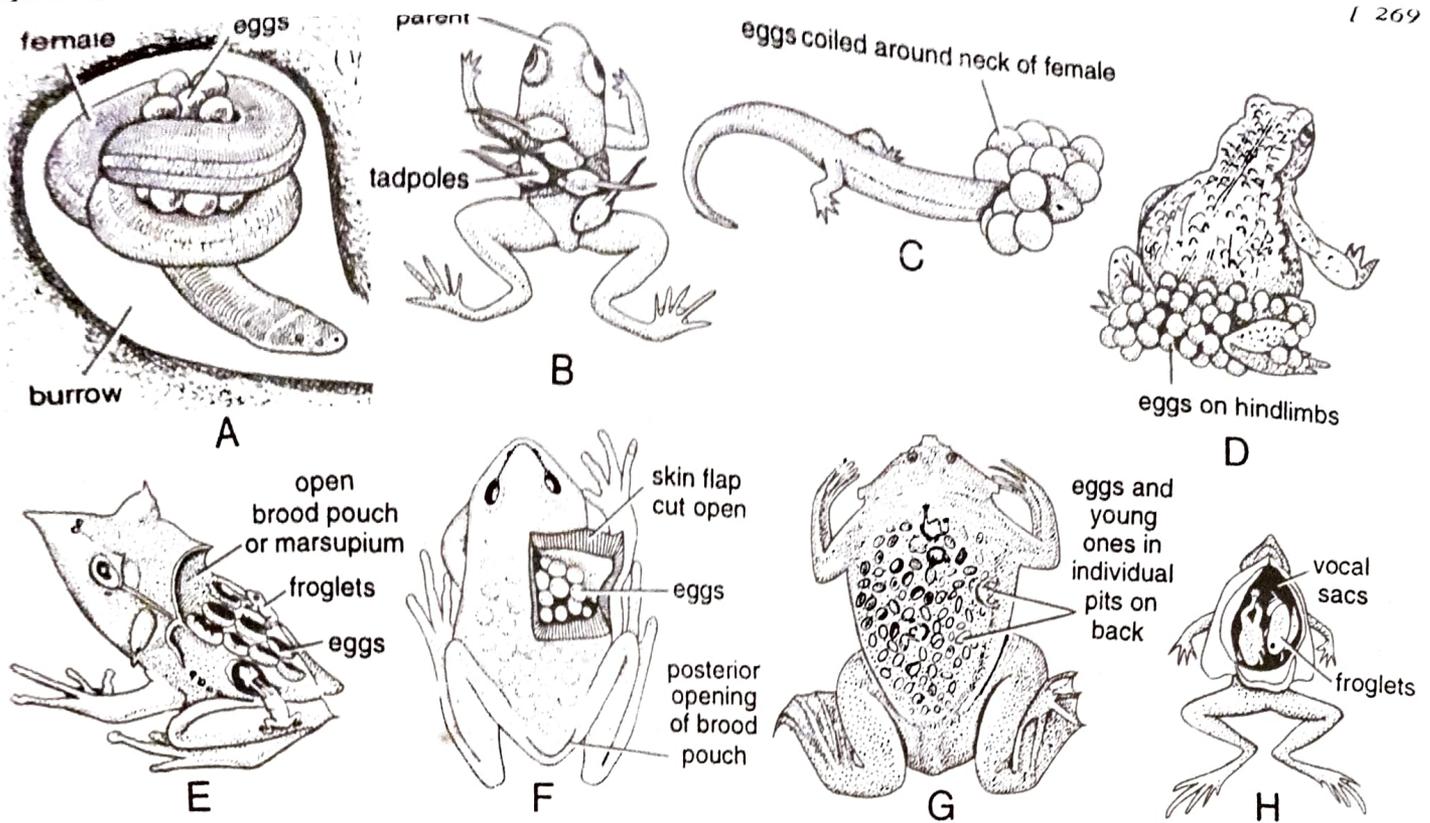


Fig. 3. Direct parental care in Amphibia. A—Female *Ichthyophis* coiling round eggs. B—Transportation of tadpoles attached to back of a parent. C—*Desmognathus fuscus* with eggs. D—Male *Alytes obstetricans* carrying eggs around his thighs. E—A marsupial frog with eggs exposed in open brood pouch on back. F—*Nototrema* or *Gastrotheca*, with flap of dorsal brood sac cut open to show eggs. G—In *Pipa*, eggs develop completely into individual capsules on back of female. H—Froglets inside vocal sacs cut open of male *Rhinoderma darwini*.

