

CLASSIFICATION AND SYSTEMATIC ARRANGEMENT

Considering that the purpose of this document is to provide a simple user-friendly guide for species identification, no reference will be found here to dichotomy keys for single species. It is important that the classification used in this guide be defined, as available literature is not always in agreement with this presentation. The classification of this group is still under review as no consensus has been found to reconcile different authors' positions.

For more information and further specific details on the taxonomy and biology of cartilaginous fish species, refer to Tortonese, 1956; Hureau and Monod 1979; Whitehead *et al.*, 1984; Fischer *et al.*, 1987; Fredj and Maurin, 1987; Compagno, 1988, 2005; Nelson, 1994; Shirai, 1996; Mould, 1998. The consultation of FishBase <http://www.fishbase.org> (Froese and Pauly, 2000) proved very useful. The most fundamental references are Compagno's catalogues issued in 1984 and his recent revision partially issued in 2001.

This guide follows the systematic organization proposed by Compagno (1999, 2001) and the classification reflects a cladogram attempt where a new concept of cladistic classification is used. For instance, the batoids are raised to the order (Rajiformes) belonging to the superorder of the Squalomorphi, even if perhaps a more suitable name should be found to indicate both Rajiformes and Squaliformes. At the same time the sawsharks group is raised to the order Pristiophoriformes. So the batoids have been diversely allocated with respect to the previous taxonomic organizations. However, even if this new phylogenetic classification is considered valid, for practical reasons sharks and batoids are described separately in the text.

Taking only modern sharks into consideration, we can adopt the following, simplified classification (the orders with no representatives in the Mediterranean Sea are indicated by an asterisk):

- Class Chondrichthyes (cartilaginous fishes)
 - Subclass Holocephali (chimaeras)
 - Order Chimaeriformes (chimaera and silver sharks)
 - Subclass Elasmobranchii (sharks)
 - Superorder Squalomorphi (squalomorph sharks)
 - Order Hexanchiformes (cow and frilled sharks)
 - Order Squaliformes (dogfish sharks)
 - Order Squatiniformes (angel sharks)
 - Order Pristiophoriformes (sawsharks) *
 - Order Rajiformes (batoids)
 - Superorder Galeomorphi (galeomorph sharks)
 - Order Heterodontiformes (bullhead sharks) *
 - Order Lamniformes (mackerel sharks)
 - Order Orectolobiformes (carpet sharks) *
 - Order Carcharhiniformes (ground sharks)

The species inside the families and in the orders are mentioned in alphabetical order according to genus. For both orders and families, some summary descriptions with their most significant characteristics are included. The current status is described for each single species on an individual sheet where, in addition to a drawing, scientific name and more recent synonyms and significant misidentifications in some important cases, other synthetic information is given, i.e. FAO common names, maximum size, habitat and biology, methods of capture and, when available, exploitation and conservation status. Arrows are superimposed on the drawings to indicate features that help in species identification.

When possible the type of spiral valve which characterizes the intestine of cartilaginous fishes is shown. There are large variations in the anatomy of the spiral valve, three different types have been described: columnar spiral with funnels pointing either backward or forward; spiral ring valve and cylindrical (scroll) valve (Compagno, 1988; Hamlett, 1999).

Local names are not included considering the large number of names used in the various Mediterranean countries. Feeding behaviour is indicated only in some cases. Remarks are indicated for species whose taxonomic status or presences are dubious.

For the purpose of this guide, a number of dubious species have not been considered as valid for the Mediterranean:

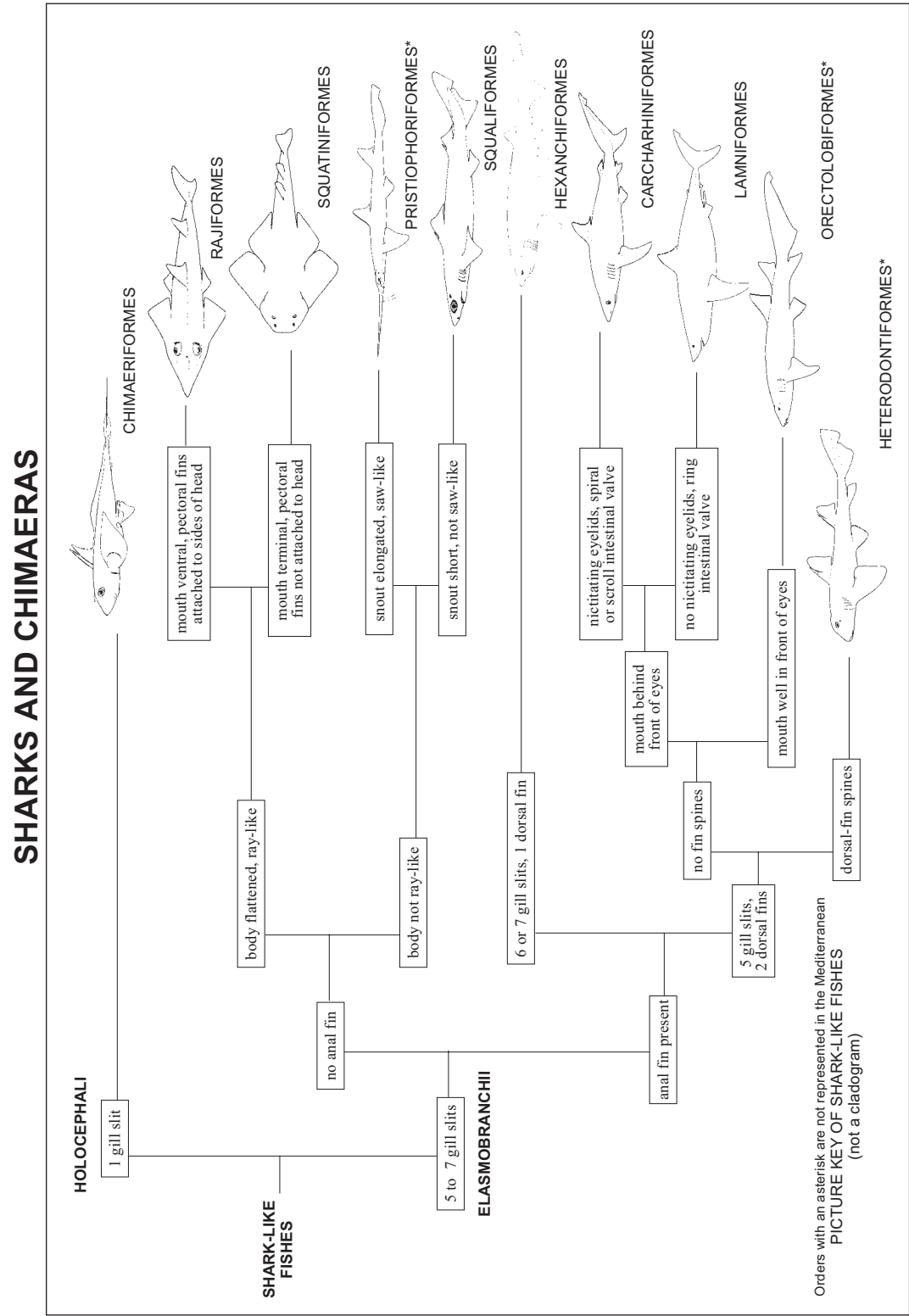
- *Carcharhinus leucas* (Valenciennes, 1841) is a doubtful species; it is neither recognized by Compagno nor in this guide.
- *Carcharhinus longimanus* (Poey, 1865) is a doubtful species; it is considered “probable” by Compagno but is not included in this guide.
- *Rhinobatos halavi* (Forsskål, 1775) was recorded by Tortonese (1951a) from the Egyptian part of the Mediterranean Sea but Ben-Tuvia (1966) noted that no specimens of this species were available to confirm its presence in this sea.
- *Torpedo alexandrinsis* Mazhar, 1982 and *Torpedo fuscomaculata* Peters, 1855 are not considered a valid species. *Torpedo alexandrinsis* is known by only five syntypes mentioned in the original paper from Alexandria (Egypt) (Séret, pers. comm.); therefore its taxonomic status is doubtful. The second *Torpedo* species recorded only once in Alexandria (Egypt) needs to be verified and is probably synonymous of *Torpedo* (*Torpedo*) *marmorata* (Séret, pers. comm.).
- The species *Raja africana* Capapé, 1977, previously defined as dubious by Compagno (1999), is now indicated as not a valid species (syntypes lost).
- *Raja rondeleti* Bougis, 1959 is probably based on an abnormal specimen of *R. fullonica* and considered as *Leucoraja* cfr. *fullonica*. The taxonomic status of four specimens from French and Italian coasts is doubtful (Séret, pers. comm.).

How to use this guide

Readers are advised to follow these simple steps in order to successfully identify any sharks, batoids and chimaera found in the region. First, refer to the picture key of shark-like and batoid fishes then read carefully through the description of key characters listed under each order and family. Use the illustrations of the families under each order or suborder only as a secondary aid in making certain that the right order or suborder has been found. Then proceed to narrow down the family of the specimen using the illustration for each family and key characters annotated in each illustration; make use of the size data included for each family. Once the family has been identified, move to the corresponding pages where the species for that family are illustrated. These illustrations and the key characters indicated should allow proper identification for all sharks and batoids known for the area.

