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ELASMOBRANCH FISH DIVERSITY:
FORM AND FUNCTION

The elasmobranch fishes (sharks, skates, and rays) are characterized by flexible, cartilaginous skeletons. They differ from bony fishes in two other major ways. They possess gill slits instead of an operculum, and they lack a swim bladder. These characteristics have a profound influence on the mode of existence of the elasmobranch groups. This plate introduces the three elasmobranch forms.

Color the dogfish views, including the upper right inset drawing which illustrates a single row of teeth in the lower jaw moving forward with use and being discarded.

The spiny dogfish shark (1 meter, 3 ft) possesses a streamlined dusky gray body with a complement of both paired, pectoral and pelvic fins, and unpaired, dorsal and caudal fins similar to the bony fishes (Plate 43). However, there are some differences. The dorsal fin of sharks is more rigid and is incapable of being folded down flush against the back. While the spiny dogfish possesses two dorsal fins, they do not straddle the midline and are not properly considered as “paired.” The dogfish caudal fin is asymmetrical (heterocercal), with a larger upper lobe. This larger lobe, supported nearly to its tip by the vertebral column, gives the shark an upward as well as forward movement that counteracts its tendency to sink. Similarly, the larger pectoral fins are more rigid than those of bony fishes and are held horizontally with a slight upward cant that provides lift. The pelvic fins of the male each have an elongated clasper on the inside; this is used in fertilization of the female (Plate 85).

The absence of an operculum means that sharks cannot actively pump water over their gills, and this suggests that they have to swim constantly to maintain a flow of oxygen-bearing water over their gill surfaces. However, many bottom-dwelling sharks possess spiracles from the dorsal body surface to the gills through which the gills can be ventilated. Each spiracle is fitted with a non-return valve that opens and closes as the fish breathes; water is drawn in only and expelled out the gill slits.

The shark’s mouth is usually underslung, or sub-terminal, with a pointed snout extending above it. When a shark strikes, it raises its snout and projects its wide-open jaws forward, allowing it to take a substantial bite. Shark teeth are usually pointed and sharp. As they break off or are worn down, they are continuously replaced from behind, as the arrows in the inset indicate. Unlike other vertebrates, the teeth of sharks are mounted in skin, not jaw bone. Shark teeth are actually modified placoid scales, or denticles, the same basic structure that covers the shark’s body, giving it a texture like sandpaper. Teeth are lined up in five or six rows (fewer in some cases; more in others) and grow forward as the leading tooth wears or falls out.

Color the underside (ventral side) of the big skate.

The skate is a much flattened (depressed) elasmobranch that spends its daylight hours buried in the sand on the bottom, with only the eyes and large gill-ventilating spiracles uncovered. At night, the skate emerges and swims, using undulations of its long pectoral fins like wings. The skate feeds on bottom-dwelling crustaceans and molluscs that it captures in its ventrally located mouth and crushes with its flat, block-shaped teeth. The skate’s body is moderately slender and often has rows of enlarged denticles along the back. The male’s pelvic fins possess long claspers for mating. The anal and caudal fins are absent, and the dorsal fins are very small. Skates are found in all seas, and species range in size from one meter to the “barndoor” skate which is over three meters (10 ft) long. They are white ventrally and tan to dark dorsally.

Color the stingray, including the enlarged spine at lower right.

The southern stingray inhabits Atlantic and Caribbean waters. Stingrays are similar to skates in the shape of the pectoral fins, position of the mouth, spiracle, and gill slits, and in behavior, feeding, and diet. They spend the daylight hours buried in soft substrata and the nighttime foraging for bottom-dwelling crustaceans and molluscs. Rays differ from skates in having a long whiplike tail that lacks dorsal fins and possesses one or more spines at its base. The spines are modified denticles and, like the shark’s teeth, are replaced in series when broken or pulled out. Buried in the sand, these rays are almost invisible, and the unwary wader who steps on one is often impaled on one of the spines by the lashing motion of the tail. Stingray “stings” are complicated by the presence of venom glands on each side of the spine; the venom flows along grooves in the spine and into the wound. The pain is often excruciating, and some stings have proven fatal to humans. Southern stingrays are medium brown dorsally and white ventrally.
FORM AND FUNCTION

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BODY
FINS
DORSAL
CAUDAL
ANAL
PELVIC
CLASPERS
PECTORAL
EYE
JAWS/MOUTH
DENTICLES
TEETH
SPINE
GILL SLIT
SPIRAL
NOSTRIL