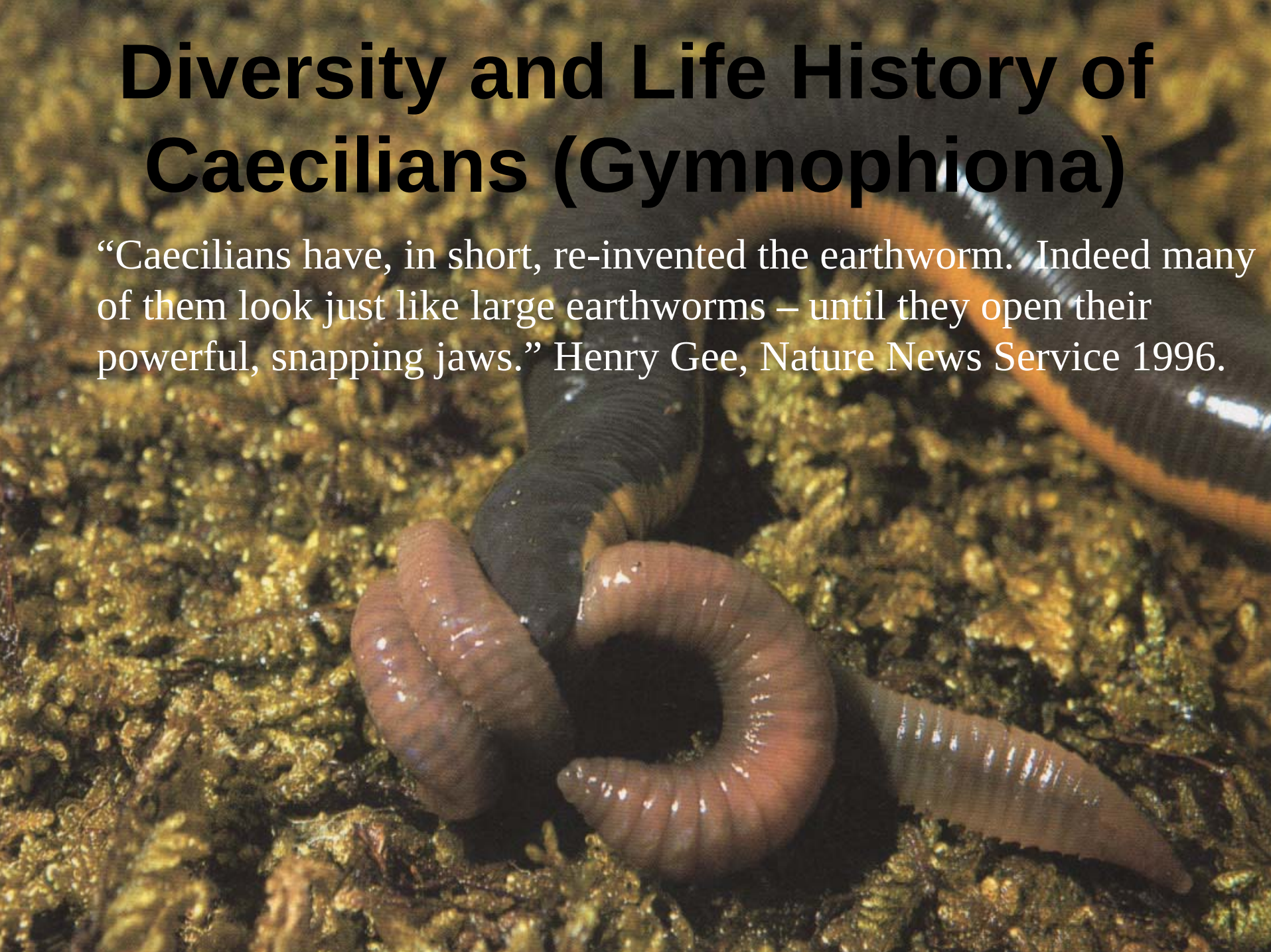
Diversity and Life History of Caecilians (Gymnophiona)



"Caecilians have, in short, re-invented the earthworm. Indeed many of them look just like large earthworms – until they open their powerful, snapping jaws." Henry Gee, Nature News Service 1996.

