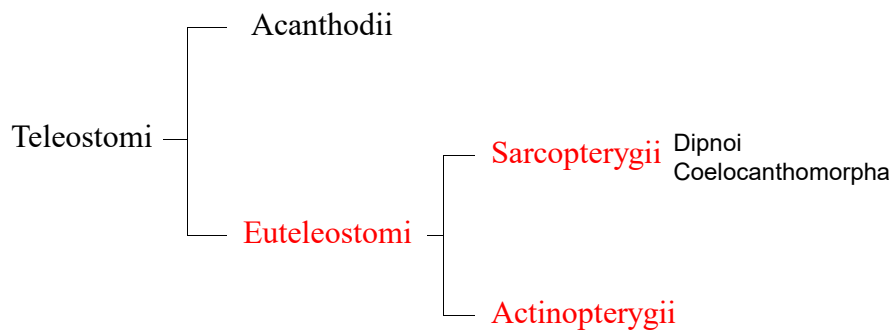
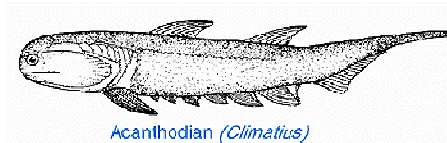
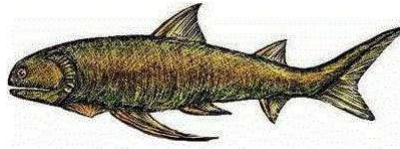
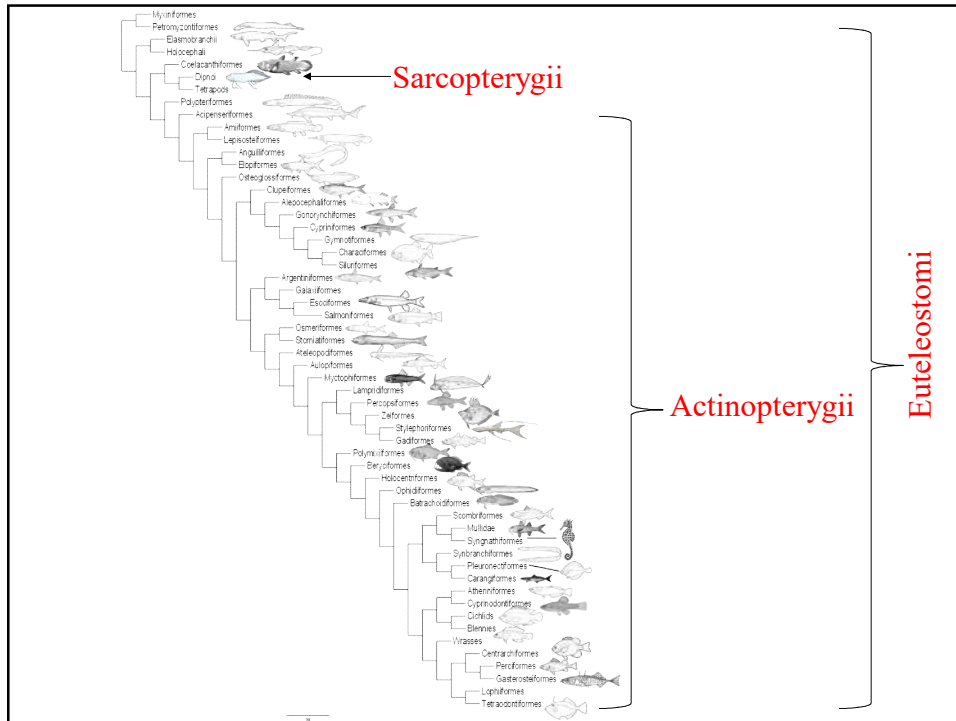


## Class Acanthodi – “spiny sharks”

- Extinct, Silurian, Devonian
- Earliest jawed fishes in the fossil record
- Rows of ventral fins with a stout spine
- Evolution:
  - reduced dermal skeleton
  - changes in operculum (bony)
- Probably active mid-water and surface feeders
- Freshwater and Marine



