

CHONDRICHTHYES

Palaeozoic Radiation

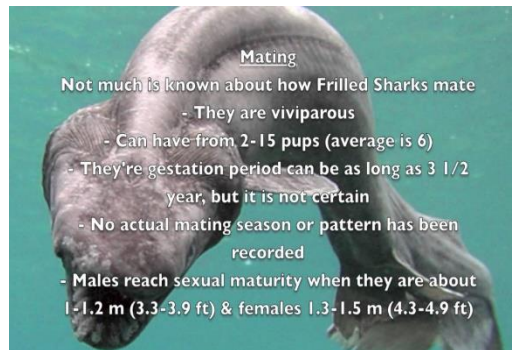
- Amphistylitic - jaw support
- Body supported notochord +
- Dorsal spines
- Caudal fin, symmetrical outside

Mesozoic Radiation

- Locomotor & feeding systems
- Hybodonts – Mouth terminal
- Heterodont dentition
- Living Hornsharks, similar
- Ceratotrichia: Long, flexible, fibrous rods that support the fins of sharks and other fish whose skeletons are made of cartilage.
- Amphistylitic - jaw support

Extant Radiation - Sharks, skates & rays

- 1st Triassic, even earlier
- Jurassic & Cretaceous Genera still here
- 1. Ventral mouth, overhanging rostrum
- 2. Solid, calcified vertebrae
- 3. Thicker, complex enamel teeth



Elasmobranchs

- ~815 species
- all marine habitats
- Large livers, squalene
- 5-7 gill slits (usually)
- Lateral line system
- Ampullary organs of Lorenzini (Electroreceptors)

- Internal fertilisation, claspers

Tails

- Heterocercal: vertebrae extend into lobe
- Epicercal Upper caudal lobe larger
- Hypocercal Lower caudal lobe larger

Scales

- Placoid
- Dentine covered enamel
- Single cusp, single pulp cavity

SHARKS

- 2, possibly 4+ lineages
- Squaloids: Megamouth, Basking
- Galeoids: Requiems, hammerheads
- Intercalary plates
- Hyostylic jaw suspension
- Small numbers of offspring
- Lecithotrophy – yolk in egg
- Matrotrophy – reproductive tract Oviparous → mermaid's purse
- Nidamental Gland in Oviduct
- 6-10month developmental period Ovoviviparous (egg retention)
- Viviparous



BATOIDS: SKATES & RAYS

Skate: thick, pair dorsal fins, caudal fin, oviparous

Ray: whip like, serrated dorsal barbs, viviparous

- ~456 extant species
- Flattened dorsoventrally
- Spread Ampullae of Lorenzini
- Rajidae family generate weak electrical discharges
- Teeth flat crowned plates
- Sexual dimorphism
- Enlarged Pectoral fins, thrust
- Bucklers

OSTEICHTHYES

- Extinct groups Placoderms, Osteolepiforms & Acanthodians bony
- Arose mid-Silurian
- Mid Devonian radiated 2 major clades: Bony Fishes
- 1. Sarcopterygii: extend central shaft bone, feather
- 2. Actinopterygii: bones at base, fanlike

Key adaptations aided radiation Bony Fishes

- Bony endoskeleton, matrix calcium phosphate
- Operculum – bony plate covering gills, attached muscles
- Gas filled pouch off esophagus – lungs, swim bladders
- Progressive specialisation jaw musculature & skeletal elements
- flattened scales

Tails

- Heterocercal, Epicercal, Hypocercal, Homocercal and Diphyrcal

Scales

- Placoid, conical, tooth-like
- Ganoid, diamond, ganoine + bone
- Cycloid and Ctenoid (Thin, flexible, overlap)

Circulation system

- Single circulation
- 2 chambered heart
- Atrium → Ventricle → Gills
- Capillary bed, drop pressure
- Swimming motion helps

Neutral Buoyancy & the Swim Bladder

- Gas filled space (swim bladder)
- 5% marine, 7% FW
- Alter level → Neutral buoyancy
- Physostomous fish: have a Pneumatic duct
- Physoclistous fish: no Pneumatic duct
- Pneumatic duct: gulp air ↑ volume
- Gas gland: lactic acid, O₂ release
- Rete mirabile: capillary network Physoclists
- Ovale valve, opened → O₂ moves into the blood

Freshwater fish

- Hyperosmolar
- Freshwater ~0.001-0.005gmole/l
- Don't drink, Lots dilute urine
- Chloride cells in gills uptake
- Large Glomerulus

Reproduction

- Oviparity, Ovoviviparity, Viviparity
- Mass spawnings e.g. Cod
- Pelagic eggs: small, buoyant, transparent, little yolk
- Benthic eggs: larger, nonbuoyant, yolky & adhesive
- Metamorphosis

Protogynous hermaphroditism

- Reproduction limited egg production
- Socially driven
- Sneaker males, large reefs

Sequential Hermaphrodites

Protandrous hermaphroditism

- Big bright ♂'s, territories, harems
- Sex change socially driven

Saltwater fish

- Hyposmolar
- Saltwater ~1gmole/l
- Drink lots seawater
- Small Glomerulus, little urine
- Salt excretory glands gills