

# Courtship in Frogs

## Role of Acoustic Communication in Amphibian Courtship Behaviour

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**Vertebrate vocalization came into existence for the first time in frogs. Acoustic signals produced by the frogs have well-defined physical characteristics and a clear biological meaning. The signals are meant to attract and assess the sex, species identity and genetic quality of potential mates. Acoustic communication plays a central role in the courtship behaviour of frogs.**

The chordates originated in the sea as jawless fishes. The bony fishes, which evolved from them are the most plentiful vertebrates today. The first vertebrate land dwellers were the amphibians, but they are not truly terrestrial because they still require frequent access to water. The first true terrestrial vertebrates were the reptiles, which independently gave rise to the birds and to the mammals, including humans (*Figure 1*).

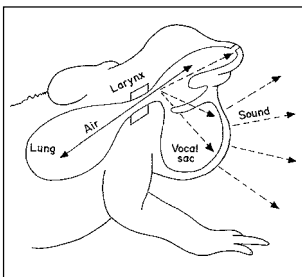
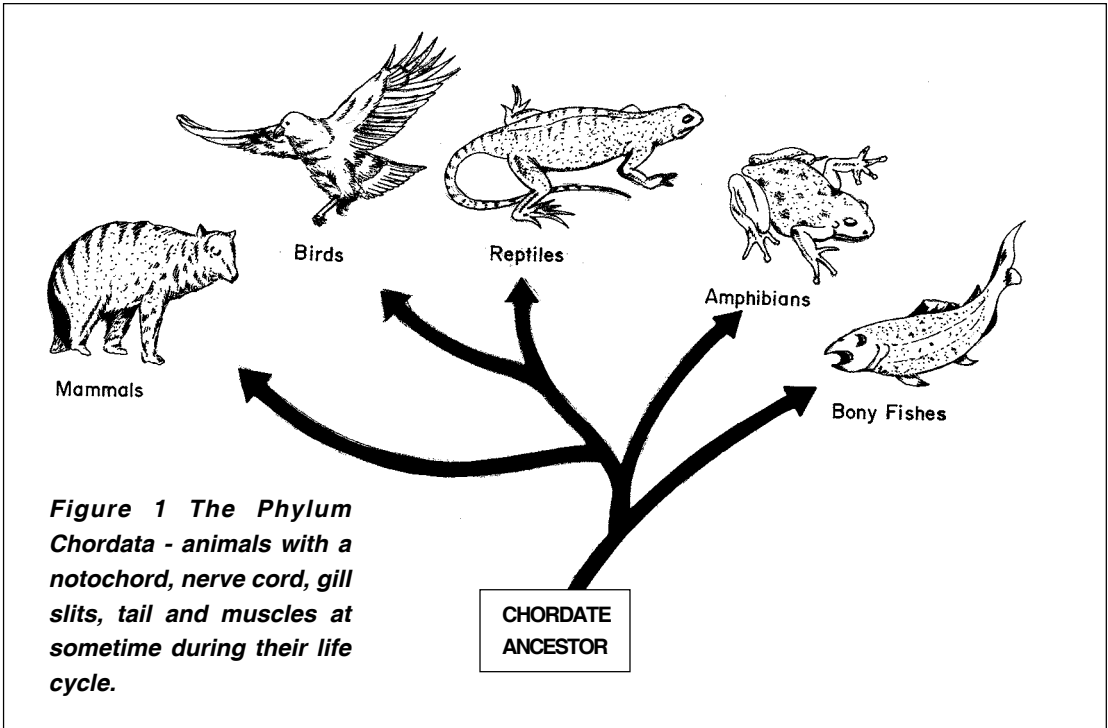
The amphibians – descendants of the crossopterygian fishes were the first land dwellers. Their transition from fresh water to land was a momentous step in vertebrate evolution. The word amphibia is derived from the Greek word *amphibious* meaning *double life* because of their two phase life style: a free living larval aquatic stage and a terrestrial juvenile and adult stage. Contemporary amphibians include caecilians (Order *Gymnophiona*), salamanders (Order *Urodela*) and frogs and toads (Order *Anura*).

