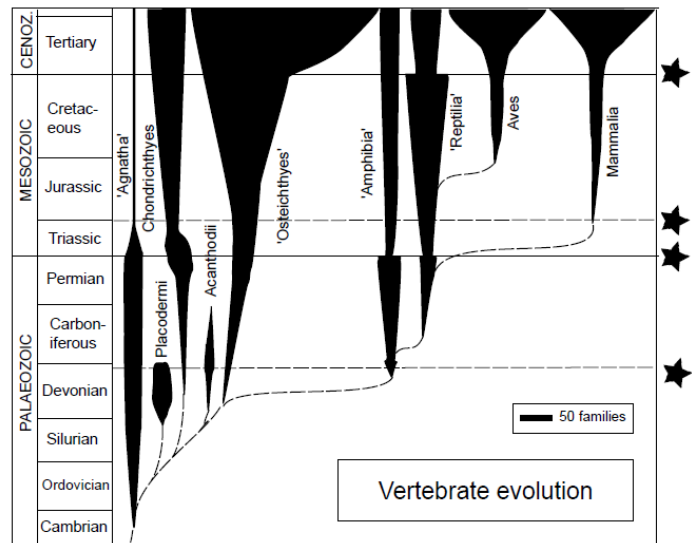


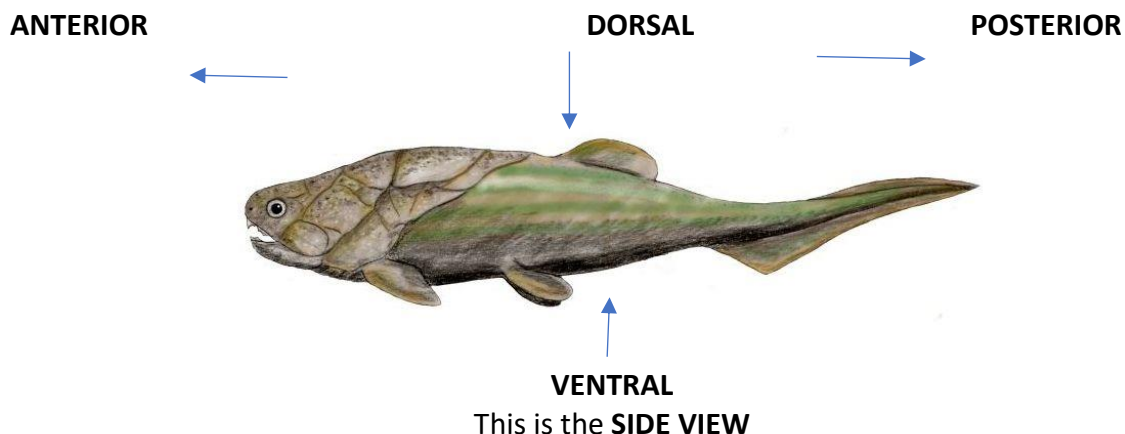
VERTEBRATE EVOLUTION – FROM FOSSIL RECORD

Kingdom	Animalia
Phylum	Chordata
Subphylum	VERTEBRATA
Class	Agnatha
Class	Placodermi
Class	Chondrichthyes
Class	Osteichthyes
Class	Amphibia
Class	Reptilia
Class	Mammalia
Class	Aves



