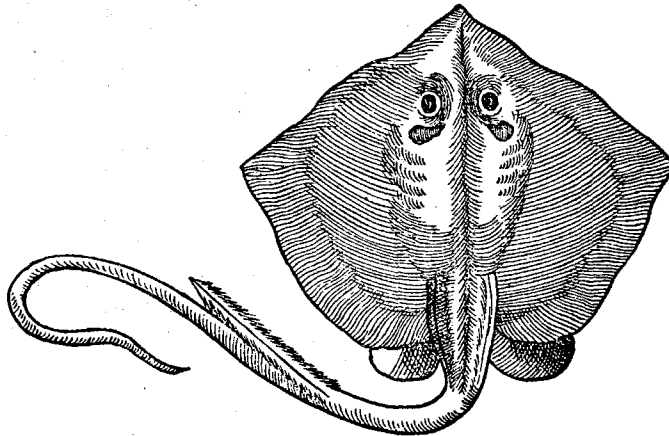


*Early print (1553) of a stingray. The spine is drawn disproportionately large.*



## THE STINGRAY

**He has a retiring personality but he's a formidable looking fish all the same—and if you tread on him you're not likely to forget it**

by FINDLAY RUSSELL

**I**N A SEVEN-MONTH PERIOD, from April to November, 1952, California lifeguard stations from Santa Monica to San Diego reported approximately 390 cases of stingray "attacks." Another 84 victims, in areas unattended by the beach services, were treated by physicians. It is not unreasonable to assume that some 50 additional victims received no medical attention from either of these sources, but recovered from their wounds without particular incident.

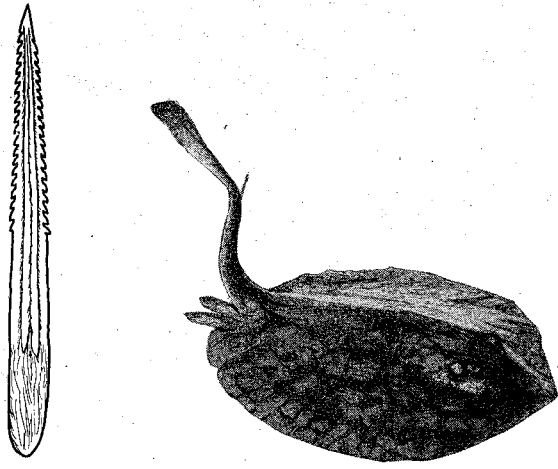
Small wonder that the stingray commands healthy respect from the fisherman and the bather.

Known to the ancients, the stingray has become one of the feared denizens of the deep. In spite of a rather retiring personality, he has often been indicted for crimes beyond the wildest imagination. What self-respecting stingray, for instance, would attack a tree? Yet Pliny, who lived from A. D. 23 to 79, credited the ray *Pastinaca* with the ability to "fix its spine in the root of a tree so that the tree withereth and dieth away."

Nor do the ray's accomplishments seem to be limited to trees. This curious aboriginal story comes from the native tribes of Tasmania.

"Two women were bathing; it was near a rocky shore where mussels were plentiful. The women were sulky, they were sad; their husbands were faithless, they had gone with two girls. The women were lonely; they were swimming in the water, they were diving for crayfish. A stingray lay concealed in the hollow of a rock. The stingray was large, he had a very long spear; from his hole he spied the women; he saw them dive; he pierced them with his spear . . . he killed them, he carried them away. Awhile they were gone out of sight. The stingray returned; he came close to shore, he lay in still water, near the sandy beach; with him were the women, they were fast on his spear . . . they were dead!

"The two black men fought the stingray; they slew him with their spears; they killed him; the women were dead! The two men made a fire . . . a fire of wood.



