OKLAHOMA COOPERATIVE EXTENSION SERVICE

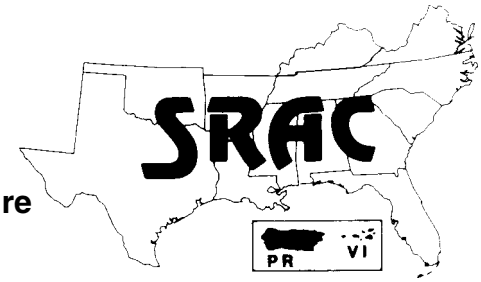
Channel Catfish

Life History and Biology

Thomas L. Wellborn
University of Florida

Oklahoma Cooperative Extension Fact Sheets are also available on our website at:
http://www.osuextra.com

Southern Regional Aquaculture Center



Channel catfish, *Ictalurus punctatus* (Rafinesque), is the most important species of aquatic animal commercially cultured in the United States. It belongs to the family *Ictaluridae*, order Siluriformes. Members of the order Siluriformes are found in fresh and salt water worldwide. There are at least 39 species of catfish in North America, but only seven have been cultured or have potential for commercial production. They are the **blue catfish,** *Ictalurus furcatus* (LeSueur); the **white catfish,** *Ictalurus catus* (Linnaeus); the **black bullhead,** *Ictalurus melas* (Rafinesque); the **brown bullhead,** *Ictalurus nebulosus* (LeSueur); the **yellow bullhead,** *Ictalurus natalis* (LeSueur); and the **flathead catfish,** *Pylodictis olivaris* (Rafinesque).

Distribution

Channel catfish were originally found only in the Gulf States and the Mississippi Valley north to the prairie provinces of Canada and Mexico, but were not found in the Atlantic coastal plain or west of the Rocky Mountains. Since then channel catfish have been widely introduced throughout the United States and the world.

Physical characteristics

Like all native North American catfishes, a channel catfish has a body that is cylindrical in cross-section, and lacks scales. Fins are soft-rayed except for the dorsal and pectoral fins which have sharp, hard spines that can inflict a nasty, painful wound if a catfish is handled carelessly. An adipose fin (lacking rays) is located on the back between the dorsal and caudal fins (Figure 1). One conspicuous characteristic of all catfish is the presence of barbels around the mouth. The barbels are arranged in a definite pattern with four under the jaw and one on each tip of the maxilla (upper jaw).

The channel catfish is the only spotted North American catfish with a deeply forked tail. There are 24-29 rays in the anal fin. They are generally olivaceous to blue on the back, shading to the off-white ventrally.

Their color, to a large extent, is dictated by the color of the water they inhabit. In clear water they may appear almost black, while in muddy water they may be a light yellow. Young channel catfish are irregularly spotted on their sides, but the spots tend to disappear in the adults.

Habitat

In natural waters, channel catfish live in moderate to swiftly flowing streams, but they are also abundant in large reservoirs, lakes, ponds, and some sluggish streams. They are usually found where bottoms are sand, gravel, or rubble, in preference to mud bottoms. They are seldom found in dense aquatic weeds. Channel catfish are freshwater fish but they can thrive in brackish water.

Channel catfish generally prefer clear water streams, but are common and do well in muddy water. During the day they

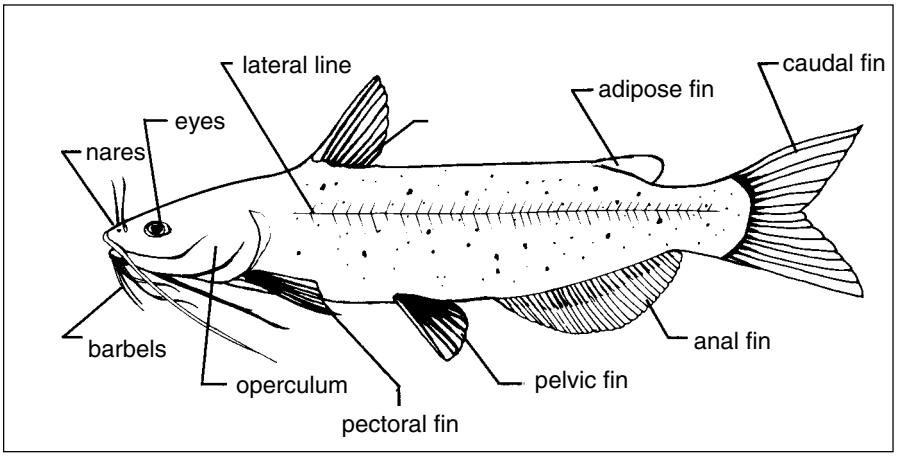


Figure 1. External parts of the Channel Catfish.

