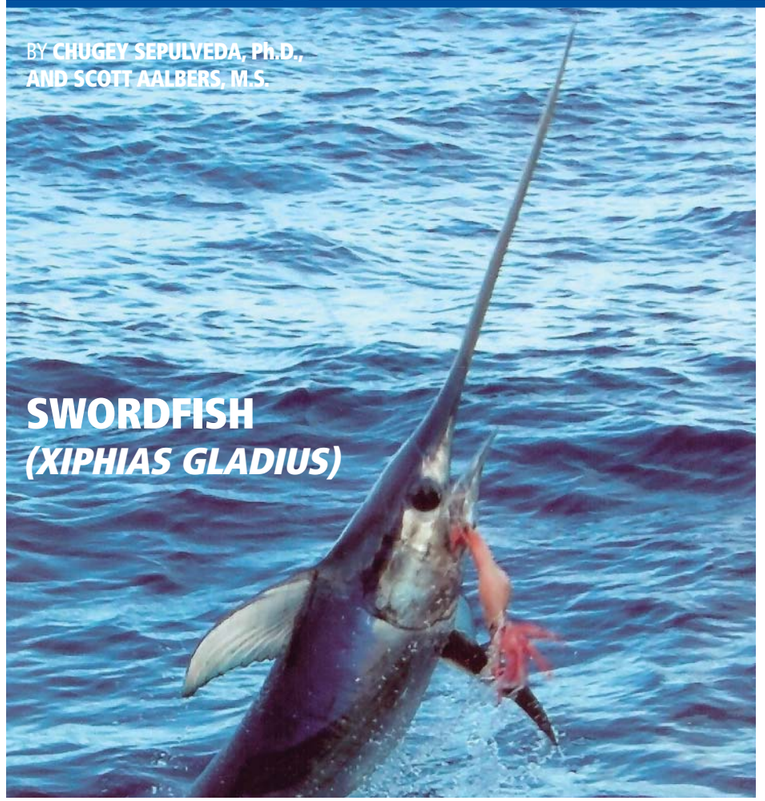
species specifics



BY CHUGEY SEPULVEDA, Ph.D., AND SCOTT AALBERS, M.S.

Swordfish is the only species of the family *Xiphiidae*, circum-globally distributed in temperate and tropical oceans of the world. It supports vast commercial fisheries throughout much of its extensive range. Readily exemplified in its vast latitudinal and depth distributions, swordfish have greater temperature tolerance than most pelagic species. In the Pacific, swordfish can be found from 50° S to 50° N and at depths from the surface to over 3,000 feet.

Movements

Because the swordfish represents a tremendously valuable resource that is targeted by many different countries, several studies have focused on the fine- and course-scale movements of this species. It has been studied using conventional or spaghetti tags, with acoustic transmitters, archival data loggers, and pop-off satellite archival tags (PSATs). In the Pacific large-scale migratory movements still remain unclear because multi-year tracks are necessary for understanding migration patterns for this species; however, off of the California coast, the fine-scale depth distribution is relatively well documented.

Typically, swordfish remain at depth (750 to 2,000 feet) during the daylight hours, while at night they are distributed mainly in the shallow waters above the thermocline. This distribution mirrors that of the deep scattering layer, a dense layer of mid-water organisms that vertically migrate daily. During the day, swordfish can also periodically return to the surface to thermally recharge. This surface basking activity forms the basis for valuable harpoon fisheries off of Southern California as well as areas off of Japan and the North Atlantic.

Growth

Age and growth studies have been conducted for several different swordfish stocks around the globe. From these works it is suggested that swordfish grow relatively rapidly, reaching approximately one meter in length (eye-fork length) within the first year of life. Females grow faster and attain larger sizes than males. Age at first sexual maturity is believed to vary among the different geographic regions; however, swordfish in the northwestern Pacific are believed to reach sexual maturity at approximately three to five years of age.

Fisheries

A valuable commercial resource supporting domestic and international long-line, gillnet, and harpoon fisheries around the world, most of the swordfish that is currently landed comes as a by-catch in tuna long-line fisheries. Along the US West Coast, swordfish are primarily harvested using drift-gillnet gear and, to a lesser extent, with traditional harpoon methods. California's drift-gillnet fleet is strictly managed with time, area, and gear restrictions in place, and California landings have fluctuated significantly over the past 30 years, with several factors influencing annual landings, including market dynamics (availability and price of foreign product) as well as the stringent regulations imposed on domestic commercial operations. For the past decade area closures above Point Conception have reduced the range in which the California drift-gillnet fishery is able to operate, one reason why anglers might see more DGN vessels off of the Southern California coast.

Feeding Ecology

In the eastern Pacific, gut contents studies have shown that swordfish are opportunistic predators capable of feeding on a wide range of species, from rockfishes to squid. Some of the most common prey found in swordfish guts include jumbo squid (*Dosidicus gigas*), Pacific sardines (*Sardinops sagax*), and Pacific hake (*Merluccius productus*).

Physiology

Similar to other billfish and most tuna species, the swordfish has the capacity to elevate the temperature of its eye and brain region (regional endothermy). In the swordfish, eye and brain endothermy is made possible by an eye muscle (superior rectus) that is modified to produce heat. Heat is retained locally by a vast network of arteries and veins that work similar to that of a radiator or heat exchanger on an engine. Cranial temperatures from fish acoustically tracked have shown that the temperature of the eye and brain area can be as much as 20° C greater than that of the surrounding water at depth. Recent studies on swordfish vision have also shown that this adaptation likely significantly enhances vision while at depth.

For more information on recent PIER swordfish research go to www.pier.org.

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