*The sting, or caudal spine, of the round stingray at the left may be barely visible (it is halfway down the tail), but it is treacherous nevertheless—as the detailed drawing of it shows.*

On either side they laid a woman; the fire was between: the women were dead! The two black men sought some ants, some large blue ants. They placed them on the bosoms of the women. Severely, intensely were they bitten. The women revived . . . they lived once more."

All in all, the rays have enjoyed a rather remarkable history. So have their stings. Ulysses was said to have been slain by the spine of a large stingray. A tribal war in the Malay States was once decided when two chieftains "gave battle armed only with ray stings." The Indians of several South American tribes, as well as some Polynesians, have used stingray spines on their spears and arrows for hundreds of years. But perhaps the strangest of all uses into which this structure has been pressed is that employed by an enterprising Australian who grinds, polishes, and sells the stings for toothpicks.

The bewildering array of stingrays that inhabit the seas of the world might confuse the most thorough of ichthyologists. Some, like the giant stingray of Australia (*Bathytoshia*), weigh more than 700 pounds, while others, like the round stingray (*Urobatis halleri*), so common to the waters off southern California, rarely reach a length in excess of 20 inches. Between these two extremes are many dozens of species which, in or out of their habitats, are justly respected by their land-dwelling neighbors.

The stingray, while a most formidable looking fish, is not usually considered to be a belligerent one. He probably never utilizes his sting except in self-defense, either against those animals which feed upon him or those unfortunate humans who walk upon him. There is no evidence to support the assumption that these fish use their spines offensively in obtaining food or attacking other fishes. The greatest danger in studying the larger rays in their natural habitat is swimming within range of the pectoral fins. The force behind these massive muscles of propulsion is sufficient to injure a man seriously. Cameramen have occasionally had their cases smashed by the broad fins of these sea monsters.

In the waters off California are four species said to be common to this region. They are the round stingray, the diamond stingray (*Dasyatis dipterurus*), the butter-

fly stingray (*Gymnura marmorata*), and the bat stingray (*Holorhinus californicus*). The bat stingray, largest of the California species, may reach a weight in excess of 200 pounds.

These fish are most commonly encountered in the late summer or early fall when, in large numbers, they move into the bays and sloughs. A population count taken on September 1, 1953 in Alamitos Bay, near Long Beach, California, revealed that there were over 50 of these fish for each of 10 areas of 100 square feet. They are, of course, more sparsely distributed along the surf, even though this area reports the greater number of "attacks." Fortunately, stingrays fear humans as fervently as humans fear stingrays. This mutual concern probably keeps the accident statistics from becoming alarming.

The species most likely to be encountered by the bather and the fisherman along the southern California coast is the rather small round stingray. This unbenevolent little creature, lying half-buried on the sandy bottom in the surf, or the mud flats of the bay, is often stepped upon by the unwary bather. The mere touch of a foot to the dorsal surface of the fish is sufficient stimulation for the animal to thrust his tail and sting forward into the foot or leg of his victim.

The sting or caudal spine of the stingray is a very treacherous-looking weapon. An 11-inch ray possesses a spine of approximately  $1\frac{1}{2}$  inches; a 200-pound stingray packs a weapon of 10 inches. Irrespective of its length, it can be driven into its victim with great force and accuracy. It is not uncommon to read of wounds  $1\frac{1}{2}$  inches long, perpetrated by a sting less than  $\frac{1}{4}$  inch wide.

Large stingrays may inflict serious and occasionally fatal injuries. One investigator tells of a fisherman who was stung by a ten-foot stingray off Australia. This animal struck with such force that he drove his sting through the lower third of the man's leg, between the tibia and the fibula, leaving a wound 7 inches long on the lateral aspect of the leg, and 4 inches long on the medial side. Another investigator reports an incident in which a young woman was wounded fatally when a stingray drove its spine through her heart.

The sting is located on the dorsal surface of the fish's tail. It is a calcified structure bilaterally serrated along the last half or so of its length. The teeth are directed cephalically; and thus are responsible for the lacerating effect of the spine as it is withdrawn from the victim's flesh.