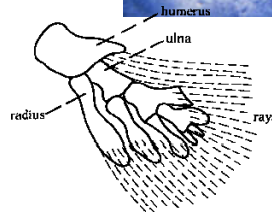
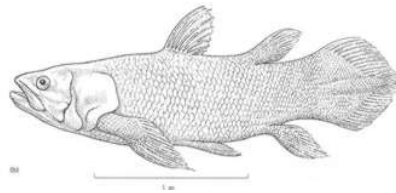


## Euteleostomi Characteristics

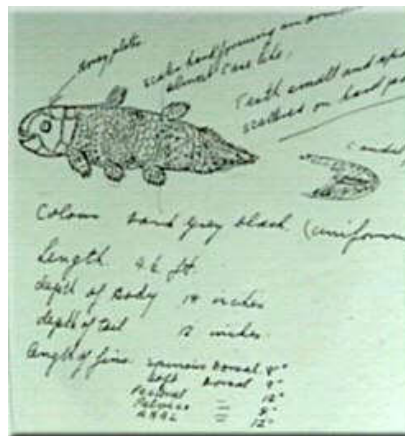
- Truly ossified skeletons (some secondary losses)
- skull with sutures
- teeth **usually** fused to the jaw bones
- soft segmented fin rays
- swim bladder or functional lung
- spiral valve **usually** absent
- low blood concentrations of urea (except in lungfish and the living coelacanth)

Grade Teleostomi, Class Sarcopterygii, Subclass Coelocanthomorpha

- ~120 species (well studied fossil record)
- Living fossil
- Thought to have gone extinct 60mya
- Unossified notocord, ossified rays, vertebral spines
- Large, thick, cycloid scales
- Living species
- Cycloid scales
- Spiral valve
- Lobe finned
- High electrosensitivity



Grade Teleostomi, Class Sarcopterygii, Subclass Coelocanthomorpha

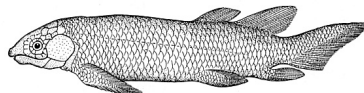


- first live specimen collected 1938
- annual catch 2-4/year
- Up to 1.8 m long
- long lived (>60 yrs?)
- aggregate in caves during day, forage at night
- ovoviviparous with large eggs, lecithotrophic
- Conservation?

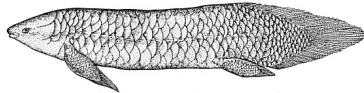


Grade Teleostomi, Class Sarcopterygii, Subclass Dipnoi, lungfishes

- Fossil records on all major continents
- Three surviving genera in N. America, S. America and Australia
- Mix of derived and primitive traits make phylogeny difficult, initially described as a reptile, then amphibian before recognition as fish
- Piltown fish



A. *Dipterus*



B. *Neoceratodus*

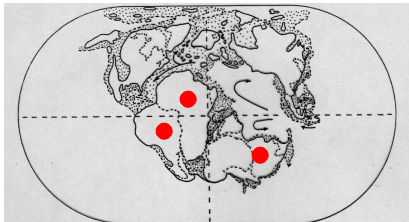


Figure 30. Lungfishes. A. An ancient Devonian fossil type; B. *Neoceratodus* of Australia. The median fins have changed greatly during the history of the group. (A after Traquair; B after Dean.)

Grade Teleostomi, Class Sarcopterygii, Subclass Dipnoi, lungfishes

- Evolutionary trends in Dipnoi
  - skeletal reduction
  - caudal fin reduction
  - reduction in size of cycloid scales
  - marine to freshwater (lungs)