In a few cases the considered area is wider than the Mediterranean basin; it refers to the CLOFNAM area (Hureau and Monod, 1979): Mediterranean and northeastern Atlantic between 30° and 80° of Latitude north, -30° and +60° of Longitude, Azores and Madeira Islands included (Whitehead *et al.*, 1984).

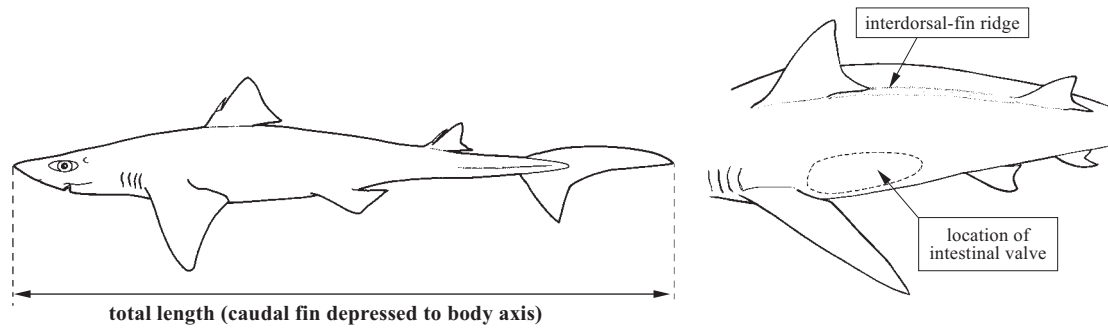
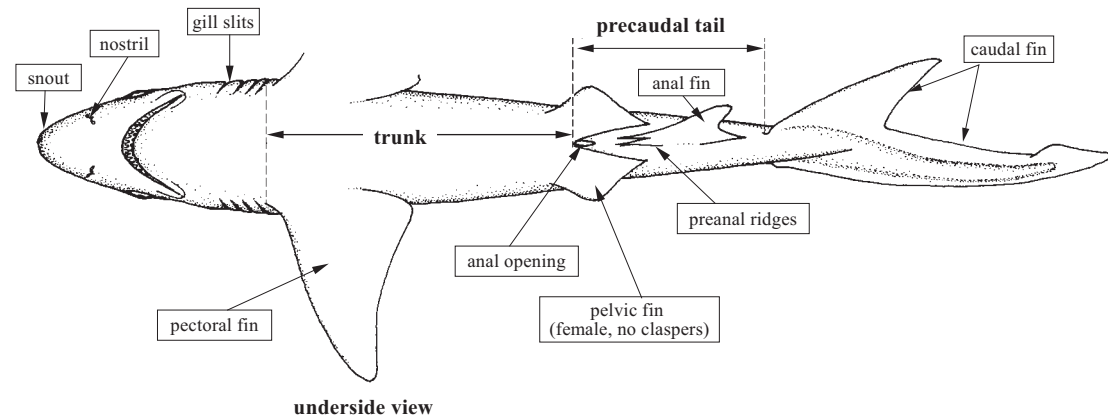
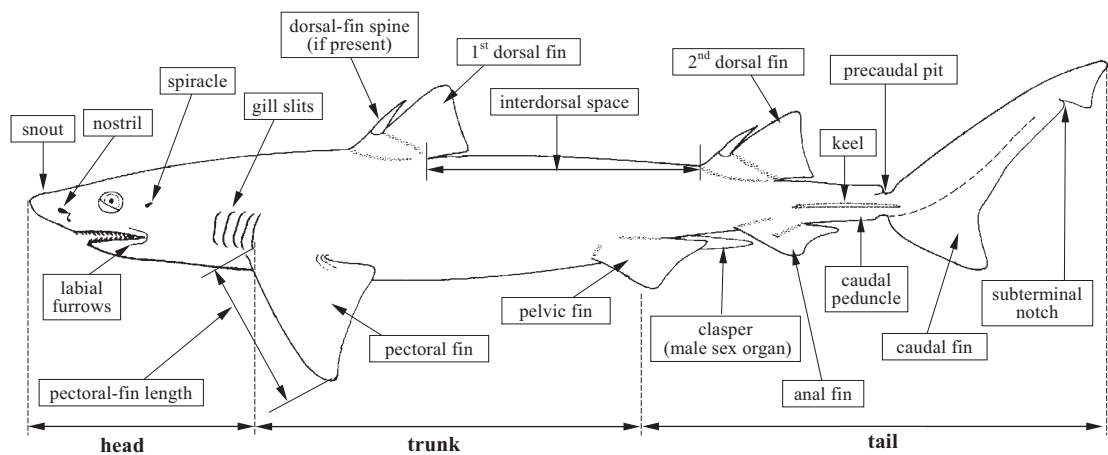
Although *Chimaera monstrosa* (Linnaeus, 1758) is represented in the sharks cladogram as indicated by Compagno, 2001, the species account is inserted at the end of the guide to follow the taxonomic sense. Eventhough there is only one chimaera species in the Mediterranean Sea, the author thought it was important to illustrate the technical terms and description of this order.

