

This order contains the most primitive shark species surviving today. There are two families of extremely distinctive sharks: Chlamydoselachidae, now known to contain at least two species, very similar in appearance; and Hexanchidae, with four species.

Identification Six or seven pairs of gill slits in front of the pectoral fins; one spineless dorsal fin over or behind the pelvic fins; one anal fin. The vertebral column extends into the caudal fin's long dorsal lobe, the ventral lobe is short or absent. Large mouth. Eyes on the side of the head, spiracles very small, located well behind and above eyes. Medium to large sized.

Biology Most species are widespread worldwide, from tropical to temperate and boreal waters. Generally found in deep cold water in the tropics, but also inshore in temperate seas.

Status Taken as bycatch and in targeted fisheries (with trawls, nets, lines and by sports anglers). All are assessed either as Data Deficient or Near Threatened in the IUCN Red List of Threatened Species.

THE EVOLUTION OF SHARKS

The common ancestor of all modern vertebrates, from fishes to mankind, was a tiny, leaf-like, eyeless animal that probably first swam in the oceans more than 500 million years ago (500mya). Over the next few tens of millions of years, this proto-fish evolved a cartilaginous spine, eyes, simple fins and protective bony plates. Jaws and paired fins followed, and a wide range of vertebrates gradually evolved, including some that began breathing air and eventually crawled out onto land.

In the oceans, some fish species developed bones and hard flattened scales, but the sharks and their relatives (the chondrichthyans) retained the ancestral cartilaginous skeleton. Because cartilage does not fossilise well, the earliest known remains of sharks are scales and spines that were deposited in sediments more than 400mya, during the Devonian Period. (The Devonian is also known as the 'Age of Fishes' because of the extraordinary diversity of fishes that evolved then, more than 200 million years before the first dinosaurs appeared.) The ancestors of the modern sharks, rays and chimaeras subsequently became incredibly common; more than 3000 ancient chondrichthyan fish species have been recognised, making up 60% of all fish species preserved as fossils in shallow-water Carboniferous limestone deposits. However, this diversity ended abruptly with a mass extinction event about 252mya, which was probably caused by massive volcanic eruptions, leading to acid rain, catastrophic sediment run-off, global warming and ocean de-oxygenation.

Although the surviving chondrichthyan fishes evolved and diversified into animals that closely resemble those described in this book, they never regained their former domination of the world's oceans. Today the bony fishes are by far the most abundant of all vertebrates, with more than 30,000 species known. In contrast, only about 500 living shark species and 700 of the closely related rays and chimaeras are known to scientists today. This number is, however, rising steadily as scientists discover 'new' species in poorly explored tropical seas and deep ocean waters. About 200 species of sharks and their relatives have been described during the past 15 years alone. It is highly likely that future editions of this book will illustrate yet more newly discovered species, but we are sadly now entering another extinction event, this time caused mainly by mankind (primarily excessive fishing effort, coastal habitat destruction and climate change).

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FRILLED SHARKS: *Chlamydoselachidae* – page 44

All frilled sharks are very similar externally (with some local variability) and were thought to be one wide-ranging living species. Internally, specimens from the southern African coast (southeast Atlantic and southwest Indian Ocean) differ from frilled sharks from Japan and Taiwan (northwest Pacific) and the two populations are now described as distinct species. More anatomical information (e.g. chondrocranium, vertebral counts and fin structure) is needed from east and northwest Atlantic and eastern Pacific specimens to determine where these are also distinct.

Identification Dark chocolate-brown, brownish-grey or brownish-black. Elongated eel-shape. Flattened snake-like head. Very short snout. Widely spaced, needle-sharp, slender three-cusped teeth in the large terminal mouth. Six pairs of curved gill slits, lower ends of first pair connected under throat. Dorsal fin low and much smaller than anal fin, pectoral fins smaller than pelvic fins.

Biology Widely but patchily distributed in offshore soft bottom habitats on continental and insular shelves and upper slopes. Sometimes enter shallow cold water. Swim in captivity with large mouth open, possibly to lure actively swimming fish and squid towards the teeth. Viviparous; pups feed on huge uterine eggs during long gestation.

Status Uncommon to rare and poorly known. Bycatch in deep bottom trawls and gillnets may be used for fishmeal and meat. Kept in some public aquaria. Harmless to man.

COW SHARKS: *Hexanchidae* – page 44

Three genera and four species: *Hexanchus* (two species), *Hepttranchias* (one species) and *Notorynchus* (one species). Cow sharks are mostly found in cold water: usually in deep water in warm temperate and tropical regions, but may also enter shallow water in cool temperate areas. Only one species, the Broadnose Sevengill Shark, is apparently a permanent resident of shallow coastal areas.