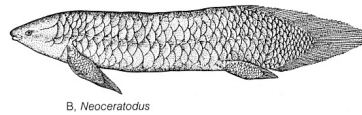
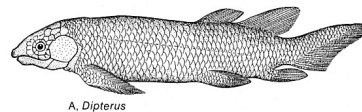
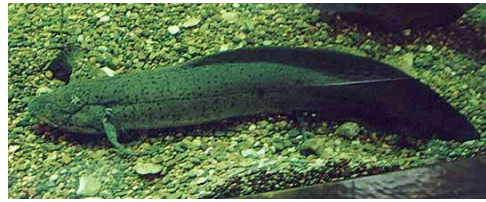
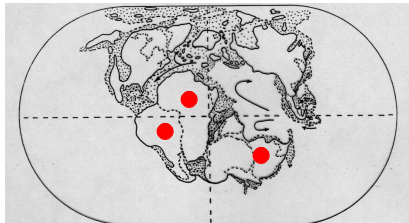
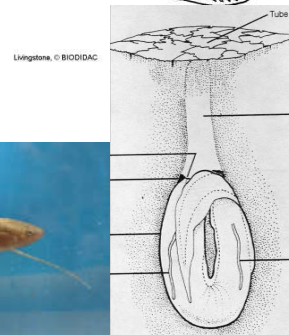
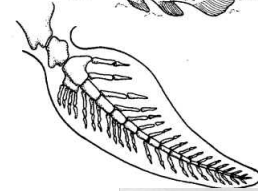
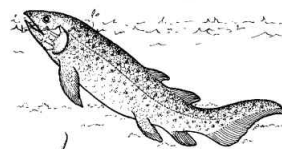


Figure 30. Lungfishes. A, An ancient Devonian fossil type; B, *Neoceratodus* of Australia. The median fins have changed greatly during the history of the group. (A after Traquair; B after Dean.)



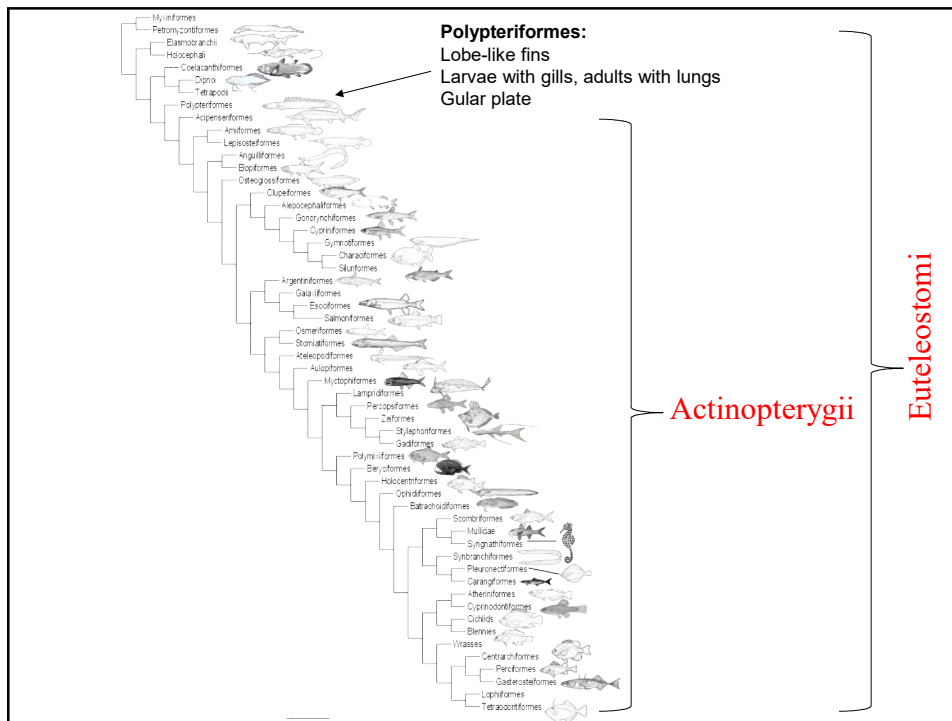
Grade Teleostomi, Class Sarcopterygii, Subclass Dipnoi, lungfishes

- Cycloid scales, reduced size
- Tooth plates not associated with jaws
- Some parental care, male pectoral fins highly vascularized with increased testosterone, an adaptation to deliver oxygen to young
- Australian
  - Facultative air breathers
  - Can't aestivate
  - Single lung
- S. American and African
  - obligate air breathers
  - Aestivate
  - Paired lung
- Larvae typically more reliant on gills (external)