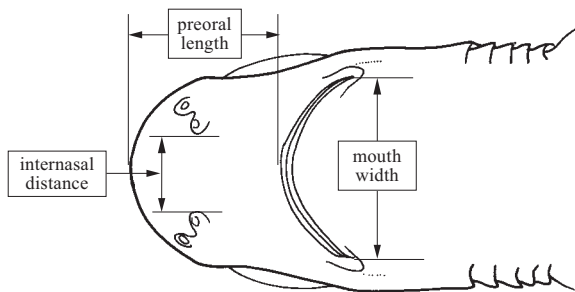
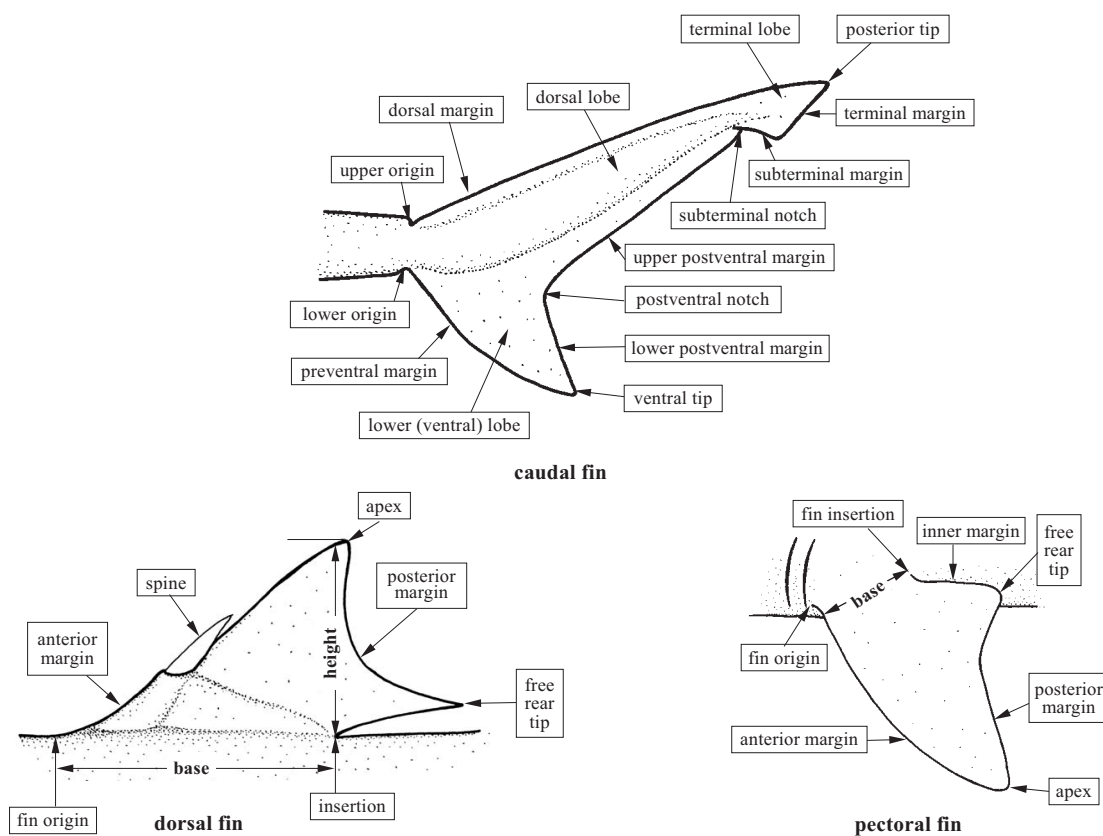


(from Compagno, 2001)

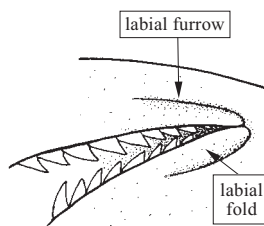
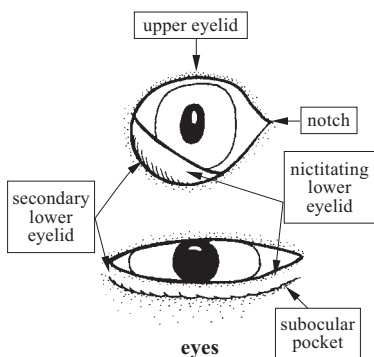
SHARKS

TECHNICAL TERMS AND MEASUREMENTS

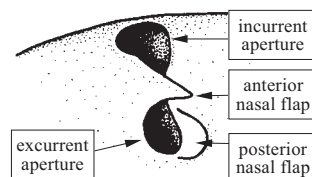




head (ventral view)



mouth corner



nostril

LIST OF ORDERS, FAMILIES AND SPECIES OCCURRING IN THE AREA

A question mark (?) before the scientific name indicates that presence in the area needs confirmation.