are usually found in deep holes wherever the protection of logs and rocks can be found. Most movement and feeding activity occurs at night just after sunset and just before sunrise. Young channel catfish frequently feed in shallow riffle areas while the adults seem to feed in deeper water immediately downstream from sand bars. Adults rarely move much from one area to another and are rather sedentary, while young fish tend to move about much more extensively, particularly at night when feeding.

Feeding

Feeding can occur during day or night, and they will eat a wide variety of both plant and animal material. Channel catfish usually feed near the bottom in natural waters but will take some food from the surface. Based on stomach analysis, young catfish feed primarily on aquatic insects. The adults have a much more varied diet which includes insects, snails, crawfish, green algae, aquatic plants, seeds, and small fish. When available, they will feed avidly on terrestrial insects, and there are even records of birds being eaten. Fish become an important part of the diet for channel catfish larger than 18 inches total length, and in natural waters fish may constitute as much as 75 percent of their diet.

Channel catfish primarily detect food with their sense of taste. Taste buds are found over the entire external surface of catfish as well as inside the mouth, pharynx, and gill arches. They are most numerous on the barbels and gill arches. In clear water, eyesight can be an important means of finding food. However, in turbid water, taste is the primary way catfish locate food. The organ of smell (olfactory organs) may play some role, but this has not been well established. The olfactory organs are found in the nostrils (nares), which are located on top of the head just in front of the eyes.

Age and growth

Channel catfish grow best in warm water with optimum growth occurring at temperatures of about 85° F (29.4° C). With each 18° F (10° C) change in temperature there is a doubling or halving of their metabolic rate. This means that within limits, their appetite increases with increasing water temperatures or decreases with decreasing water temperatures.

In natural waters, the average size channel catfish caught by fishermen is probably less than 2 to 3 pounds, but the world record of 58 pounds was caught in Santee Cooper Reservoir, South Carolina, in 1964. The size and age that channel catfish reach in natural waters depends on many factors. Age and growth studies have shown that in many natural waters channel catfish do not reach 1 pound in size until they are 2 to 4 years old. One study in the Lake of the Ozarks, Missouri, found that channel catfish did not reach a size of 13 inches total length until they were 8 years old. The maximum age ever recorded for channel catfish is 40 years, whereas most commercially raised catfish are harvested before they are 2 years old.

In production ponds the growth rate of channel catfish is determined by water temperature; length of time held at different water temperatures; quantity and quality of food fed; palatability, or taste of food; frequency of feeding; water quality, etc. Most farm-raised catfish are harvested at a weight of 11/4 pounds at an age of about 18 months.

Water Quality

Water quality preferences and limitations for wild channel catfish are not any different from those of farm-raised channel catfish. The lethal oxygen level for both wild and farm-raised catfish is about 1 ppm, and reduced growth occurs at oxygen concentrations of less than 4 ppm. Channel catfish, in natural waters, are no more tolerant of high levels of ammonia and nitrites than are farm-raised catfish, but are seldom exposed to lethal concentrations of either ammonia or nitrite.

Respiration

Like other animals, channel catfish need oxygen to live. They use oxygen for energy production and to help build all the various parts of the body. However, oxygen is at most only about 25 percent as abundant in water as in the air. To get oxygen, fish must expend more energy than air-breathers. Fortunately, fish have well developed breathing organs, the gills. Although catfish live in the water, gills serve essentially the same functions as our lungs – to take oxygen from the external environment and to rid the body of toxic gaseous waste, carbon dioxide (CO_2). Water passes over the gill surface where oxygen diffuses into the blood and carbon dioxide diffuses out.

The gills of channel catfish are located on each side of the head (Figure 2) and they are covered by a protective movable flap of skin called the gill flap or operculum. There are four gills on both sides of the head, each consisting of a double row of slender gill filaments.