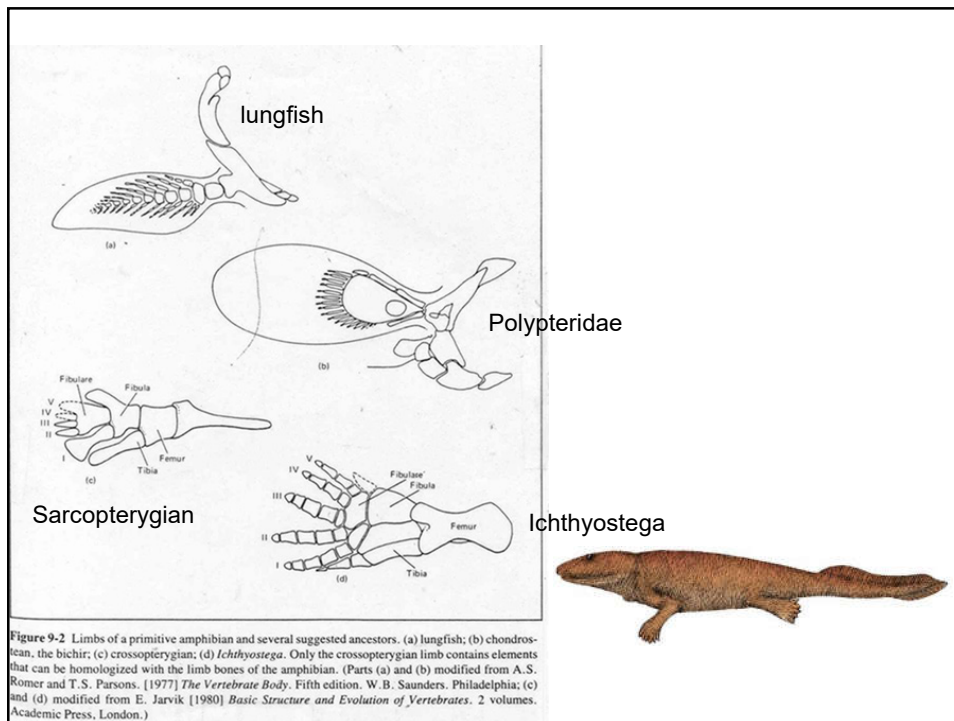
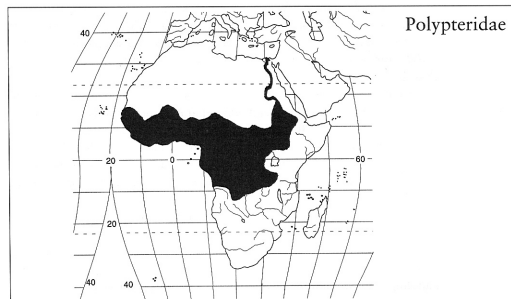
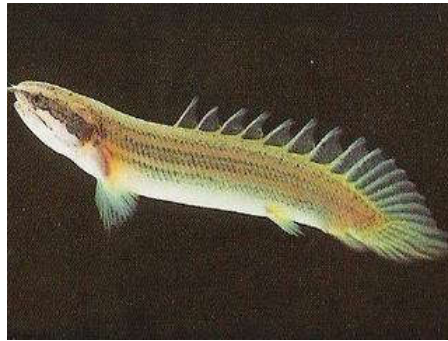
## Class Actinopterygii – ray finned fishes

- Vast majority of fishes (38 orders, 426 families, 4064 genera)
- Monophyletic group
- Group arose 200 mya
- Three subclasses
  - Cladista
  - Chondrostei
  - Neopterygii
- Common characteristics
  - Cycloid, ctenoid or ganoid scales
  - Spiracle **usually** absent
  - Gular plate **usually** absent
  - branchiostegal rays **usually** present
  - Uroneural, hyeural bones – flattened neural and haemal arches, hypural plate
  - Mobile, detached premaxilla (jaw suspension, protrusability)
  - Interopercle bone usually present