Order **HEXANCHIFORMES**

Family **HEXANCHIDAE**

Heptranchias perlo
Hexanchus griseus
Hexanchus nakamurai

Order **SQUALIFORMES**

Family **ECHINORHINIDAE**

Echinorhinus brucus

Family **SQUALIDAE**

Squalus acanthias
Squalus blainvillei

? *Squalus megalops*

Family **CENTROPHORIDAE**

Centrophorus granulosus

? *Centrophorus uyato*

Family **ETMOPTERIDAE**

Etmopterus spinax

Family **SOMNIOSIDAE**

Centroscyrnus coelelepis
Somniosus (Rhinoscyrnus) rostratus

Family **OXYNOTIDAE**

Oxynotus centrina

Family **DALATIIDAE**

Dalatias licha

Order **SQUATINIFORMES**

Family **SQUATINIDAE**

Squatina aculeata
Squatina oculata
Squatina squatina

Order **LAMNIFORMES**

Family **ODONTASPIDIDAE**

Carcharias taurus
Odontaspis ferox

Family **ALOPIIDAE**

Alopias superciliosus
Alopias vulpinus

Family **CETORHINIDAE**

Cetorhinus maximus

Family **LAMNIDAE**

Carcharodon carcharias
Isurus oxyrinchus

? *Isurus paucus*

Lamna nasus

Order **CARCHARHINIFORMES**

Family **SCYLIORHINIDAE**

Galeus atlanticus
Galeus melastomus
Scyliorhinus canicula
Scyliorhinus stellaris

Family **TRIAKIDAE**

Galeorhinus galeus
Mustelus asterias
Mustelus mustelus
Mustelus punctulatus

Family **CARCHARHINIDAE**

Carcharhinus altimus
Carcharhinus brachyurus
Carcharhinus brevipinna
Carcharhinus falciformis
Carcharhinus limbatus
? *Carcharhinus melanopterus*
Carcharhinus obscurus
Carcharhinus plumbeus

? *Galeocерdo cuvier*

Prionace glauca
Rhizoprionodon acutus

Family **SPHYRNIDAE**

Sphyrna (Mesozygaena) tudes
Sphyrna (Sphyrna) lewini
Sphyrna (Sphyrna) mokarran
Sphyrna (Sphyrna) zygaena

GUIDE TO THE ORDERS AND FAMILIES OF SHARKS OCCURRING IN THE AREA

Order HEXANCHIFORMES – Cow sharks

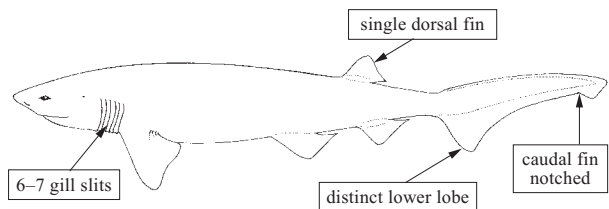
Six or seven pairs of gill slits; single dorsal fin without spines; anal fin present; eyes without nictitating eyelid; spiracle present but small.

HEXANCHIDAE

Page 24

Cow sharks

Three species in the Mediterranean. Mostly demersal, from shallow depths to 1 800 m. Size to 480 cm TL.



Order SQUALIFORMES – Dogfish sharks

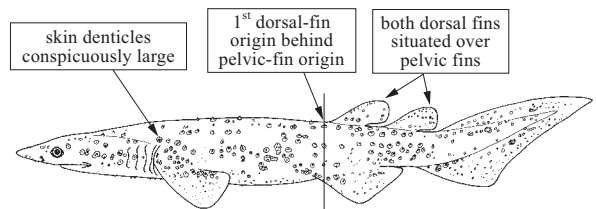
Five pairs of gill slits; two dorsal fins often with spines on the anterior margin; mouth extending behind front of eyes; no anal fin, caudal peduncle without precaudal pits. Seven families and nine valid species (occurrence of other two species to be confirmed).

ECHINORHINIDAE

Page 25

Bramble sharks

One genus with one species. Demersal sluggish sharks, mostly in cold and deep waters to at least 100 m; occasionally found in the upper shelf. Size to 270 cm TL.

