About 1000 species
Unchanged in last 200 MY
Nearly all marine
Shark populations threatened

Vertebrates
Living Gnathostomes (jawed fishes)
Cartilaginous fishes
(Class Chondrichthyes)
- No bone (calcified cartilage)
- Heterocercal tail
- Paired pectoral and pelvic fins
- Pelvic claspers in males
- Placoid scales
**Vertebrates**

**Living Gnathostomes (jawed fishes)**

Cartilaginous fishes (Class Chondrichthyes)

- Exposed gill slits
- No swim bladder
- Retain high urea concentrations
- Well-developed senses

---

**Vertebrates**

**Feeding in Chondrichthyes**

- Mostly carnivores
- Olfactory organs
- Mechanoreception with lateral line
- Good vision
- Attacks fine-tuned with electroreceptors

---

**The dogfish shark (Squalus)**

- Nostril
- Spiracle
- Spine
- First dorsal fin
- Second dorsal fin
- Caudal fin
- External gill openings
- Pectoral fin
- Pelvic fin
- Rostrum
- Tooth shed
Types of maternal investment:

1. Oviparity
2. Ovoviviparity
3. Viviparity

Intrauterine cannibalism
"oophagy"
Skates and rays

- Dorsoventrally flattened
- Large, fused pectoral fins
- Dorsal spiracles for water intake
- Pavement-like crushing teeth
- Skates lay eggs in leathery case "mermaid's purse"

Vertebrates

Living Gnathostomes (jawed fishes)

Bony fishes (Osteichthyes)

- Skeleton of bone (endochondral)
- Presence of swim bladder or lungs
- Gill cover = operculum

Two classes:
1. Class Actinopterygii (ray-finned)
   - Modern bony fishes (teleosts)
2. Class Sarcopterygii (lobe-finned)

Evolution of fishes

- Modern bony fishes (teleosts)
- Lobe-finned fishes
- sharks, skates, rays
- Lampreys
- Chimaeras
Vertebrates

Ray-finned fishes (Actinopterygii)

Teleost modifications:

- Cycloid or Ctenoid scales
- Homocercal tail
- Fin morphology
- Swim bladder
- Jaw design

Types of scales
Types of caudal fins

- Heterocercal (shark)
- Homocercal (porch)
- Diphyocercal (lungfish)

Vertebrates

Lobe-finned fishes (Sarcopterygii)

- Only 7 species; includes lungfish and coelacanth
- Diphyocercal tail
- Muscular fins
- Lungs and gills present
- Lineage gave rise to tetrapods
**Vertebrates**

**Teleost Function**

- **Migration**
  - Diadromous fishes (anadromous vs. catadromous)
  - Spawning migrations
  - Seasonal (temperature)

- **Respiration**
  - Gill filaments with plates containing blood vessels
  - Water flow opposite of blood flow

- **Reproduction**
  - External fertilization and oviparity in most
  - Large numbers of eggs
  - Larvae carry yolk sac

---

**Lungfishes**

- Australian lungfish
- African lungfish
- South American lungfish

---

**Atlantic wolffish**
New world record largemouth bass caught recently in California

25.1 pounds
World’s smallest fish (7.9mm) recently discovered in Southeast Asia peat wetlands

BIO202 - 2012 Scharf