When the spine is driven into the victim, the pressure exerted by the involved tissues is sufficient to tear the integumentary sheath from the sting, and to express venom from a group of toxin-producing cells and their supporting structures. The fish usually retracts his sting, though occasionally it becomes detached or broken in the wound.

Until a decade or so ago there was considerable question in the minds of some investigators regarding the presence of a venom-producing organ within the caudal structures of this fish. It is now generally agreed that along the ventral surface of the sting, in two lateral grooves, lie certain specialized secretory cells which produce a toxin that is more directly responsible for the symptoms experienced by the victim than is the mechanical injury caused by the sting.

In spite of the serious damage that may be done by the fish's sting, the changes effected by the toxin may be even more dangerous. The venom from a 1½ inch sting, when injected intravenously, is sufficient to kill a rabbit within several minutes. While a fatality is fortunately rare, men have no doubt died from the effects of this toxin.

In 1952, at Caltech, an investigation was begun into the effects of the venom on the various components of the cardiovascular system. The study offered many problems from the beginning—the foremost of which was the taking of these unfriendly little creatures.

Unaccustomed as these fish are to being obliging, they have now become the victims of a system. A spe-



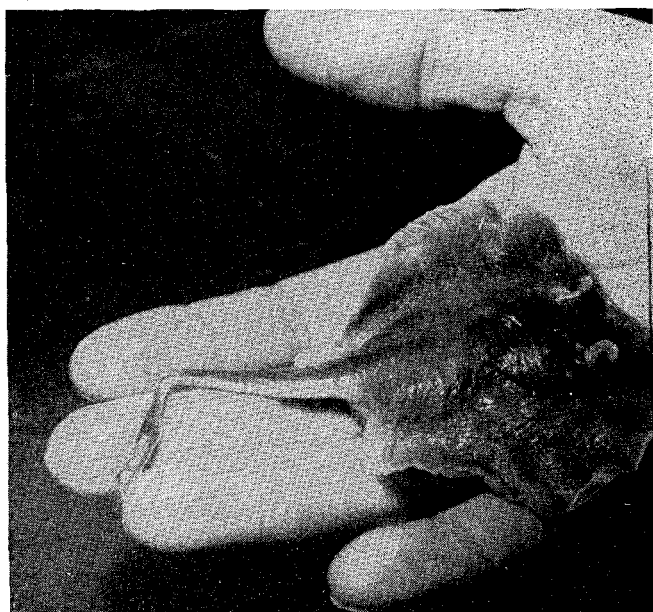
*Diamond stingrays collected by University of California researchers. As diamond stingrays go, these are standard—not outsized—specimens.*

cially designed beach seine was constructed through the efforts of Captain Steve Smith and Professor G. E. MacGinitie of the Caltech Marine Laboratory. This 50-foot seine is set in 15 to 20 feet of water about 200 feet from shore. It is pulled across the bottom and onto the beach by a team of four men.

