

**TABLE 5.** Stingray Injuries at Seal Beach in Southern California between 1993 and 2001\*

<b>Year</b>	<b>Stingray Injuries</b>
2001	299
2000	385
1999	290
1998	185
1997	132
1996	167
1995	209
1994	378
1993	31

\*Injury statistics provided by Seal Beach lifeguards.

## How to Use This Book

California's cartilaginous fish fauna should be no more difficult to identify than many of the bony fishes, birds, or marine mammals that occur along the coast. The common coastal species in particular are easily distinguishable from each other. Some of the less common to rare deepwater catsharks and skates, or those species that occasionally visit our area, may be a bit more difficult to identify. Most of the sharks in our area can be identified by focusing on particular characteristics, such as general body shape, number of gills, the presence or absence of fin spines, the position of the fins, body coloration, and tooth shape. Distinguishing batoid characteristics include the disc and tail shape, body color, the size and shape of the dermal denticles or enlarged thorns on the dorsal surface of the disc, and the presence or absence of tail spines. The chimaeras that occur off our coast can be distinguished from each other by their coloration, snout shape, and the presence or absence of an anal fin.

Experience is ultimately the best means by which you can quickly identify a species in the field. Keep in mind that a species not previously reported in our local waters may stray into our area. During extreme El Niño years a species commonly found in Mexican waters might migrate northward out of its usual range following the warmer water masses into our area. This is

especially true for several of the requiem or hammerhead sharks, which can prove problematic even for the experienced ichthyologist. If you happen to collect or observe a particularly difficult-to-identify specimen, be sure to note where and when it was caught as it may be new to California. If the specimen is too large to keep be sure to take a good photograph of it in side view and save the teeth, jaws, and/or spines. Most local natural history museums, public aquariums, and universities have ichthyologists on staff who will gladly identify difficult specimens. A partial list of these institutions is provided at the end of this book.

### Species Account

Under each species account is a color illustration of that particular species with a line illustration of the underside of the head and teeth. Following the illustrations is a description that can be used to identify the species, and pertinent information on its habitat and range, natural history, human interactions, nomenclature, and references. The species descriptions have been kept fairly simple, but it is advisable to consult the glossary and to examine the terminology illustrations (Figs. 7–9) to become familiar with the terminology used to identify cartilaginous fishes.

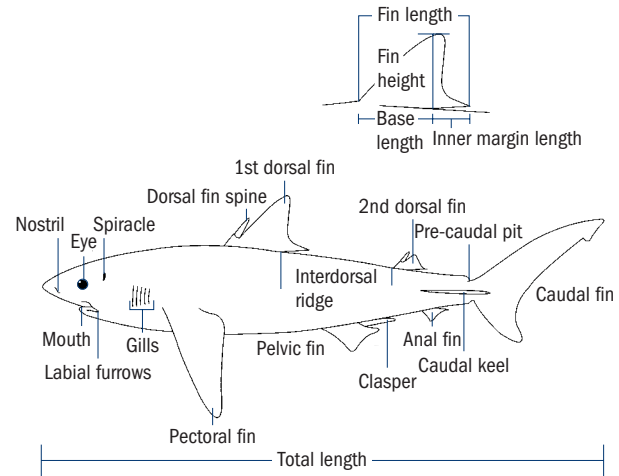


Figure 7. Shark terminology.

