52
ELASMOBRANCH FISH DIVERSITY: RAYS AND RELATIVES

Color the manta ray at the top of the page.

The Atlantic manta ray, like all mantas, possesses special *cephalic fins* on either side of its *mouth*. These fins are the anterior portion of the *pectoral fins* and serve to form a funnel through which plankton and small fish are directed into the mouth of the filter-feeding manta. Because the cephalic fins are widely separated and held in front of the *body*, they were called "horns" by fisherman who referred to the manta as a devilfish. Mantas are graceful creatures which swim by slowly beating their huge, winglike pectoral fins. The Atlantic manta shown here may reach a width of over 6 meters (20 ft) and weigh in excess of 1360 kilograms (3000 lb). It is dark gray on the dorsal surface and creamy white underneath. Mantas are renowned for their habit of leaping high into the air and coming down like a shot; this may serve to loosen parasites or perhaps to stun fish.

Now color the spotted eagle ray.

The spotted eagle ray is found inshore in all tropical and warm temperate seas. This large, active ray (over 2 meters, 6 ft in length; 230 kg, 500 lb) is generally seen swimming near the bottom joined in formation with several other rays. Its long tail (more than three times its body length) is characterized by one to five *spines* near its base and is held straight out behind the body. The placement of the spines makes them a questionable defensive weapon compared to the posteriorly located spines of other stingrays. The eagle ray's body is thicker than other stingrays, and the head projects forward from the disc formed by the pectoral fins and body. The head is thick, box shaped, and harbors powerful jaws with pavementlike teeth used in crushing bottom-dwelling crustaceans and molluscan prey. The *eyes* and *spiracles* are mounted on the sides of the head rather than on top. Eagle rays are green with dark spots.

Large numbers of eagle rays often enter estuaries at high tide to feed on commercial shellfish. They use their pectoral fins like plungers ("plumber's friend") to pop shellfish out of their burrows; their passage can leave a mudflat looking like a minefield. Oystermen often construct fences and other deterrents to foil the marauding rays.

Next color the sawfish.