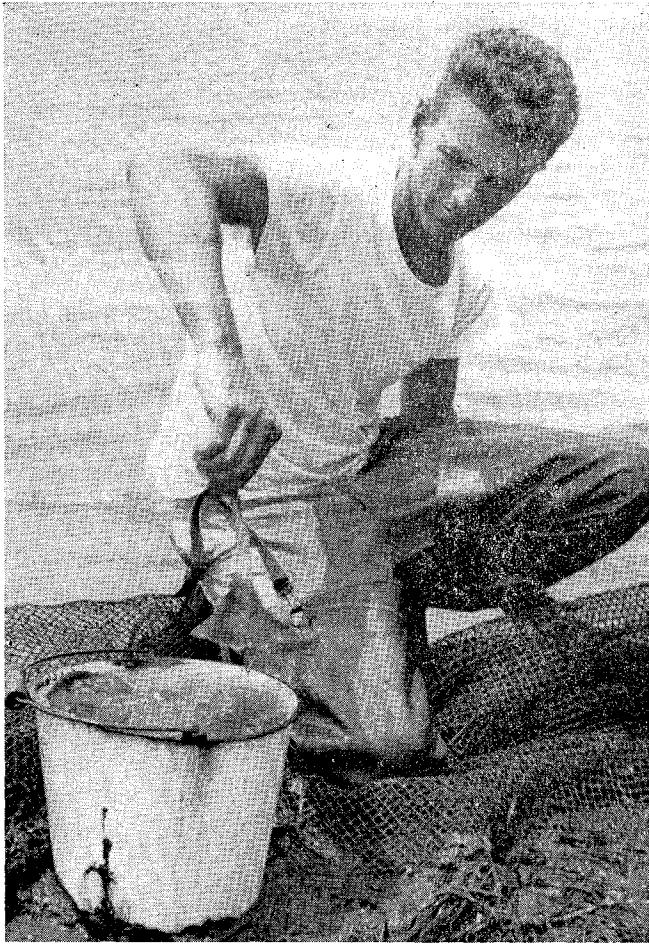
The fishes within this area are thus brought into shallow water, where the rays are removed and the rest of the species returned to the deeper water. The stings are severed from the rays and immediately refrigerated at -20° C. The venom is extracted from the tissues of the lateral grooves just prior to its injection in the experimental preparation.

Utilizing the intact animal, after a method proposed by Dr. A. Van Harreveld, Professor of Physiology at Caltech, it is possible to demonstrate that the venom has a deleterious effect on the cardiovascular system. Studies with the isolated preparations further confirmed these changes. In small doses the toxin causes dilation of the small blood vessels. This change is followed by a period of vasoconstriction which overshadows the dilative effect of the toxin. A similar type of response takes place in the larger vessels.

With greater, and usually lethal, dosages the venom causes cardiac dilatation and failure. While this study



*Diamond stingray is one of four species said to be common to the waters off California. A newborn ray can be held in the palm of a man's hand.*



*Dr. Findlay Russell handles a round stingray with care*

has given us considerable insight into the mode of action of the poison, there is much yet to be learned of the effects of the venom.

From the observations in the experimental preparations it has become possible to establish a more rational approach to the treatment of the stingray victim. While

the physician may occasionally have to be called upon to render medical aid for the complications caused by the venom, in the greater number of cases the victim may treat himself.

It is wise when wading in areas known to be inhabited by stingrays to shuffle one's feet while walking to and from the beach. In collecting rays, we have used this precaution, and have only once suffered the displeasure of having to treat one of our seiners. We also wear rubber boots, but this precaution is purely psychological; a boot is no measure of safety to be placed between one's anatomy and a stingray.

When one is stung by a stingray he should irrigate the wound immediately with the cold salt water at hand. Not only may much of the toxin be washed from the wound by the simple mechanics of this operation, but the cold water acts as both a vasoconstrictor and a mild anesthetic agent.

A constriction band may be applied above the stab site. When the wound has been thoroughly irrigated and no evidence of the sting's epithelial sheath can be seen, the extremity may be submerged in hot water. The water should be maintained at as high a temperature as the victim can tolerate without injury, for 30 minutes to an hour. The addition of various anesthetic and anti-septic agents to the hot water is optional.

Following the soaking procedure, the wound should be covered with a sterile antiseptic dressing. In those cases where the injury has been severe, or where systemic complaints are registered, it is advised that the victim be seen by a physician immediately.

Further studies of the venom's influence on the blood cells, nervous tissues, and the pacemaker of the heart are now being conducted at the Huntington Institute of Medical Research in Pasadena. Support for the cardiovascular investigations was provided through the Bank of America-Giannini Research Foundation.

*In the late summer and early fall stingrays move into California's bays and sloughs in large numbers. Right—a typical fall catch near Balboa.*