These filaments are supported by a flexible white gill arch. Each side of the filament has many thin, small cross plates called lamellae. It is across the gill lamellae that the important respiratory gases are exchanged (Figure 3).

Each gill and gill filament has a rich supply of blood vessels which carries blood from the heart to the gills and then throughout the fish. The lamellae have spaces through which blood rapidly percolates. Oxygen that is picked up at the gill lamellar surface is carried throughout the body in the blood. Waste carbon dioxide is also carried in the blood for release into the water at the lamellar surface.

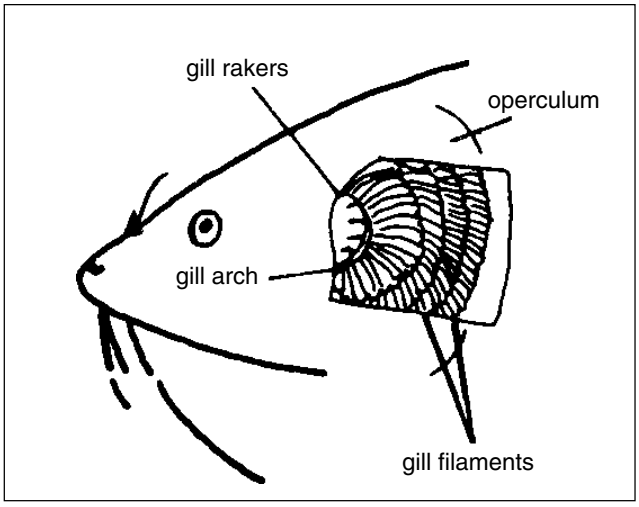


Figure 2. Schematic drawing of fish gills.

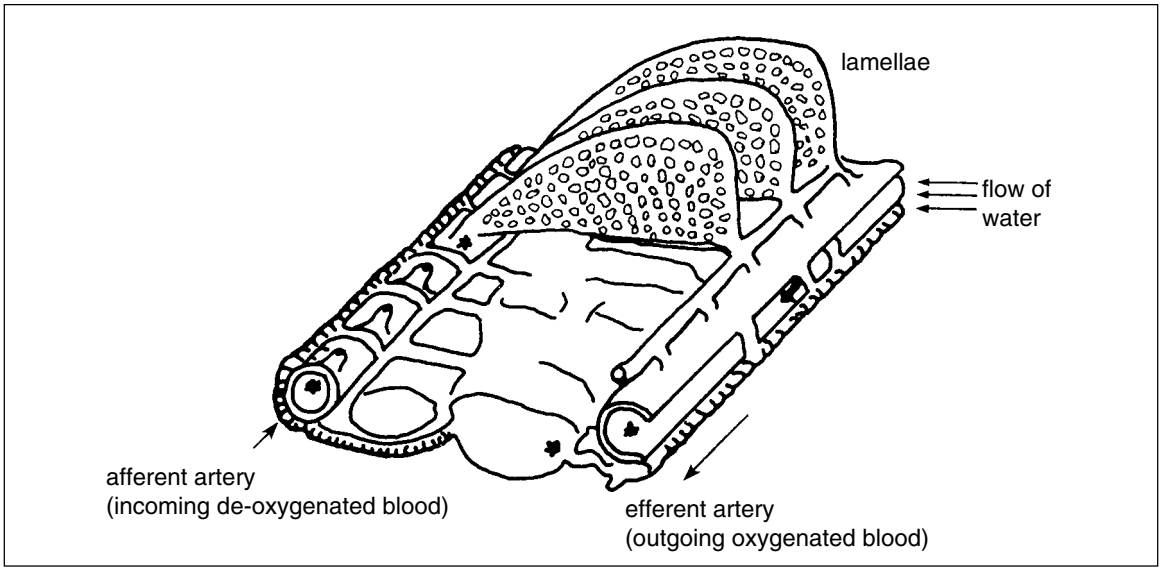


Figure 3. Schematic drawing of gill filament.

A fish breathes by sucking water in through the mouth where it flows directly over the gill filaments and across the lamellae. Blood channeled through the heart has a low oxygen concentration, but at the gill lamellae surface it passes near water high in oxygen. By simple diffusion, oxygen crosses the gill surface and enters the blood where it is carried throughout the fish. Respiration of this type is called counter-current exchange. Simple diffusion of oxygen through the gill lamellae and into the blood occurs because the gill lamellae are extremely thin.