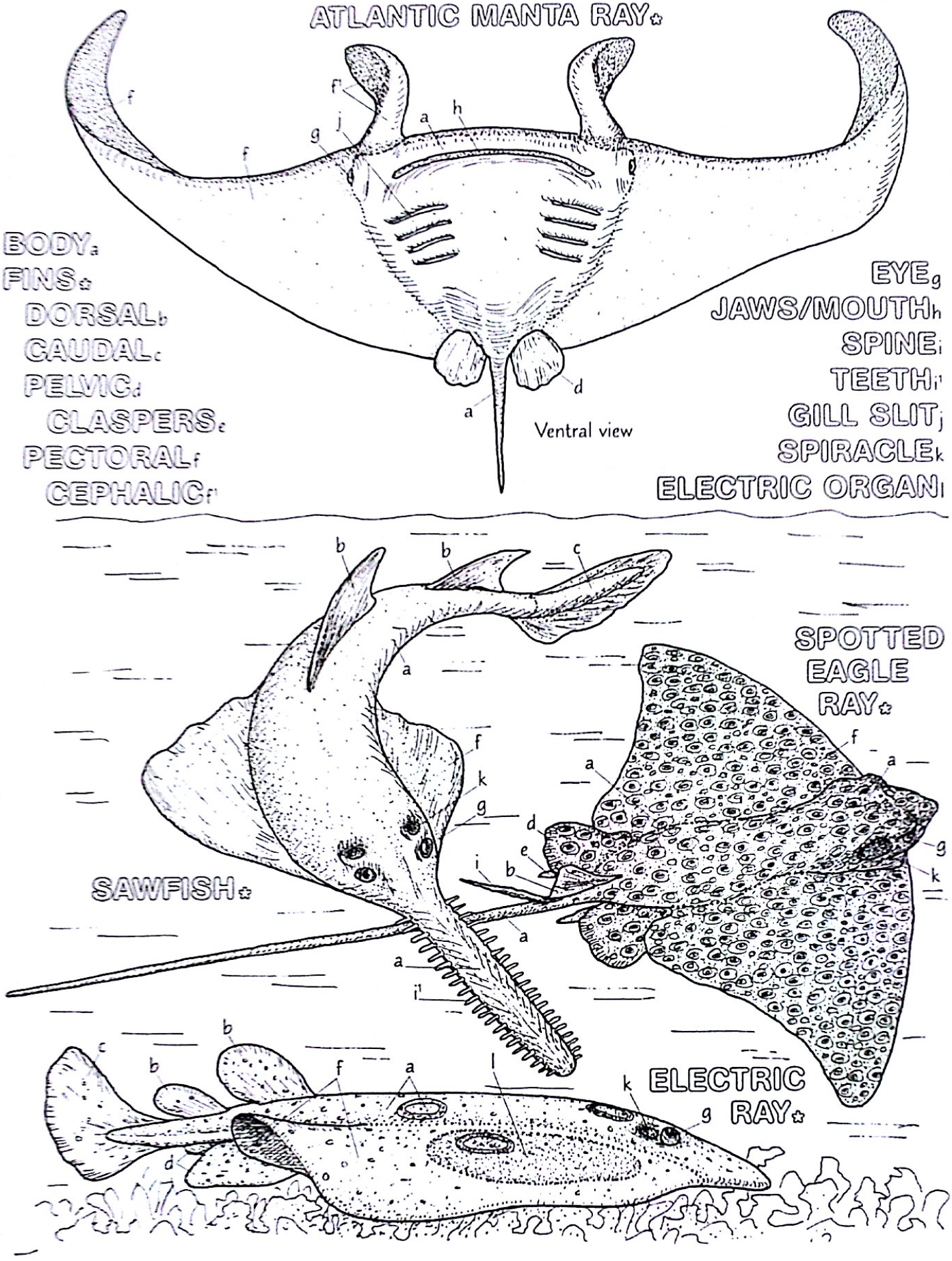
The gray sawfish looks distinctly un-raylike. However, it shares with the rays a bottom-dwelling existence and ventrally placed gill slits. Its form is dominated by the long, paddlelike extension of the head that bears pairs of *teeth* (actually modified denticles like shark teeth and stingray spines). The sawfish uses its "saw" to dig shellfish out of the bottom and to stun fish. It will swim through a school of fish slashing wildly and impaling or stunning fish, which it then eats. Sawfish also use their weapon defensively against natural predators and humans.

The body of the sawfish is decidedly more like a shark than a ray, and it swims by using its *caudal fin* in typical shark fashion. These animals can be quite large (over 6 meters, 20 ft, in length and 365 kg, 800 lb) and are found inshore in all tropical seas. They often enter brackish and even fresh water, as demonstrated by a large population of sawfish landlocked in Lake Nicaragua.

Now color the electric ray. The electric organ is located beneath the skin and is given a separate color for illustration purposes.

The giant electric ray is thick and flabby compared to other rays, and its almost circular body is smooth and without scales. The dark gray body is continuous with a relatively thick tail characterized by two *dorsal fins* and a distinct caudal fin. It is white underneath.

Two large kidney-shaped *electric organs* are located on the pectoral fins. These organs are modified muscle tissue directly innervated by the brain. They contain special hexagonal-shaped tissues that are, in essence, storage batteries wired in series. The electric organs account for one-sixth of the ray's total weight and can generate an initial shock in excess of 200 volts, enough to electrocute a large fish.

Ichthyologists (scientists who study fish) diving at night off southern California reefs have found that the electric ray emerges from its half-buried, daylight repose and actively hunts along the reefs. When it physically encounters other fish it shocks them with electricity and then uses its pectoral fins to move the stunned, inactive fish into its ventrally located mouth.

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