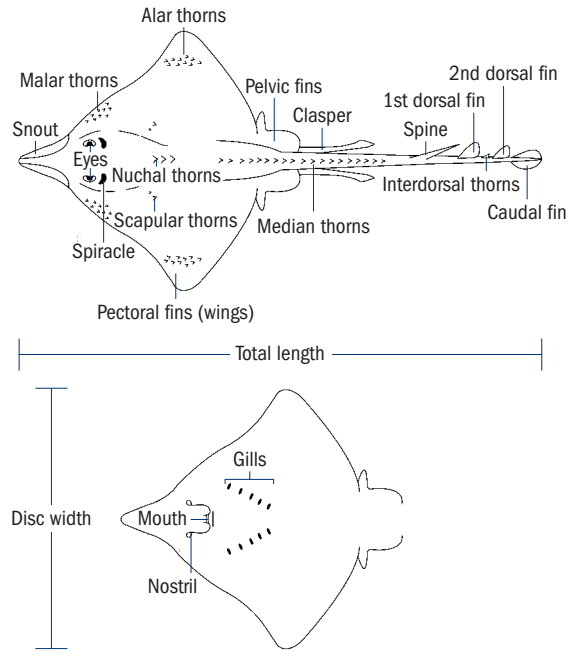


Figure 8. Ray terminology.

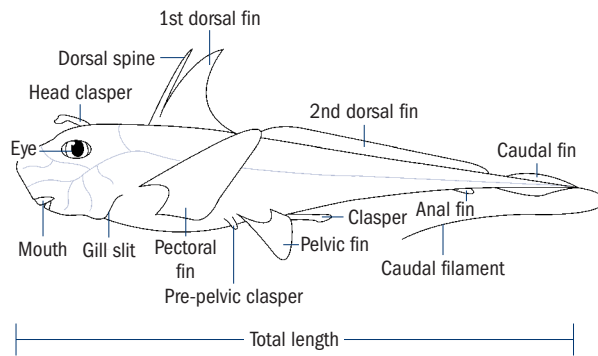


Figure 9. Chimaera terminology.

## Illustrations

Color illustrations for all chondrichthyan species from off the California coast are based on the most “common” color scheme for each. In species whose color may vary regionally the most common local variant is illustrated. Juvenile coloration in newborns may vary considerably from that of the adult, although some species are very rare and have poorly described color features. This is particularly true for the skates and other rarely seen deepwater species. Every effort has been made to describe the color of living specimens where possible or to follow closely the description in the literature. In those instances in which color variants may differ dramatically these differences are described.

A line drawing of the underside of the snout and a representative upper and lower tooth is also included for most species. The teeth on many species may vary by position, and in some exhibit sexual dimorphism, but every attempt has been made to provide a drawing that should assist in identifying the species. Additional tooth descriptions have been provided under the species account.

## Common and Scientific Names

The common names used here are taken from the American Fisheries Society (1991) publication, *Common and Scientific Names of Fishes from the United States and Canada*, or from the local vernacular used by fishermen, researchers, and others in referring to a particular species. Because the common name can change somewhat over the years, the most recent common name is used for each species. The scientific names used follow Compagno (1999) for the sharks and rays and Didier (1995) for the chimaeras.

## Description

In this subsection a brief descriptive account of each species emphasizing key features such as body, snout, eye, mouth, fin, and tooth shape; number of gills; the presence or absence of dorsal and anal fins; the presence or absence of fin spines; and the relative position of fins to their approximate origin and/or insertion where appropriate is given. Ranges in the total number of (upper and lower) teeth, vertebra, and spiral valve counts are included, and although they may be of more use to ichthyologists, the

amateur naturalist shouldn't be intimidated from using them to identify species. The counts used in this book come from several sources including my own research, unpublished data generously provided by colleagues, and literature accounts including, but not exclusively, those by Compagno (1988, 1990), Ebert (1990), Garrick (1982), Gilbert (1967), Nishida (1990), Notarbartolo-di-Sciara (1987), and Springer and Garrick (1964). Counts were taken for eastern North Pacific specimens except where little or no local information was available. An asterisk (\*) is used to denote counts taken for specimens outside the eastern North Pacific region.

## Habitat and Range

The geographic range in our waters is given as well as the range throughout the eastern North Pacific and general geographic distribution if applicable.

## Natural History

The biological information for this subsection is based on original data I have collected over my many years of studying California's cartilaginous fish fauna, as well as data generously provided by colleagues, and from the many references cited in this book. Included in this subsection is information on species' mode of reproduction, size at maturity, size at birth, maximum size, migratory patterns, age at maturity, longevity, growth rate, diet, and foraging behavior as well as predators that feed on cartilaginous fishes.