Amphibians were the first vertebrates to have evolved a partially terrestrial way of life. This became possible due to a series of anatomical and physiological adaptations to the new environment. One feature of this new environment was the acoustic world – the sounds that were abiotically caused. The amphibians that



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**Figure 5a** Sound production in frogs. Sound production uses the respiratory ventilation cycle without releasing air to the outside. Before calling the, bucopharyngeal force-pump inflates the lungs and vocal sacs. With the nostrils closed, the body muscles contract, pushing a pulse of air through the larynx, vibrating the vocal cords. Sound radiates outwards and the vocal sacs resonate it.

adapted to the changed acoustic conditions of their environment most successfully were the frogs and toads (hereafter referred to collectively as frogs). They adapted so well that acoustic communication came to play a central role in their reproduction. Vertebrate vocalization came into existence for the first time in frogs.

The sound production apparatus of the frogs consists of the larynx and its vocal cords. The laryngeal apparatus is well developed in the males, who also possess a vocal sac. Air from the lungs is forced over the vocal cords and cartilages of the larynx, causing them to vibrate and regulate the frequency of sound. Muscles control the tension of the vocal cords. Vocal sacs act as resonating structures and increase the volume of the sound (Figure 5a & b).

The emitted sound consists of regularly alternating compressions and rarefactions of the air, basically increased and decreased air















**Box 2**

**1. Mating or advertisement call:** These calls attract females to the breeding sites and announce to other males that a given territory is occupied. Advertisement calls are species specific and any one species has a limited repertoire. They may also help induce psychological and physiological readiness to breed. The intensity of the call varies from species to species. The intensity of the advertisement call increases by almost 10 dB after the appearance of the female. Mating calls are emitted by male frogs.

**2. Territorial call:** These calls by male frogs may be of long or short range. They serve to demarcate and defend the territory and are emitted either sporadically or at faster call repetition rates. They may be of functional significance in the maintenance of territories or the regulation of population densities.

**3. Release call:** These are short explosive sounds repeated at irregular intervals. They often resemble an accelerated or imperfect mating call interspersed by sounds or short durations in some instances. These calls inform the partner that a frog is incapable of reproducing. They are given by unreceptive females during attempts at amplexus by a male or by males that have been mistakenly identified as females by another male.

**4. Reciprocal call:** These low pitched feeble calls are produced by females in response to the male advertisement call. Due to the feebleness of the call, it had till now escaped the attention of researchers. Recently it has been shown that only after the female produces the reciprocal call, are the final mating and egg laying activities initiated.

**5. Distress call:** These are low pitched, shrill cries or screams. They are not associated with reproduction but are produced by either sex in response to pain or while being seized by a predator. They may be loud enough to cause a predator to release the frog.

female reciprocal call given in response to the male advertisement call plays a significant role in the courtship and breeding biology of frogs. The female reciprocal calls seem to act as a *catalyst* for the enhancement of the reproductive activity of the breeding colony. Once the female responds to the advertising males, more activity is observed in the breeding colony, involving mostly jumping around and across the responding female.

Comparative Fourier Analysis of the female reciprocal call and the conspecific male advertisement call showed that the frequency domain of the male call is almost double that of the female call and accordingly there is a shift in the dominant frequency,



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whereas the spectral pattern is common to both (*Figure 11*).

Although auditory signals dominate frog courtship, the tactile and visual signals serve in the final approach and amplexus. For most frogs, the tactile role in amplexus must be emphasized as it stimulates ovulation in some frogs and oviposition in all. Migration is a common feature in the life cycle of terrestrial amphibians, due to the requirement of water for their eggs and larvae. This migration occurs just before or during courtship. Pond breeding amphibians move from their terrestrial or arboreal homes to temporary or permanent ponds. Usually the males precede the females and arrive hours or days before the females. Male frog calls or chorus guide the females to the breeding areas. They partition their breeding sites, each species having a calling microhabitat. Each male defends its own territory mostly by vocalization and when that fails, they defend by head butting, wrestling or biting.

Most frogs are twilight or nocturnal creatures. They leave their hidden recesses at dusk, based on a specific brightness level. During the day they sleep directly in the sunlight above the water. Bright daylight has a striking effect on mating behaviour in species which leave their homes only at night. Bright light and water acting together release the spawns, which are then fertilized by the amplexing male.

### Suggested Reading

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