


Electric eel

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For other meanings, see Electric eel (disambiguation).

The **electric eel** (*Electrophorus electricus*) is an electric fish, and the only species in its genus. It is capable of generating powerful electric shocks of up to 860 volts, which it uses for hunting, self-defense and communicating with fellow eels. It is an apex predator in its South American range despite living in an environment rich in predators such as humans, dogs, caimans, jaguars, giant otters, giant snakes, and birds of prey that kill fish of similar size of the electric eel as prey. Despite its name, it is not an eel, but rather a knifefish.

Electric eel



Conservation status

Extinct
Threatened
Least Concern

EX
EW
CR
EN
VU
NT
LC

Least Concern (IUCN 3.1)^[1]

Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
Superclass:	Osteichthyes
Class:	Actinopterygii
Order:	Gymnotiformes
Family:	Gymnotidae
Genus:	<i>Electrophorus</i>
	T. N. Gill, 1864
Species:	<i>E. electricus</i>

Binomial name

Electrophorus electricus

(Linnaeus, 1766)

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Anatomy

The electric eel has an elongated, cylindrical body, typically growing to about 2 m (6 ft 7 in) in length, and 20 kg (44 lb) in weight, making it the largest species of the Gymnotiformes.^[2] The coloration is dark gray-brown on the back and yellow or orange on the belly. Mature males have a darker color on the belly. They have no scales. The mouth is square, and positioned at the end of the snout. The anal fin extends the length of the body to the tip of the tail. As in other ostariophysan fishes, the swim bladder has two chambers. The anterior chamber is connected to the inner ear by a series of small bones derived from neck vertebrae called the Weberian apparatus, which greatly enhances its hearing capability. The posterior chamber extends along the whole length of the body and maintains the fish's buoyancy. *E. electricus* has a well-developed sense of hearing. This fish has a vascularized respiratory organ in its oral cavity. As obligate air-breathers, electric eels must rise to the surface every 10 minutes or so to inhale before returning to the bottom. Nearly 80% of the oxygen used by the fish is retrieved in this way.^[3]

Despite its name, the electric eel is not closely related to the true eels (*Anguilliformes*), but is a member of the neotropical knifefish order (*Gymnotiformes*), which is more closely related to the catfish.

Physiology



Electric eel at the New England Aquarium.

The electric eel has three abdominal pairs of organs that produce electricity: the main organ, the Hunter's organ, and the Sach's organ. These organs make up four-fifths of its body, and are what give the electric eel the ability to generate two types of electric organ discharges: low voltage and high voltage. These organs are made of electrocytes, lined up so a current of ions can flow through them and stacked so each one adds to a potential difference. When the eel locates its prey, the brain sends a signal through the nervous system to the electrocytes. This opens the ion channels, allowing sodium to flow through, reversing the polarity momentarily. By causing a sudden difference in electric potential, it generates an electric current in a manner similar to a battery, in which stacked plates each produce an electric potential difference. In

the electric eel, some 5,000 to 6,000 stacked electroplaques are capable of producing a shock at up to 600 volts and 1 ampere of current (600 watts) for a duration of two milliseconds. It would be extremely unlikely for such a shock to be deadly for an adult human, due to the very short duration of the discharge. Still, this level of current could in theory cause fatal electrocution in humans, depending on the path the current takes through the human body, and the duration of current flow. Heart fibrillation (reversible via a heart defibrillator) can be triggered by electric currents of 700 mA for more than 30 ms.

The Sach's organ is associated with electrolocation.^[4] Inside the organ are many muscle-like cells, called electrocytes. Each cell can only produce 0.15 V, though the organ can transmit a signal of nearly 10 V overall in amplitude at around 25 Hz in frequency. These signals are emitted by the main organ; the Hunter's organ can emit signals at rates of several hundred Hertz.^[4]

The electric eel is unique among the *Gymnotiformes* in having large electric organs capable of producing potentially-lethal discharges that allow them to stun prey.^[5] Larger voltages have been reported, but the typical output is sufficient to stun or deter virtually any animal. Juveniles produce smaller voltages (about 100 V). They are capable of varying the intensity of the electric discharge, using lower discharges for hunting and higher intensities for stunning prey, or defending themselves. When agitated, they are capable of producing these intermittent electric shocks over a period of at least an hour without tiring.

The electric eel also possesses high-frequency-sensitive tuberous receptors, which are distributed in patches over its body. This feature is apparently useful for hunting other *Gymnotiformes*.^[4]

Electric eels have been used as a model in the study of bioelectrogenesis.^[6] The species is of some interest to researchers, who make use of its acetylcholinesterase and adenosine triphosphate.^{[7][8]}

Bionics

Researchers at Yale University and the National Institute of Standards and Technology argue artificial cells could be built that not only replicate the electrical behavior of electric eel cells, but also improve on them. Artificial versions of the eel's electricity-generating cells could be developed as a power source for medical implants and other microscopic devices.^[9]

Ecology and life history

Habitat

Electric eels inhabit fresh waters of the Amazon and Orinoco River basins in South America, in floodplains, swamps, creeks, small rivers, and coastal plains. They often live on muddy bottoms in calm or stagnant waters.^[4]

Feeding ecology

Electric eels feed on invertebrates, although adult eels may also consume fish and small mammals. First-born hatchlings will eat other eggs and embryos from later clutches.^[4] The juveniles will eat invertebrates, such as shrimps and crabs.

Reproduction

The electric eel is known for its unusual breeding behavior. In the dry season, a male eel makes a nest from his saliva into which the female lays her eggs. As many as 3,000 young will hatch from the eggs in one nest. Male electric eels are much smaller than the females.^{[10][11]}

In zoos and private collections

These fish have always been sought after by some animal collectors, but catching them is difficult, because the only reasonable option is to make the eels tired by continually discharging their electricity. The fish's electric organs will eventually become completely discharged, allowing the collector to wade into the water in comparative safety.^[10]

Keeping electric eels in captivity is difficult and mostly limited to zoos and aquaria, although a few hobbyists have kept them as pets.

The Tennessee Aquarium is home to an electric eel which uses its electrical discharges to post from its own Twitter account. Named Miguel Wattson, the eel's exhibit is wired to a small computer that sends out a pre-written tweet when the eel emits electricity at a high enough threshold.^{[12][13]}

Taxonomic history

The species is so unusual that it has been reclassified several times. Originally, it was given its own family, Electrophoridae, and then was placed in a genus of Gymnotidae alongside *Gymnotus*.^[5]

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External links

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