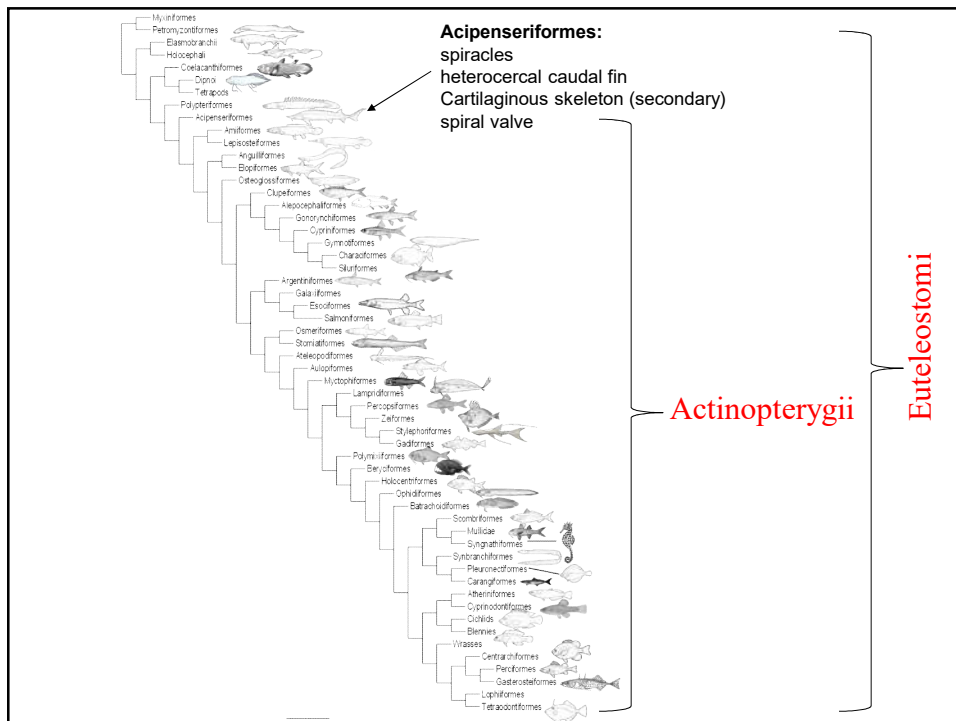
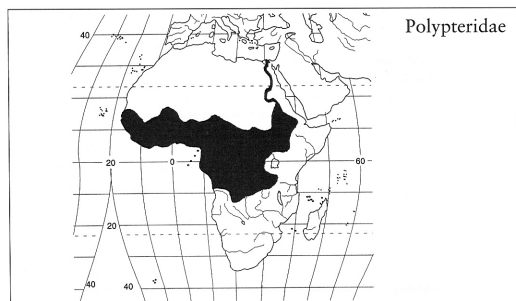
**Class Actinopterygii, Subclass Cladista, Order Polypteriformes bichirs**

- Fossils restricted to Africa, Taxonomy unresolved
- 2 genera, 10 species
- Most obligate air breathers
- Lobe-like fins but pectoral fins anatomically different from lobe finned fish
- Ganoid scales
- Horizontal dorsal finlet rays



**Class Actinopterygii, Subclass Cladista, Order Polypteriformes bichirs**

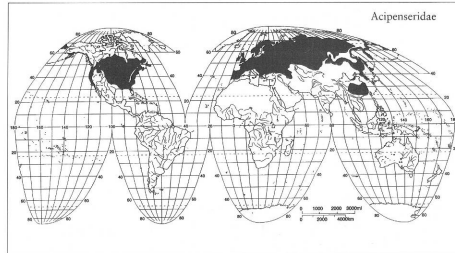
- Traits that complicate classification
  - Larva with external gills, adults with 2 lungs (lungfish)
  - Exhaled air exits via spiracles (sturgeon)
  - 2 gular plates (Coelocanth)
  - Reduced heterocercal tail (gar)
  - Ganoid scales (gar)





Class Actinopterygii, Subclass Chondrostei, Order Acipenseriformes, Sturgeon and Paddlefish

- Family Acipenseridae, 4 genera, 24 species
  - Most primitive ray-finned fishes
  - Largely cartilagenous skeleton, a secondary loss of ossification
  - Spiral valve
  - Heterocercal tail
  - Bony scutes and plates
  - Snout, transverse row of barbels
  - No branchiostegal rays
  - Spiracles



Class Actinopterygii, Subclass Chondrostei, Order Acipenseriformes, Sturgeon and Paddlefish

- Diadramous, anadramous, land locked populations
- Long lived (>100 years), large
- Protrusible mouth
- Asian species – 28 feet, 2800 lbs
- Commercial fisheries peaked ~1890
  - meat, caviar, oil
- Life history
  - long time to mature, non-annual breeding, few large young
- Habitat requirements (large rivers)
  - dams & levees