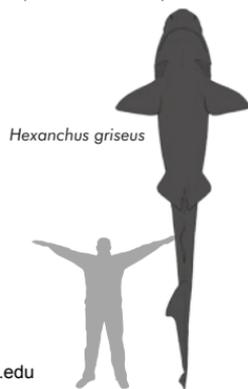
Identification Moderately slender to stocky cylindrical sharks, with six or seven pairs of gill slits (the first pair not connected across the throat) in front of pectoral fins. Ventral mouth. Large compressed comb-like teeth in the lower jaw, smaller cuspidate teeth in the upper jaw. Single spineless dorsal fin, relatively high, angular and short. Pectoral fins angular, larger than pelvic fins. Anal fin smaller than dorsal fin. Caudal fin has marked sub-terminal notch.

Biology Viviparous, giving birth to large litters of relatively large pups. Some species are migratory, moving inshore seasonally to feed or give birth. Cow sharks are powerful predators; large Bluntnose Sixgill and Broadnose Sevengill Sharks are known to catch and eat cetaceans and pinnipeds. The latter species, in particular, appears to be highly social and may hunt cooperatively, in packs; it has even been observed 'spy-hopping' and has taken domestic dogs swimming and wading in shallow water.

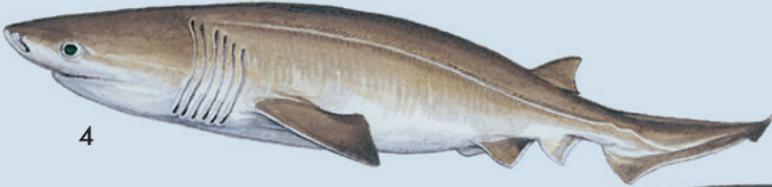
Status Taken as a bycatch and in some target commercial and sports fisheries. Some populations have declined significantly following target commercial and sports fisheries and, like several other large deepwater species, these slow-growing sharks require careful management. They are important for dive tourism in a few shallow water locations in the USA, Canada and South Africa. A few large individuals have been implicated in non-fatal attacks on divers. Some species are kept in public aquaria.

Plate 1: FRILLED AND COW SHARKS

- 1 **Southern African Frilled Shark** *Chlamydoselachus africana* ♀ at least 117cm
DN South Africa. **HT** Benthic, epibenthic and pelagic; 300–1400m. **ID** Large terminal mouth with widely spaced slender three-cusped needle sharp teeth. Six pairs of gills. Low dorsal fin smaller than anal fin; pectoral fins smaller than pelvic fins. Similar to species *C. anguineus*, difficult to distinguish externally. Head usually longer and body shorter than *C. anguineus*. **CR** Dark grey, but covered with a thin membrane that gives it a uniform dark brown colour. **Status:** NE.
- 2 **Frilled Shark** *Chlamydoselachus anguineus* ♀ 196cm
DN Patchy worldwide. **HT** Benthic, epibenthic and pelagic; 20–1500m. **ID** Large terminal mouth with widely spaced slender three-cusped needle-sharp teeth. Six pairs of gills. Low dorsal fin smaller than anal fin; pectoral fins smaller than pelvic fins. **CR** Dark chocolate-brown, brownish-grey or brownish-black. **Status:** NT.
- 3 **Sharpnose Sevengill Shark** *Heptanchias perlo* 139cm
DN Patchy tropical and temperate waters, not in North-east Pacific. **HT** Mainly deepwater; 27–720m, to a maximum depth of 1000m. **ID** Slender body. Acutely pointed head with narrow mouth and large eyes. **CR** Above brownish-grey to olive, lighter below. Juvenile with black dorsal fin apex which fades with growth. **Status:** NT.
- 4 **Bluntnose Sixgill Shark** *Hexanchus griseus* at least 482cm
DN Patchy worldwide, possibly absent polar regions. **HT** Juveniles found inshore in cold water, adults in shallow waters near submarine canyons; 200–1100m, down to 2500m or more. **ID** Large heavy body. Broad head with wide mouth. Soft supple fins. **CR** Grey or tan to blackish, sometimes darker spots on sides. Small white-ringed eyes; pale lateral line and posterior fin edges. **Status:** NT.
- 5 **Bigeye Sixgill Shark** *Hexanchus nakamurai* 180cm
DN Patchy warm temperate and tropical waters, possibly absent in East Pacific. **HT** On or near the seabed; 90–621m, occasionally near the surface or inshore. **ID** Slender body. Narrow head with narrow mouth and large eyes. Caudal fin with deep subterminal notch. **CR** Sharply divided between dark dorsal and light ventral surface. Fins with white posterior edges and tips. **Status:** DD.
- 6 **Broadnose Sevengill Shark** *Notorynchus cepedianus* 296cm
DN Patchy inshore cool temperate waters. **HT** Coastal, common in shallow bays and close to shore; surfline–50m, large sharks down to 136m or more. **ID** Bluntly pointed broad head with wide mouth and small eyes. **CR** Grey to brown body with numerous small black spots (some plain or white-spotted). Newborn's black dorsal fin apex fades with growth. **Status:** DD.



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colour variants