Caecilians, defined:

- Caecilians are tropical amphibians.
  - 160 species in 6 families.
- All are blind and worm-like, with annuli around the body.
- Truly legless with no rudiments of pectoral and pelvic girdles.
- Caecilians are highly specialized for burrowing.
  - heavily ossified skulls,
  - specialized sensory tentacles,
  - unique locomotory pattern,
- all these traits make them well suited for a fossorial lifestyle.

Caecilians, defined

(cont'd.):

- Caecilians have **retractable tentacles** which are sensory organs, perhaps used to locate prey.
  - Tentacles are unique in that they are organs of smell, but associated with the eye.
  - Tentacles carry chemical cues from the environment to the nasal cavity.
  - The tentacle is retracted by the same muscle that retracts the eye in other vertebrates.
  - The channel for the tentacle is lubricated by Harderian gland, which lubricates the eye socket in other vertebrates.
- Eyes are nonessential in caecilians; the structures formerly used by eyes were free to be adapted for other purposes.

A “primitive” caecilian, Ichthyophiidae: *Ichthyophis kohtaoensis*

An “advanced” caecilian, the live-bearing *Schistometopum thomense* (Caeciliidae)

Life History of Caecilians

Reproduction

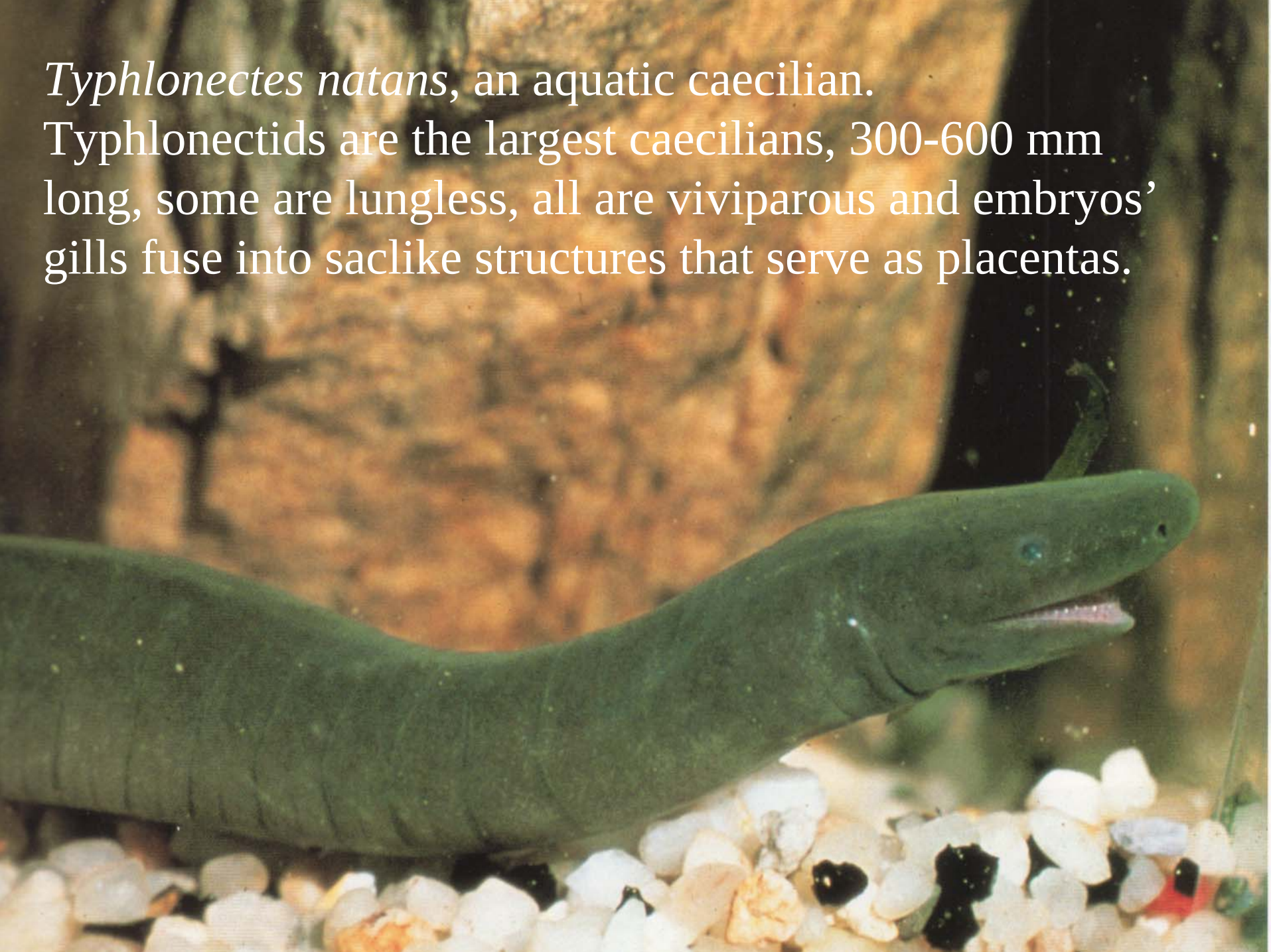
- Unlike most amphibians all caecilians reproduce via **internal fertilization**.
- Males have a copulatory organ called a **phallodeum**.
- Eggs are similar to those of fish and other amphibians in gelatinous ; they are not especially adapted for dry land.

