SWORD-FISH. Sword-fishes are a small family of spiny-rayed fishes *(Xiphiidx),* the principal characteristic of which consists in the prolongation of the upper jaw into a long pointed sword-like weapon. The “sword” is formed by the coalescence of the intermaxillary and maxillary bones, which possess an extremely hard texture ; it has the shape of a much elongate cone, more or less flattened throughout its whole length ; the end is sharply pointed. It is smooth above and on the upper part of the sides, and rough below owing to the presence of innumer­able rudimentary teeth, which have no function.

The general form of the body is well proportioned, somewhat elongate, and such as is always found in fishes with great power of

swimming, as, for in­

stance, in the mackerel

and tunny, and the tail

terminates in a powerful bi-

lobed caudal fin. A long fiu

occupies nearly the whole length of the back, whilst the anal fin is generally interrupted in the middle, and conse­quently appears to be double. The skin is very firm, partly naked, partly with small lanceolate scales deeply imbedded in the skin. The teeth of the lower jaw are, like those of the upper, merely rudimentary structures, which render the surface of the bone rough without possessing any special function.

Sword-fishes have been divided into three generic groups :—

*a. Histiophorus,* with a high dorsal fin which can be spread out like a sail, and with ventral fins which are reduced to a pair of long styliform appendages.

*b. Tetrapturus,* with a dorsal fin of which the anterior rays only are elongate, the remainder of the fin being low or partly obsolete, and with styliform ventral fins as in the preceding genus.

c. *Xiphias,* with the dorsal fin shaped as in *Tetrapturus,* but without ventral fins.

Sword-fishes are truly pelagic fishes, which either singly or in pairs or in smaller or larger companies roam over the oceans of the tropical and subtropical zones of both hemi­spheres. Some species wander regularly or stray far into the temperate seas. Some of the tropical forms are the largest of Acanthopterygian fishes, and not exceeded in size by any other Teleostean ; such species attain to a length of from 12 to 15 feet, and swords have been preserved more than 3 feet long and with a diameter of at least 3 inches at the base. The *Histiophori,* which inhabit chiefly the Indo-Pacific Ocean, but occur also in the Atlantic, seem to possess in their high dorsal fin an additional aid for loco­motion. During the rapid movements of the fish this fin is folded downwards on the back, as it would impede the velocity of progress by the resistance it offers to the water; but, when the fish is swimming in a leisurely way, it is frequently seen with the fin erected and projecting out of the water, and when quietly floating on the surface it can sail by the aid of the fin before the wind, like a boat.

The food of the sword-fishes is the same as that of tunnies, and consists of smaller fish, and probably also in great measure of pelagic cuttle-fishes. It has been ascer­tained by actual observation that sword-fishes procure their food by dashing into a school of fishes, piercing and kill­ing a number of them with their swords ; and this kind of weapon would seem to be also particularly serviceable in killing large cuttle-fish, like the saw of saw-fishes, which is used for the same purpose. But the swords of the large species of *Histiophorus* and *Tetrapturus* are, besides, most formidable weapons of aggression. These fishes never hesi­

tate to attack whales and other large cetaceans, and, by repeatedly stabbing them, generally retire from the combat victorious. That they combine in these attacks with the thresher-shark is an often-repeated story which has its foundation in the imagination of the observer, and which is fully disproved by the fact that the dentition of the thresher-shark is much too weak to make an impression on the skin of any cetacean. The cause which excites sword­fishes to such attacks is unknown ; but they follow the in­stinct so blindly that they not rarely assail boats and ships in a similar manner, evidently mistaking them for ceta­ceans. They easily pierce the light canoes of the natives of the Pacific islands and the heavier boats of the pro­fessional sword-fish fishermen, often dangerously wounding the persons sitting in them. Attacks by sword-fishes on ocean-going ships are so common as to be included among sea-risks : they are known to have driven their weapon through copper-sheathing, oak-plank, and timber to a depth of nearly 10 inches, part of the sword projecting into the inside of the ship; and the force required to pro­duce such an effect has been described by Prof. Owen in a court of law as equal to “ the accumulated force of fifteen double-handed hammers,” and the velocity as “ equal to that of a swivel-shot,” and “as dangerous in its effects as a heavy artillery projectile.” Among the specimens of planking pierced by sword-fishes which are preserved in the British Museum there is one less than a foot square which encloses the broken ends of three swords, as if the fishes had had the object of concentrating their attack on the same vulnerable point of their supposed enemy. The part of the sword which penetrates a ship’s side is almost always broken off and remains in the wood, as the fish is unable to execute sufficiently powerful backward move­ments to free itself by extracting the sword.

In the Mediterranean and on the Atlantic coasts of the United States the capture of sword-fishes forms a regular branch of the fishing-industry. The object of the fishery in the Mediterranean is the common European sword-fish *(Xiphias gladius),* the average weight of which is about one cwt., and which is abundant off the Sicilian coasts and on the opposite coast of Calabria. Two methods are em­ployed,—that by harpoons, chiefly used for larger fish, and that by peculiarly constructed nets called *palamitare.* This fishery is very productive : a company of fishermen fre­quently capture from twenty to fifty fish in a single day, and the average annual catch in Sicily and Calabria is reported to be 140,000 kilogrammes (138 tons). The products of the fishery are consumed principally in a fresh state, but a portion is preserved in salt or oil. The flesh of the sword-fish is much preferred to that of the tunny, and always commands a high price. This species is occa­sionally captured on the British coast.

On the coast of the United States a different species, *Histiophorus gladius,* occurs ; it is a larger fish than the Mediterranean sword-fish, attaining to a length of from 7 to 12 feet, and an average weight of 300 or 400 lb. It is captured only by the use of the harpoon. From forty to fifty vessels, schooners of some 50 tons, are annually engaged in this fishery, with an aggregate catch amounting annually to about 3400 sword-fishes, of a value of $45,000. The flesh of this species is inferior in flavour to that of the Mediterranean species, and is principally consumed after having been preserved in salt or brine.

Useful and detailed information on the sword-fish fishery can be obtained from A. T. Tozzetti, “La Pesca nei Mari d’Italia e la Pesca all’ Estero esercitata da Italiani,” in *Catalogo Esposizione Internazionale di Pesca in Berlino,* 1880; also from *La Pesca del Pesce-Spada nello Stretto di Messina* (Messina, 1880), and from G. Brown Goode, “Materials for a History of the Sword-fish,” in *Report of the Commissioner of Fish and Fisheries,* part viii., Washington, 1883. (A. C. G.)