

Lecture 8 – History of fishes



Ray Troll
Picture =
CARD
SHARKS

Structural Patterns and Trends in Diversification

- Fish subsumed (since Cope (1889) proposed - Agnatha - jawless fishes and Gnathostome lines - hasn't really stood the test of time (explain later).
- Consider Agnathan briefly.
- Earliest fish-like vertebrates with reasonable fossil record - middle Ordovician (440-510 mya) of North America, Europe and Australia.
- Many early vertebrate groups tried hard external armor (dermal bone) – this is preserved. ~ 500 mya dermal bone with structural complexity evolved.
- Evolution of calcified tissues has had profound effect on vertebrate evolution - and the origin of vertebrate skeletal structure - considerable interest
- All oldest fish-like vertebrates sometimes called **ostracoderms** (shell-like skin).
- All (at least partly) encased in some bony armor, lacked jaws, paired lateral fins.
- Mouth was slit or oval opening towards front of animal.
- From tail structure - adapted to bottom dwelling existence, feeding probably by suction?? using flexible floor of oralobranchial chamber and associated ventral branchial muscles as a pump.

Agnathans

- Class – Pteraspidomorphi
- Class – Myxini?? (living)
- Class – Cephalaspidomorphi
 - Osteostraci
 - Anaspidiformes
 - Petromyzontiformes (living)

Major Groups of Agnathans

1. Osteostracida
 2. Anaspida
 3. Pteraspidomorphida
- 1) Osteostracidan agnathans - include thumb sized cephalaspids (see Stensio) - characteristic anatomy = head shield, pair of openings (presumably for the eyes) and single aperture for naso-hypophyseal canal.

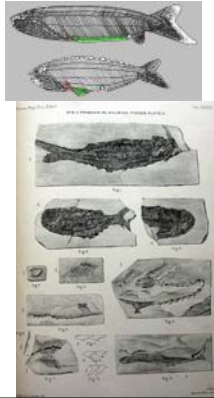


Major Groups of Agnathans

1. Osteostracida
2. Anaspida
3. Pteraspidomorphida

2 - Anaspidian agnathans - streamlined bodies and small scales suggest strong swimmers. Strange hypocercal tail probably raised anterior end of body in swimming.

Immediately behind head is row of pores - thought to be gill openings.



Major Groups of Agnathans

- 1. Osteostracida, 2. Anaspida, 3. Pteraspidomorphida
- 3) Pteraspidomorphidan agnathans - Most successful in abundance, taxonomic diversity and duration in fossil record – head, trunk enclosed in bony plates



2 living groups of agnathan fishes

- Hagfish and Lamprey = Traditionally together in cyclostomata
- Not a good group BUT many uncertainties surrounding evolutionary interrelationships of various agnathan groups (both fossil and living)



Jaws = GNATHOSTOMES

- Gnathostomes: the jawed fishes
- While agnatha cannot be called good (monophyletic) group - there is very good evidence for gnathostome monophyly.
- 4 major groups of jawed vertebrates:
Extinct Acanthodii and Placodermi.
Living Chondrichthyes and Osteichthyes

FOSSIL GNATHOSTOMES

- Fossil gnathostome radiations:
- 1) Placodermi - Most primitive
 - Diverse and bizarre group of heavily armored gnathostomes - Devonian (408-360 mya) - almost restricted to period.
- Typically Placoderms are dorsoventrally compressed. All = head shield articulated with trunk shield - cover anterior body.

Placoderms – most primitive jawed

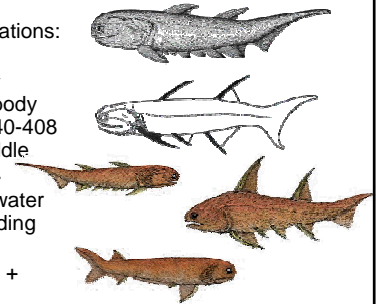


GNATHOSTOMES

- Living Chondrichthyans - usually divided into Selachii or Elasmobranchi (sharks and rays) and Holocephali (chimeroids).

FOSSIL GNATHOSTOMES

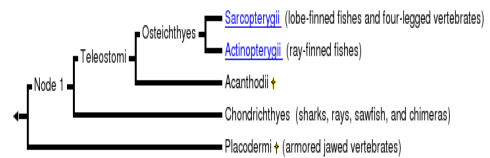
- Fossil gnathostome radiations:
- 2) Acanthodians, or spiny-sharks = relatively conservative "fish-like" body form. Middle Silurian (440-408 mya) - disappear by middle Permian (290-245 mya).
- Large eyes, active mid-water swimmers. Array of feeding specializations.
- Teleostomi = Acanthodii + Osteichthyes



GNATHOSTOMES

- Living Osteichthyans commonly regarded as forming two major groups -
 - Actinopterygii – Ray finned fish
 - Sarcopterygii (coelacanths, lungfish, Tetrapods).