Carbon dioxide is released from fish in much the same way oxygen is taken in – by counter-current exchange. Blood high in carbon dioxide is channeled through the heart to the gills where it comes in close contact with water low in carbon dioxide. By simple diffusion carbon dioxide is then released into the water.

Depending on the needs of the fish, the rate of breathing may be variable. Fish that are stressed or are pursued by a predator have a greater oxygen demand than fish at rest. Similarly, if the oxygen concentration in the water is low, a fish has to breathe faster if it is to meet all of its oxygen requirements. During normal respiration only about 60 percent of the gill surface is used for gas exchange. During increased respiratory demands, up to 100 percent of the gill surface may be used.

It is easy to see that any alteration in gill structure or function can be dangerous to catfish. Any increase in the thickness of the gill lamellae will decrease the efficiency of gas diffusion. If the gills become swollen or puffy, oxygen and carbon dioxide transfer are decreased. Gills can become thickened following exposure to ammonia, certain vitamin deficiencies, or to long-term parasite or bacterial infestations. Any type of toxic agent which damages the gill filaments or lamellae will also affect the efficiency of gas exchange. Finally, if a fish is anemic or has brown blood disease, even though the gills are not damaged and there is adequate oxygen in the water, the blood may not be able to carry enough oxygen to ensure survival.

Spawning

Channel catfish spawn when the water temperature is between 75° and 85° F (23° to 30° C) with about 80° F (27° C) being optimum. Wild populations of catfish may spawn as early as late February or as late as August depending on the location. The length and dates of the spawning season vary from year to year depending on the weather and area, but peak spawning time in Mississippi usually occurs in May.

Channel catfish are cavity spawners and will spawn only in secluded, semi-dark areas. In natural waters male catfish will build a nest in holes in the banks, undercut banks, hollow logs, logjams, or rocks. It is this behavior that necessitates the use of spawning containers in order to successfully spawn channel catfish in commercial ponds.

The male selects and prepares the nest by fanning out as much mud and debris as possible. He will then defend this location against any intruder until spawning is completed and the fry leave the nest. The female is attracted to the nest and spawning occurs within the nest with eggs being laid in a gelatinous mass on the bottom. After the eggs are laid, the male takes over and cares for the eggs by constantly fanning them with his fins to provide aeration and to remove waste products given off by the developing eggs.

Females spawn only once a year, producing about 3,000 to 4,000 eggs per pound of body weight, while the males may spawn more than once. In wild populations, males seldom spawn more than once a year, but in hatcheries where the eggs are removed from the spawning container soon after being laid, males may spawn 3 or 4 times; and there is a record of one male spawning nine females in one season. Channel catfish usually become sexually mature at 3 years of age, although some may spawn when 2 years old. In wild populations they may not spawn until after the age of 5 years. Channel catfish weighing as little as 3/4 of a pound may spawn if old enough, whereas farm-raised catfish usually weigh in excess of 2 pounds when they spawn. After the eggs are laid they will usually hatch in 5 to 10 days depending on water

temperature. At 78° F (26° C) the eggs will hatch in about 8 days. For each 2° F (1° C) rise in temperature above 78° F, subtract 1 day, and for each 2° F (1° C) fall in temperature below 78° F, add 1 day to get the approximate length of time required for hatching. Water temperatures below 65° F (18° C) and above 85° F (30° C) will reduce hatching success. Newly hatched fry have a large yolk sac which contains the nourishment they need for the next 2 to 5 days until they are fully developed and are ready to start feeding. After the yolk sac is absorbed, the fry take on their typical dark color and will begin to swim-up looking for food. At first swim-up fry will gulp air to fill their swim bladders which helps them maintain and regulate their buoyancy.

For more information about aquaculture in Oklahoma, see our OSU county Extension agent or contact Marley D. Beem, Extesnion Aquaculture Specialist, 303J Ag Hall, Stillwater, OK 74078-6013 (phone: 405-744-9636).

This publication was supported in part by a grant from the United States Department of Agriculture, Number 87-CRSR-2-3218, sponsored jointly by the Cooperative State Research Service and the Extension Service.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Sam E. Curl, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Dean of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 20 cents per copy. 0204