## Human Interactions

This subsection discusses the relationship between humans and cartilaginous fishes including commercial and recreational fisheries and injuries to humans caused by some of these fishes.

## Nomenclature

The derivation of the Greek or Latin scientific name is included in this subsection as well as other common names that have been used in the literature. Common names from areas outside California waters are not included. Also in this subsection is a brief synonymy in instances in which taxonomic confusion has existed with regard to a particular species. The synonymy for

each species is not complete, but includes those names frequently cited in earlier publications on the California fauna.

## References

This subsection includes pertinent or significant literature based on studies from California or the eastern North Pacific. Additional references that were consulted for information on California's cartilaginous fish fauna, but that are not listed under each species account, include Castro (1983), Compagno (1984, 1988), Eschmeyer et al. (1983), Jordan and Evermann (1896), Roedel and Ripley (1950), Kato et al. (1967), Hart (1973), Miller and Lea (1972), Starks (1917, 1918), and Walford (1935).

## Taxonomical Keys

A series of keys has been provided so that the reader can narrow down the list of options in identifying a particular species. At the end of this introduction is a key to the orders that will tell you whether the specimen is a shark, a ray, or a chimaera. By considering each pair of options and choosing the one that most accurately describes your specimen—regarding number of gill openings, presence or absence of fins, shape of the body, and so on—you will by a process of elimination arrive at the correct order.

Next, turn to the listing for that order (using the color coding in the table of contents) and you will mostly likely find a key to the families that comprise it. (There is no family key for the orders Squatiniformes, Heterodontiformes, and Orectolobiformes because they are monotypic, which means they are represented by only one family and one species in California waters.) As with the key to the orders, just work your way through the paired options to determine the family that your specimen is in.

From there, turn to the appropriate family—these are arranged phenotypically rather than alphabetically, so you may need to hunt through the order section a bit. In some cases, such as that of the frilled shark (*Chylamydoselachidae*), a single species is found; in others, such as the requiem sharks (*Carcharhinidae*), several genera are represented. Once you feel that you have keyed out the correct species, check to see if the description and illustration accurately describe your specimen. Remember that the color pattern shown is just one of several possible variants, and be sure to compare descriptions and illustrations of species in the same genus.

## KEY TO CHONDRICHTHYAN ORDERS FOUND IN CALIFORNIA WATERS

- 1a One paired gill opening. . . . . Ratfishes (**Chimaeriformes**)
- 1b Five to seven paired gill openings. . . . . 2
  - 2a Anal fin absent . . . . . 3
  - 2b Anal fin present. . . . . 5
- 3a Body flat, raylike. . . . . 4
- 3b Body not raylike. . . . . Dogfish Sharks (**Squaliformes**)
  - 4a Mouth ventral, pectoral fins attached to head. . . . .  
 . . . . . Rays or Batoids (**Rajiformes**)
  - 4b Mouth terminal, pectoral fins not attached to head. . . . .  
 . . . . . Angel Sharks (**Squatiformes**)
- 5a One dorsal fin, six or seven paired gill openings. . . . .  
 . . . . . Cow and Frilled Sharks (**Hexanchiformes**)
- 5b Two dorsal fins, five paired gill openings . . . . . 6
  - 6a Fin spines present. . . . .  
 . . . . . Horn Sharks (**Heterodontiformes**)
  - 6b Fin spines absent. . . . . 7
- 7a Mouth in front of eyes. . . . .  
 . . . . . Carpet Sharks (**Orectolobiformes**)
- 7b Mouth behind eyes . . . . . 8
  - 8a Nictitating eyelids. . . . .  
 . . . . . Ground Sharks (**Carcharhiniformes**)
  - 8b No nictitating eyelids. . . . .  
 . . . . . Mackerel Sharks (**Lamniformes**)