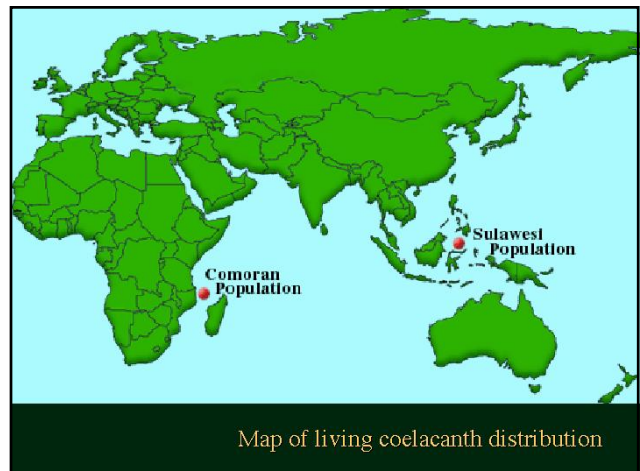
Gnathostome Summary



Sarcopterygians

- Actinistia = Latimeria = Coelacanths
- Dipnoi = Lung-fish
- Osteolepimorphi = Tetrapod Ancestors

Cranial kinesis, internal choanae and labyrinthodont teeth. Famous – *Eusthenopteron*
Close to tetrapods - *Panderichthys*



And a live coelacanth, posing with a second sarcopterygian. . .



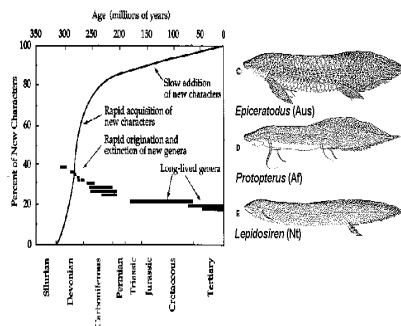
Lungfish - Dipnoi

- Three genera
- Africa
- Australian
- South American

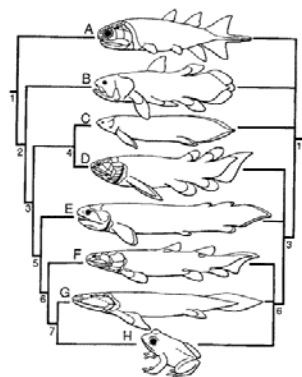


Lungfish - Dipnoi

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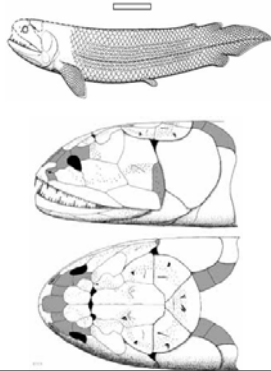
- A) [Onychodontiformes](#) - early to late Devonian
- B) [Actinistia](#) - middle Devonian to Recent
- C) [Dipnoi](#) - late Silurian or early Devonian to Recent
- D) [Porolepiformes](#) - early to late Devonian
- E) [Rhizodontiformes](#) - late Devonian to Carboniferous
- F+G) [Osteolepiformes](#) - middle Devonian to early Permian; G) [Panderichthys](#) - ? - type of Osteolepiformes - middle to late Devonian
- H) [Tetrapoda](#) - late Devonian to Recent



Rhizodonts

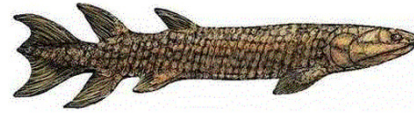
- Rhizodonts = extinct group of sarcopterygian fishes. Many areas of world - Upper Devonian to Upper Carboniferous - earliest known species = 377 Ma, latest around 310 Ma.

Rhizodonts lived in tropical rivers and freshwater lakes. Dominant predators. Huge sizes - largest known species, *Rhizodus hiberni* from Europe and NA, estimated 7 meters, largest freshwater fish known.



Osteolepimorphi = Tetrapod Ancestors – *Eusthenopteron*

Also known as Rhipidistians



Actinopterygii