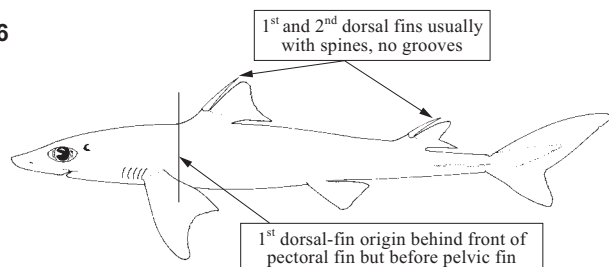


SQUALIDAE

Page 26

Dogfishes

One genera and two species, plus one dubious. Demersal and pelagic to depths of over 2 000 m. Size to 160 cm TL.

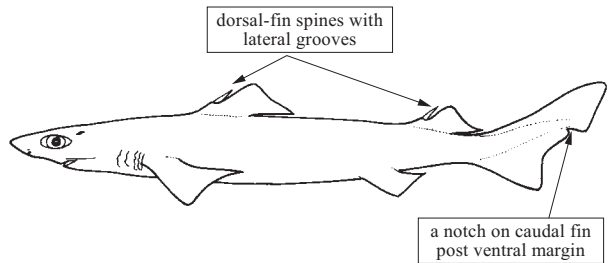


CENTROPHORIDAE

Page 27

Gulper sharks

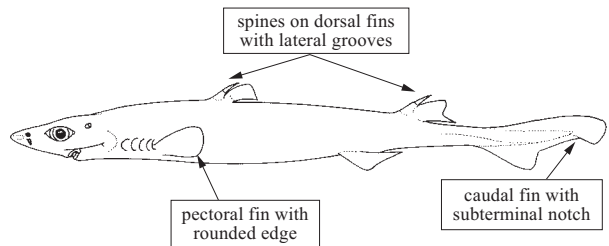
Primarily demersal deep-water sharks from depths of 200 to at least 2 400 m. Size to 170 cm TL. Two species in the region, but one questionable.

**ETMOPTERIDAE**

Page 28

Lantern sharks

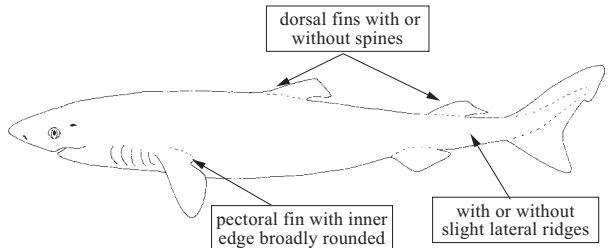
Benthic on shelf and slopes, from depths of 70 to 2 000 m, mostly 200 m. Size to 45 cm TL. One species in the region.

**SOMNIOSIDAE**

Page 29

Sleeper sharks

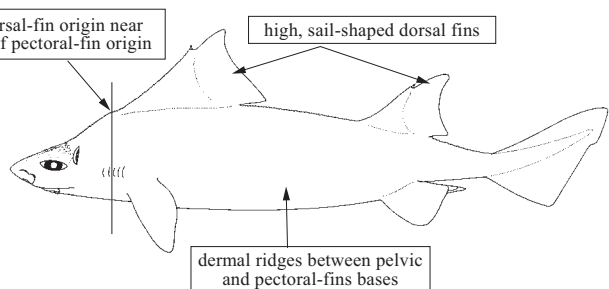
Benthic on slopes. Size up to 100 cm TL. Two genera and two species in the Mediterranean.

**OXYNOTIDAE**

Page 30

Rough sharks

Body very high and compressed, triangular in cross-section with longitudinal ridges, one species. Demersal from depths of 60 to 660 m. Size up to 150 cm TL.

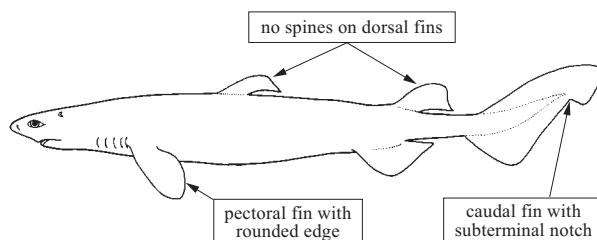


DALATIIDAE

Page 30

Kitefin sharks (Liche sharks)

Benthic to mesopelagic, primarily on slopes at depths of 300 to 600 m. Size to 180 cm TL. One species present in the area.