Reproduction cont'd

- **Terrestrial or aquatic larvae** which hatch from eggs
- **Females guard eggs**.
- Others are **viviparous**. Give birth to young alive.
- Embryos in oviduct use up their yolk and females secrete **"uterine milk"** to nourish the babies.
- Embryos shed specialized teeth after birth.
- Enormous gills of larvae developing in oviducts may be used for gas exchange.
- Courtship is not well known

Feeding, Diet, locomotion, enemies, and defense

- Sit and wait predators. Eat earthworms, arthropods, other invertebrates.
- Coral snakes are important predators in South America.
- Skin has poison glands, like most amphibians.
- Locomotion is via “rod within a tube”. Push head forward and move skin up in waves. Can also locomote by undulation in loose substrate.



Typhlonectes natans, an aquatic caecilian. Typhlonectids are the largest caecilians, 300-600 mm long, some are lungless, all are viviparous and embryos' gills fuse into saclike structures that serve as placentas.

Burrowing machines

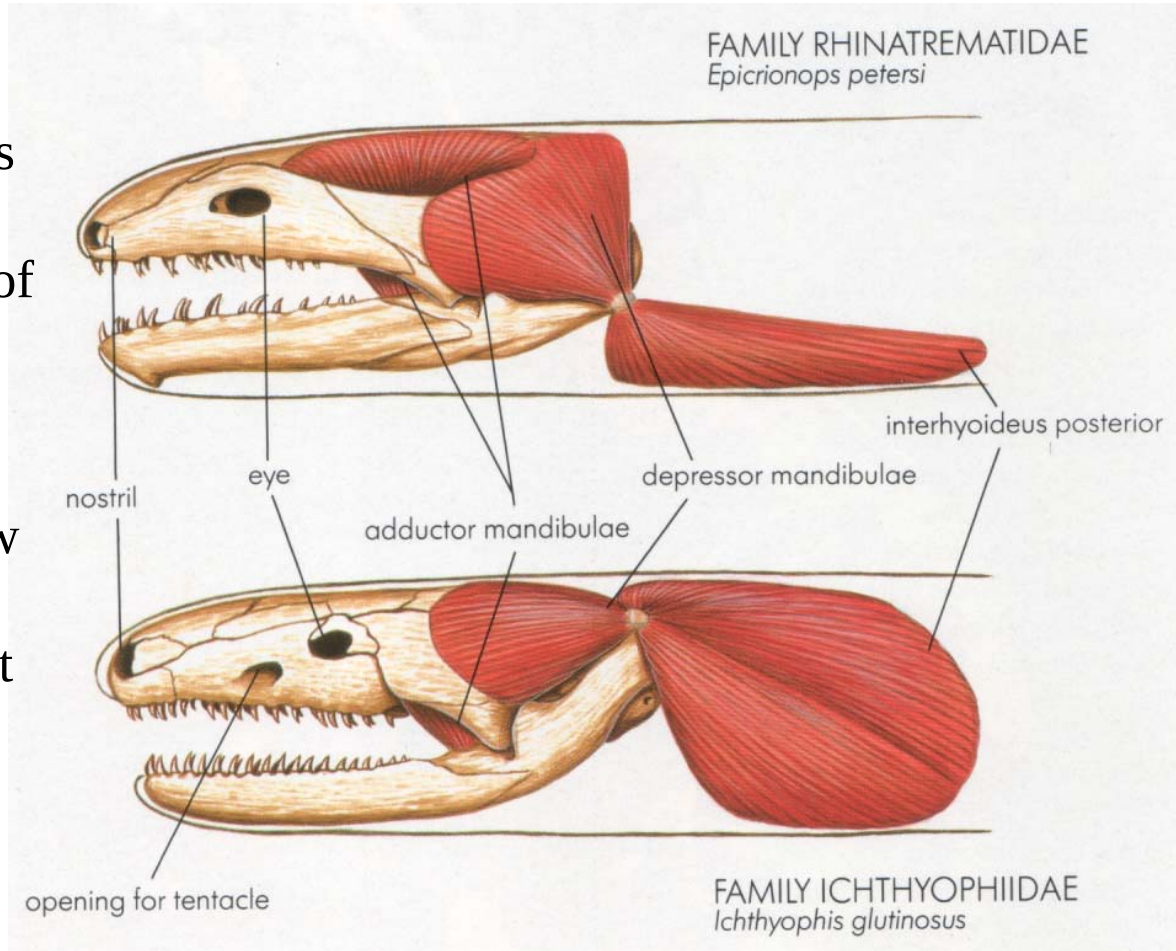
- Skin of skull is very adhered so it doesn't tear away
- What is evolutionary trend toward burrowing in Caecilians?
  - Reduction of bony elements.
  - Increasing ossification of skull
  - Trend towards dissociation of tentacle from eye.
  - Tentacle placed farther forward
  - Mouth increasingly subterminal, or recessed.