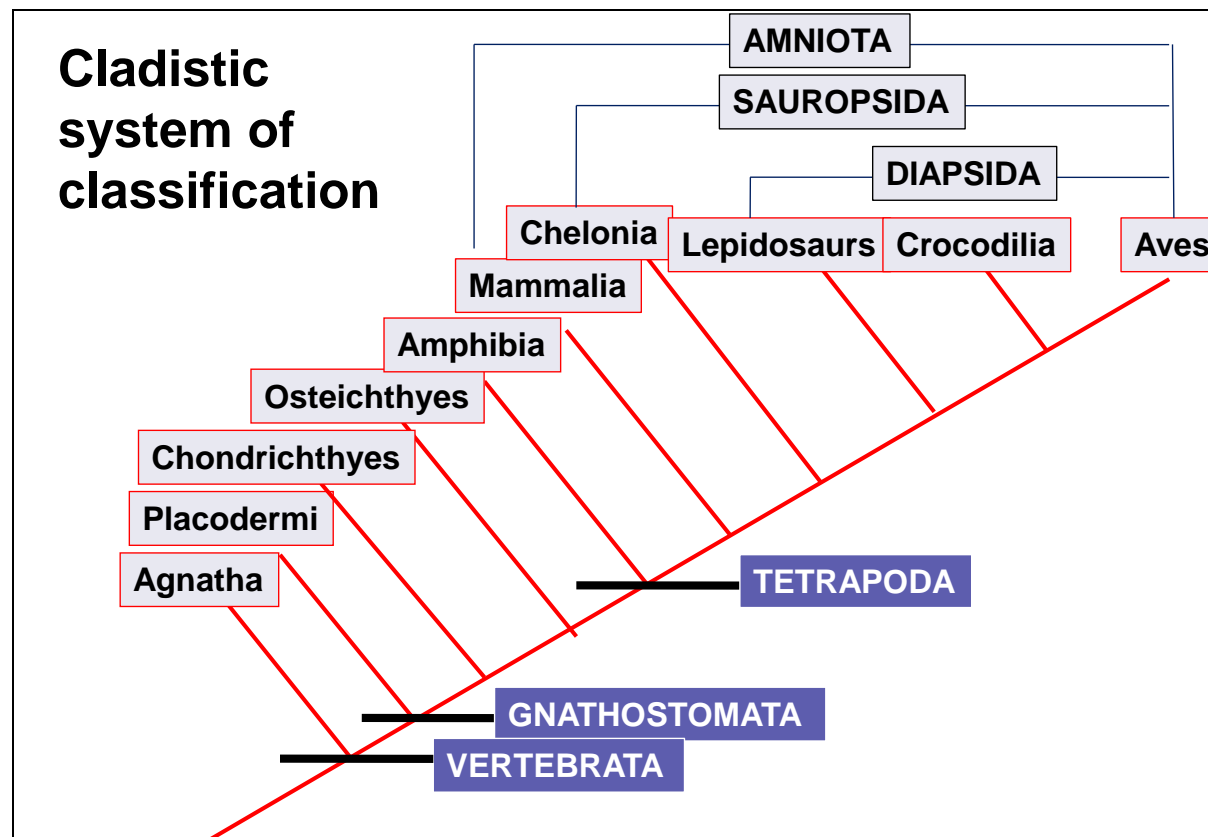
1. The history of vertebrates spans more than 500 mys from their appearance in the Cambrian Sea to the present rich and varied fauna. During this time, some of the largest and the most complex animals evolved among the vertebrates.
2. Vertebrates occupy marine, fresh water, terrestrial and aerial environments and exhibit a vast array of life styles.
3. Vertebrates are proper chordates and possess notochord, pharyngeal slits, and dorsal nervous system.
4. In most vertebrate fossils, mineral/inorganic components retain their integrity so that morphology, histology are little altered even after hundreds of millions of years.
5. Preserved as: entire animal or disarticulated and scattered skeletal parts; as casts, footprints as trace fossil and coprolites. Sometime in rare cases soft tissues in the form of e.g., skin impressions are also preserved.
6. The fossil record is by no means complete or entirely coherent. The early stages are poorly known and significant gaps still separate many major groups.

