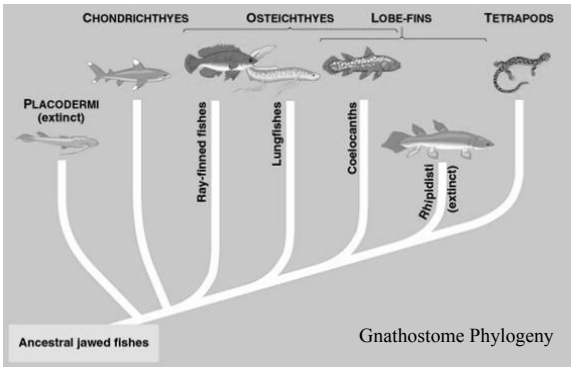
CHONDRICHTHYES



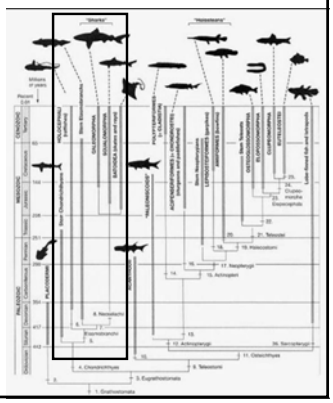
Gnathostome Phylogeny

Placoderms

1. An extinct group of primitive jawed fish
2. Variety of sizes, diets
3. *Dunkleosteus*

Class CHONDRICHTHYES

1. Cartilaginous fish
2. Sharks, rays, ratfish
3. 750 species
4. Fig 3-14



Chondrichthyes

1. notochord
2. Cartilage
   A. may be calcified.

Reproduction

1. Internal fertilization
   A. claspers
   B. cloaca
   C. Females

Mating

1. Small sharks,
2. Large sharks,
3. Males bite females .

Class CHONDRICHTHYES

1. placoid scales
   A.
   B. bone

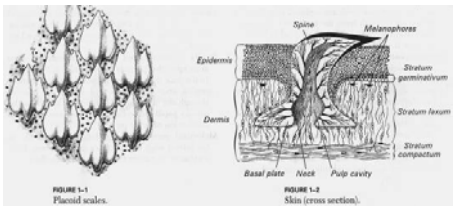


FIGURE 1-1
Placoid scales.

FIGURE 1-2
Skin (cross section).

Replacement tooth rows [fig. 5-2]

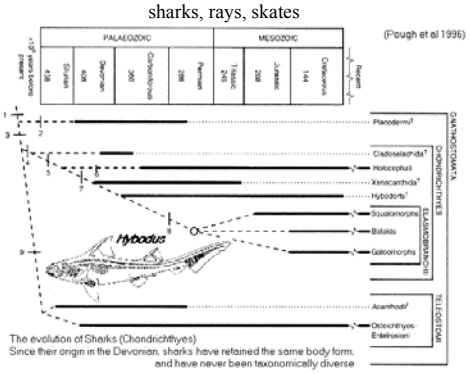
1. serially replaced
2. about every 8 days.

Class CHONDRICHTHYES

1. oil filled liver
2. Mouth ventral
3. spiral valve

Subclass Elasmobranchii

sharks, rays, skates



The evolution of Sharks (Chondrichthyes)
Since their origin in the Devonian, sharks have retained the same body form, and have never been taxonomically diverse

Subclass ELASMOBRANCHII

sharks, rays, skates

1. teeth

Subclass ELASMOBRANCHII

1. 5-7 pairs of gill slits
2. Spiracle
3. Heterocercal tail
4.