Burrowing machines cont'd.

- Head musculature:
  - As skull evolves to be increasingly ossified, the adductor mandibulae muscle has less room for attachment through temporal fossae.
  - In advanced caecilians, the temporal fossae are sealed, and adductor mandibulae are much reduced.
  - The interhyoideus posterior muscles become more developed and serve to close the jaw by pulling back and down on a process behind the hinge of the lower jaw.
  - These muscles are enormous in the advanced caecilians.

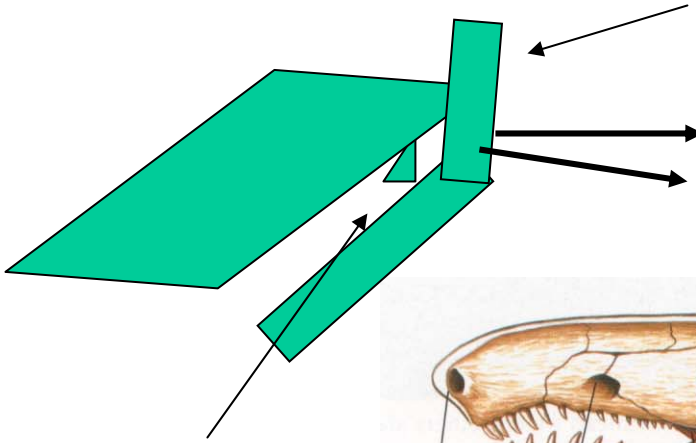
In “primitive” caecilians (above right) jaw closing is mostly accomplished with adductor mandibulae pair of muscles, as in most vertebrates

In advanced families below right) the innterhyoideus posterior muscle does most of the work.



The IH muscle attaches to an extension of the mandible behind the hinge of the lower jaw. The IH essentially pulls back on a lever, swinging the mandible closed with great force.

Why? The answer is related to burrowing efficiency. The trend of muscle arrangement and modification is even more pronounced in the highly specialized burrowing species shown below. Note the subterminal mouths, rigid skulls, and reduced number of skull bones.



Long retroarticular process makes a lever.

Interhyoideus posterior muscle can pull hard on the lever, together with the longus capitus, these forces generate a very strong bite.

Quadrate works as the fulcrum