[II] Direct carrying by parents

1. Coiling around eggs. In Congo eel, *Amphuima* and certain caecilians like *Ichthyophis* and *Hypogeophis*, the female lays large eggs in burrows in damp soil and carefully guards them by coiling her body around them until they hatch. The female of Salamander, *Plethodon* also coils round the eggs which are laid in small packages in the hollow of a rotten log or beneath a rock. In *Megalobatrachus maximus*, it is the male who coils around the eggs.

2. Transferring tadpoles to water. Some species of small frogs (e.g. *Phyllobates*, *Arthroleptis*, *Pelobates*, *Dendrobates*) in both tropical Africa and South America, deposit their eggs on ground. The tadpoles hatching out, fasten themselves to the back of one of the parents with their sucker-like mouth and transported to water.

3. Eggs glued to body. Many amphibians, instead of remaining with the eggs, carry the eggs glued to their body. In the dusky salamander, *Desmognathus fuscus*, female carries the string of

eggs coiled around her neck, until they have hatched. In Srilankan tree frog, *Rhacophorus reticulatus*, the eggs are glued to the belly of female. An interesting case is that of the European midwife toad, *Alytes obstetricans*. When the female lays eggs, the male entangles them around his hindlegs. He carries them with him until they are ready to hatch. At that time he releases the tadpoles into nearest water.

4. Eggs in back pouches. In one group of tree frogs called *marsupial frogs* or *toads*, the female carries the eggs on her back, either in an open oval depression, a closed pouch or in individual pockets. The eggs develop into miniature frogs before they leave their mother's back. In the Brazilian tree toad, *Hyla goeldii* or *Cryptobatrachus evansi*, the posterior part of the back of female forms a sort of incipient brood pouch in which the eggs remain exposed. In *Nototrema* (= *Gastrotheca*), the eggs are covered by skin forming a single large brood pouch which opens posteriorly in front of the cloacal aperture.

A similar adaptation is seen in the completely aquatic Surinam toad, *Pipa*. In breeding season, skin of female's back becomes thick, vascular, soft and gelatinous. The male presses fertilized eggs against female's back, where they sink into individual pits. A hinged cover forms over each egg enclosing it in a small capsule. Complete metamorphosis occurs with capsules. The tiny toads leaving mother are tailless and do not enter water.

5. Organs as brooding pouches. Male of the terrestrial South American Darwin's frog, *Rhinoderma darwinii*, pushes at least two fertilized eggs into his relatively large vocal sacs. Here, they undergo complete development to emerge out as fully formed froglets. In West African tree frog, *Hylambates breviceps*, the female carries eggs in her buccal cavity. In *Arthroleptis*, it is the male who keeps the larvae in his mouth. The only known case of gastric incubation in vertebrates is found in the Australian frog, *Rheobatrachus silus*. The female keeps the eggs in her stomach. The tadpoles are expelled through mouth after metamorphosis.

6. Viviparity. Some anurans are ovoviviparous. They retain eggs in the oviducts and the females give birth to living young. African toads, *Nectophrynoids* and *Pseudophryne* give birth to little frogs. The European Salamander, *Salamandra salamandra* produces 20 or more small young while the Apline salamander, *S. atra* gives birth to one or two fully developed young. Viviparity is widespread in order Gymnophiona, and 3 out of 4 families have this mode of reproduction. Common examples are *Typhlonectes*, *Geotrypetes*, *Dermophis*, etc.