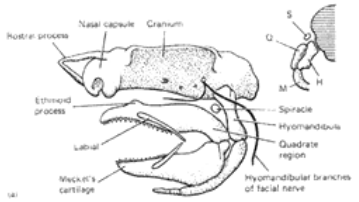
Spiracle

1. vestigial gill slit
2.
   A. in fast swimming sharks

   B. bottom dwelling sharks and rays.
3. oxygenated blood
4. pumps water

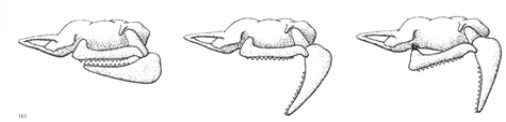
Hyoid Jaw Support

1. hyoid involved in jaw suspension
2. hyostylic jaw support
   A. hyomandibular alone supports the palatoquadrate,
   B. flexible connection to braincase



How are sharks able to swallow large prey?

1. Sharks dislocate their jaws .
2. Mouth opens ventrally
3. loosely attached to the cranial bones.
4. jaws come out



Shark Sensory Systems

1. sharks switch from one sense to another as they approach potential prey.
   - Sound:.
   1. Chemoreception
   2. Mechanorecpetion
   3. Vision: .
   4. Electroreception
   - Touch & taste:

Chemoreception

1. enlarged nasal capsules.
2. sensitive to one part in 10 billion
3. hammerheads (*Sphyrna*)

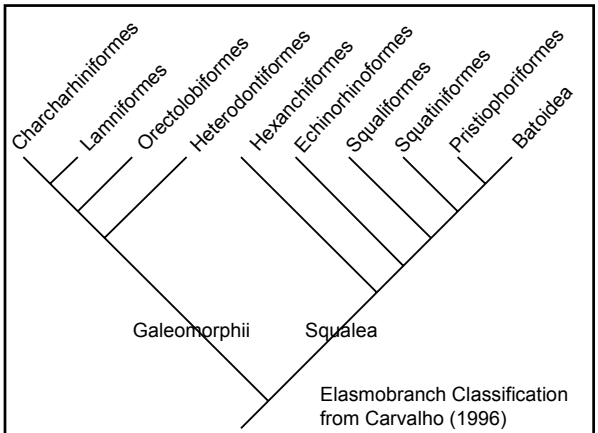
Attack behavior

1.

2.

3.

4.



Elasmobranch Classification from Carvalho (1996)

GALEOMORPHA

1. About 250 species
2. Active sharks _____.
   A. hammerhead, bull, nurse, whale, tiger, blue, white sharks etc.
3.
4. Spiracle…
5. _____ brain size to body ratio.

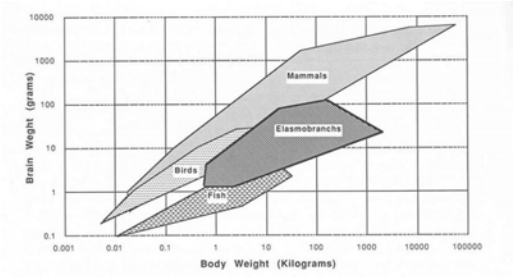


Figure 34. Comparison of brain and body weights in vertebrates. Those for elasmobranchs (sharks, skates, rays, and chimaeras) are encompassed by the striped area. (After Northcutt, 1977, and Moss, 1984)

Carnivores

1. *Carcharodon carcharias*: great white shark: up to 7 m long
2. extinct megatooth shark *Carcharodon megalodon* (or *Carcharocles*) up to 15 m long

Filter Feeding

1. The largest chondrichthyans
2. Three are galeomorphs. The fourth is
3. Manta ray.

Whale shark Rhincodon typus

1. Up to 18 m in length; 41 metric tons;
2. feeds mostly on _____;
3. Takes large mouthfuls of water

   _____

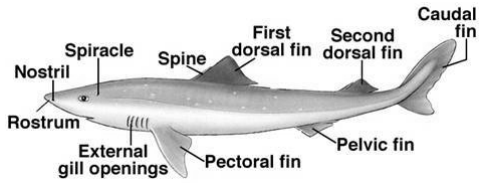
   _____

More filter feeding sharks

1. *Cetorhinus*
   A. up to 10 m in length
   B.
2. *Megachasma*:
   A. 5 m in length
   B. very large mouth
   C.