**Order SQUATINIFORMES – Angel sharks**

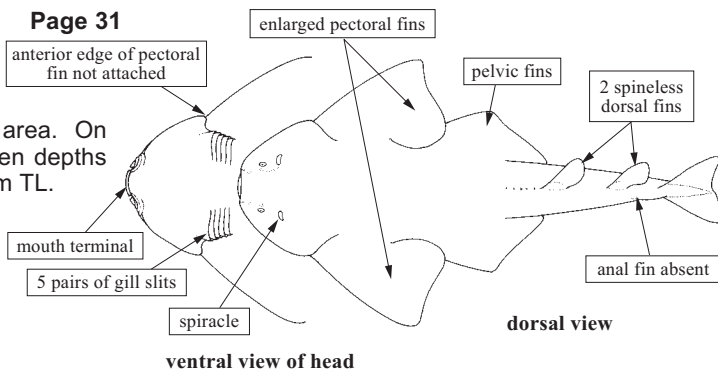
Five pairs of gill slits; eyes dorsal; two spineless dorsal fins; pectoral fins greatly expanded along sides of head as a free triangular lobe; no anal fin. Only one family and three species in the Mediterranean.

SQUATINIDAE

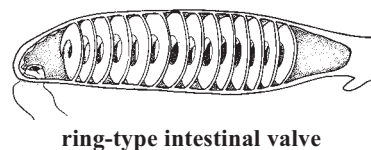
Page 31

Angel sharks

Three species occurring in the area. On continental slope and shelf between depths of 30 and 500 m. Size up to 190 cm TL.

**Order LAMNIFORMES – Mackerel sharks**

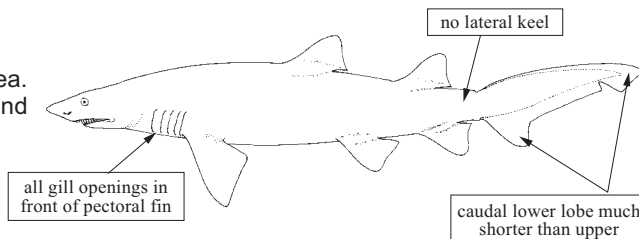
Five pairs of gill slits; two dorsal fins without spines; anal fin present; no movable nictitating eyelid; mouth strongly arched and extending behind front of eyes; ring-type intestinal valve. Four families reported in the Mediterranean.

**ODONTASPIDIDAE**

Page 32

Sand tiger sharks

Two species in the Mediterranean area. Neritic, in shallow water down to around 200 m. Size to 320 cm TL.

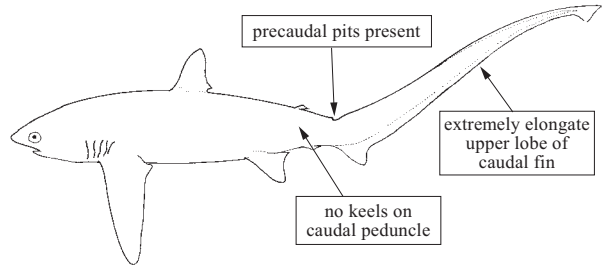


ALOPHIIDAE

Page 33

Thresher sharks

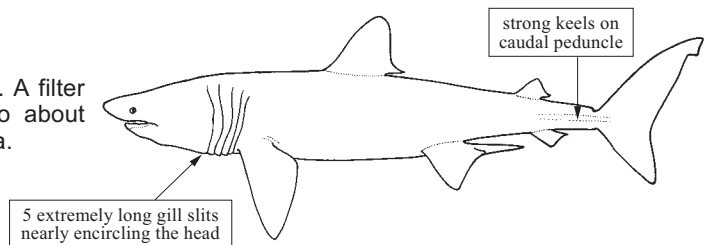
Two species reported in the Mediterranean. Oceanic and coastal, to depths of 500 m. Size to 610 cm TL.

**CETORHINIDAE**

Page 34

Basking sharks

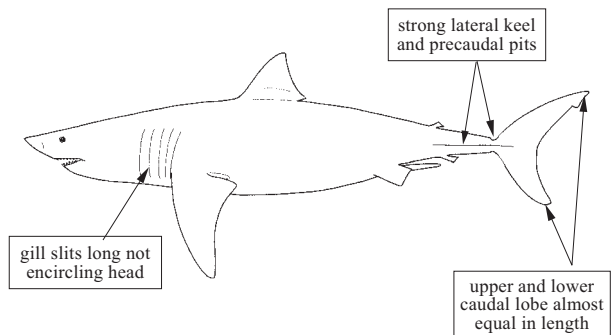
Coastal and on the continental shelf. A filter feeder, gills slits elongated. Size to about 1 000 cm TL. One species in the area.