DIFFERENT VIEWS



CLASSIFICATION OF VERTEBRATES

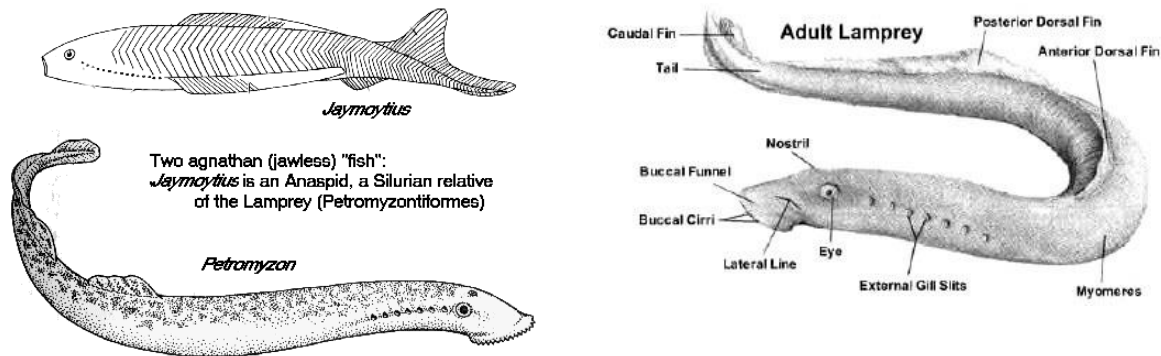
PHYLUM	CHORDATA	(presence of dorsal nerve and notochord)	
SUBPHYLUM	VERTEBRATA	(presence of vertebral column, brain, sensory organs)	
CLASS	AGNATHA		
CLASS	PLACODERMI		DIFFERENT TYPES OF
CLASS	CHONDRICHTHYES		PISCES/FISHES
CLASS	OSTEICHTHYES		
CLASS	AMPHIBIA		TETRAPODA
CLASS	REPTILIA		(ANIMALS WITH FOUR
CLASS	MAMMALIA		LIMBS)
CLASS	AVES		



CLASS AGNATHA

The early organisms are called ostracoderms because of their excessive exoskeleton in the form of a solid carapace/shell, large boney plates and scales. Some ostracoderms with light and flexible exoskeleton live in the open ocean. Others with heavy armour and dorsoventrally flattened bodies were probably bottom dwellers.

The first adequately known fossil agnathans ranged from middle Ordovician to early Devonian but after that they are no longer represented in the fossil record though living jawless fishes are still present today.



CLASS PLACODERMI

Most primitive jawless vertebrates. The oldest remains of jawed vertebrate have been collected from the Lower Silurian rocks and several major groups are known from upper Silurian and lower Devonian. Most placoderms continued to have a carapace and the biggest group of placoderms are called **Arthrodire**s. Within this group numerous lineages show adaptations towards active open water predators by reduction of their armour and development of incipient fins. The other group of placoderms called **Antiarchs** where bottom dwellers and lived in fresh water and was the only placoderm to survive into carboniferous.

The placoderms are almost completely limited to the Devonian. They remained diverse and numerous until near the end of the Devonian when they rapidly became extinct. The demise of the placoderms may be attributed to the radiation of more advanced jawed fishes like the Chondrichthyes and Osteichthyes.

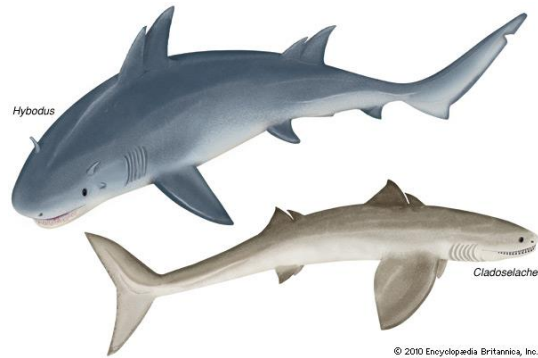


CLASS CHONDRICHTHYES

Modern sharks and their fossil forms belonged to this group. Fossil sharks were common in the late Devonian and Carboniferous. The internal skeleton is composed of cartilages. The fossil record of shark mostly incorporated isolated teeth and scales. There are two subclasses:

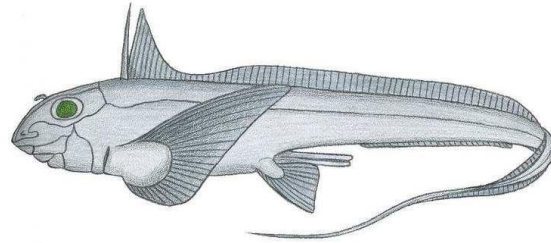
(A) ELASMOBRANCHII

Many groups of chondrichthyans resemble modern sharks in general body form. Most of these groups are of late Devonian and Carboniferous period and they became extinct by the end of Triassic.



(B) HOLOCEPHALI

The holocephalian are rare in modern fauna and are characterized by large head, short bodies and whip like tails. These are thought to be closely related to sharks as they have similar calcified cartilages. The fossil record of modern holocephalian goes back to the Jurassic and more primitive genera lived during the carboniferous.

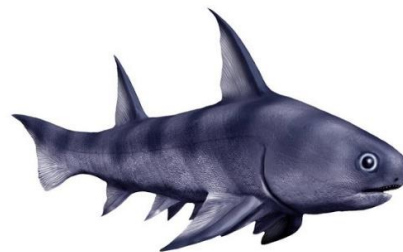


CLASS OSTEICHTHYES

These are extremely diverse groups which have dominated the marine and fresh water environment. They are characterized by a well ossified endoskeleton. These are known from early Devonian and there are three main subclasses.

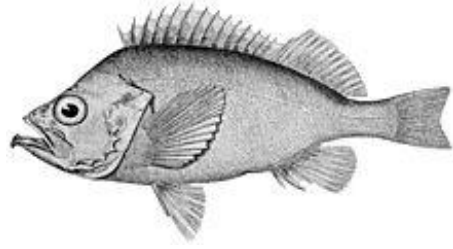
(A). ACANTHODII

Accompanying the placoderms and primitive sharks in the Devonian and still persisting into early Permian where a group of primitive bony fishes called acanthodians whose relationship with other fishes remains problematic. Most of these were small but some exceeded a meter in length. All of these were characterized by large spines and though they superficially resemble the modern bony fishes they remain as an isolated group.



(B). ACTINOPTERYGII

The vast majority of modern bony fishes comprising about 2000 species are actinopterygians but these were rare and little diversified until the end of the Palaeozoic. Early actinopterygians were called palaeoniscoids which had fusiform bodies of small size, triangular fins and a heavy covering of scales. Fish of these primitive types continued into the Cretaceous but most actinopterygians from Permian onward advanced towards modern bony fishes.

**(C). SARCOPTERYGII**

These are mostly found in Australia, Africa, South America, the most famous being the coelacanths. In the Devonian and Carboniferous they were dominant freshwater predators, were of large size and lived in deep water. The paired fins are supported by a strong bony axis that had its own musculature giving the fin a thickened lobed appearance.

There are two subclasses:

(I). DIPNOI (or lungfishes) – They show very rapid evolution in the Devonian. They had large jaw muscles suggesting that they could feed on a wide range of prey and these dipnoans remained common and diverse in the Triassic but only two or three genera are known in the later Mesozoic and Cenozoic. These are also known as lungfishes as first occurrence of primitive form of lungs appeared in this group. As a result, the dipnoans could stay outside water for a prolonged period of time.



(II). CROSSOPTERYGIANS – Several major groups of crossopterygians are known from Devonian and one genus called *Latimaria* belonging to the group Coelacanthia is still present today. The modern genus is marine but in Carboniferous these groups were present both in freshwater and salt water. Fossil coelacanths are common in near shore marine deposits in the Cretaceous but disappeared from the fossil record in the Cenozoic. The remaining crossopterygians are included in the suborder Rhipidista which were common in the Devonian. This group gave rise to the first land vertebrates – AMPHIBIA.