Order SQUALOMORPHA

1. *Squalus*, the spiny dogfish, is characteristic;
   A.
   B.
   C.
   D.



Cookie Cutter

1. A small shark. .
2. Deep water dweller
3. _____ mouth
4. _____lower teeth.
5. _____ the upper jaw.
6.

Batoidea

1. Skates (dorsal fin) and Rays (no dorsal fin)
2. Ca.. 500 species
3. bodies
4. pectoral fins
5. Eyes
6. Mouth and gill slits
7. blunt teeth
8. Manta rays are filter feeders
9. Stingrays.

Reproduction

1. Shark and ray reproductive modes.
   A. Oviparity
   B. Ovoviviparity
   C. Viviparity

Reproduction: Oviparity

1. Rays and primitive sharks
2. eggs hatch outside the body.
3. yolk sac.
4. mermaid´s purses

Reproduction: Ovoviviparity

1. eggs that hatch within the female.
2. yolk
3. Dogfish sharks, cow sharks, frill sharks, angel sharks, tiger sharks, and some nurse sharks.

Reproduction: Viviparity

1. nourishment from outside the egg.
2. two categories
   A. aplacental
   B. placental
3. no parental care after birth

Aplacental Viviparity, 1

1. Oophagy
   A.
2. Adelphophagy
   A.

flmnh.ufl.edu/fish/Education/questions/Biology.html

Aplacental viviparity with trophonemata

1.

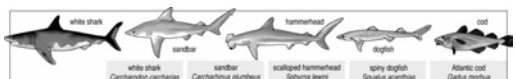
2. Found in Rajiformes (rays)

Placental Sharks

1. yolk sac contacts mother's uterus,
   A. yolk sac placenta.
2. nutrients are passed to the developing embryo.
3. requiem and hammerhead sharks.

Life History and Conservation of Sharks

1. slow rate of reproduction [Fig. 5-7].
2. some species more than 15 years old before reaching sexual maturity



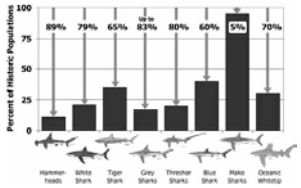
	white shark *Carcharodon carcharias*	sandbar *Carcharhinus plumbeus*	scalloped hammerhead *Sphyrna lewini*	spiny dogfish *Squalus acanthias*	Atlantic cod *Gadus morhua*
age to maturity (years)	m 9–10, f 12–14	m 13–16	m 4–10, f 4–15	m 6–14, f 10–12	m 2–4
size at maturity (centimeters)	m 350–410, f 400–430	m 170, f >180	m 140–280, f 150–300	m 60, f 70	m 32–41
life span (years)	m 15(?)	m 25–35	m 35	m 35, f 40–50	m 20+
litter size	2–10 pups	8–13 pups	12–40 pups	2–14 pups	2 million–11 million eggs
reproductive frequency	biennial(?)	biennial	?	biennial	annual
gestation period (months)	>12	9–12	9–12	18–24	n/a

Reproduction

1. High investment in few young
2. K-selection vs. r-selection
   A.
   B.

Shark Conservation

1. Slow reproduction
2. Commercial and recreational overfishing .
   A. Shark meat has become more popular
3. 80 - 90 % decline of some species.



Overexploitation

1. *Squalus*: an important commercial foodfish.
   A. fish and chips
2. Finning.
   A.
   B.
   C.
   D.
   E. The rest is thrown away.

Subclass Holocephali

1. Chimaeras
   A. Ratfish, rabbitfish, spookfish, and ghostfish
2. 25-30 species [Fig. 5-9]
3. Temperate oceans
4. Mostly deep water
5. Oviparous
6. Operculum
7. No spiracle

Chondrichthyes-Ratfish

1. Diphycercal tail
2. Naked skin to very few scales.
3. Claspers
4. poisonous spine

Subclass Holocephali

1. holostylic jaw suspension.
2. grinding plates
3. Flattened teeth .
4. nipping teeth.