**LAMNIDAE**

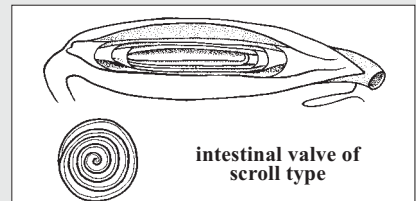
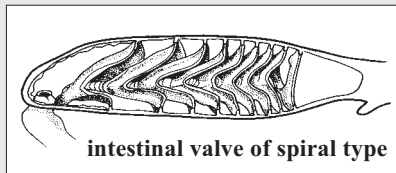
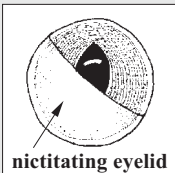
Page 35

Mackerel sharks

Three species present in the Mediterranean. The presence of a fourth species, *Isurus paucus*, in the area needs confirmation. Coastal and epipelagic, from the surface to depths of around 1 200 m. Size probably up to 700 cm TL. Gillrakers absent.

**Order CARCHARHINIFORMES – Ground sharks**

Five pairs of gill slits, gillrakers absent; two dorsal fins without spines; anal fin present; movable nictitating eyelid; mouth arched and extending behind anterior edge of eyes; intestinal valve of scroll or spiral type. Four families in the Mediterranean.

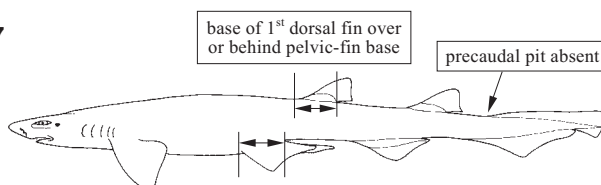


SCYLIORHINIDAE

Page 37

Catsharks

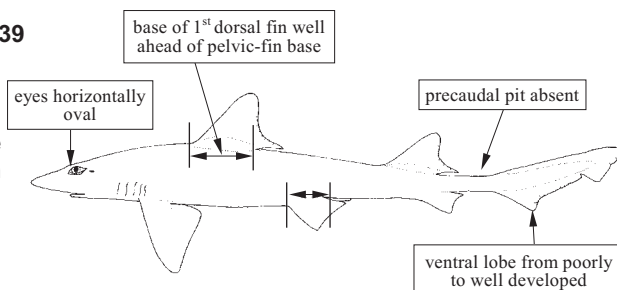
Four species and two genera. Mostly demersal from shallow inshore waters to 700 m. Size to 120 cm TL. Spiral type intestinal valve.

**TRIAKIDAE**

Page 39

Hound sharks

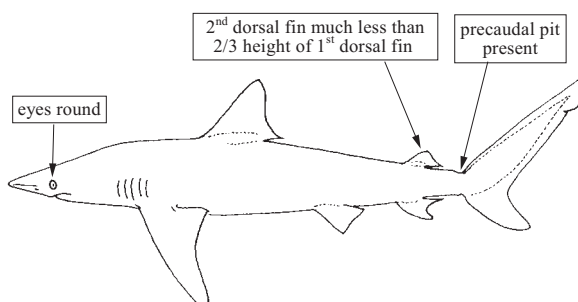
Four species and two genera in the Mediterranean. From inshore shallow depth to around 400 m. Size to about 200 cm TL. Spiral Intestinal valve.

**CARCHARHINIDAE**

Page 41

Requiem sharks

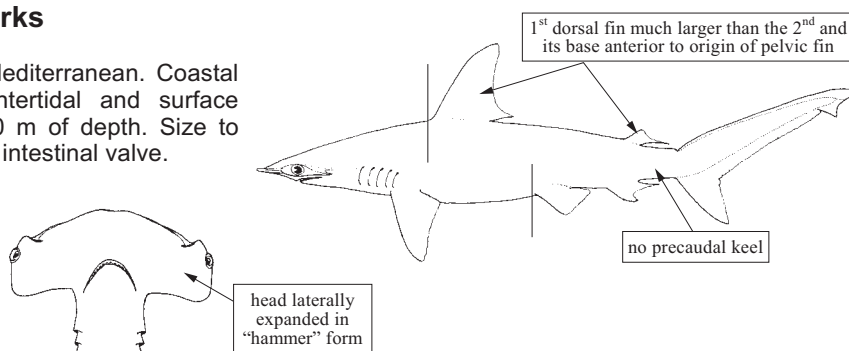
Nine species and three genera. Other two species and one genus are doubtful. The presence of *Galeocerdo cuvier* needs confirmation. Neritic and oceanic pelagic to depth of 600 m. Size to 400 cm TL.

**SPHYRNIDAE**

Page 46

Hammerhead sharks

Four species in the Mediterranean. Coastal and oceanic, from intertidal and surface waters to at least 260 m of depth. Size to 600 cm TL. Scroll type intestinal valve.



underside of head