Worldwide harvest of farmed tilapia has now surpassed 800,000 metric tons, and tilapia are second only to carps as the most widely farmed freshwater fish in the world.

The Nile tilapia (*O. niloticus*) was one of the first fish species cultured. Illustrations from Egyptian tombs suggest that Nile tilapia were cultured more than 3,000 years ago.

snapper gives it higher market value. The original red tilapias were genetic mutants. The first red tilapia, produced in Taiwan in the late 1960s, was a cross between a mutant reddish-orange female Mozambique tilapia and a normal male Nile tilapia. It was called the Taiwanese red tilapia. Another red strain of tilapia was developed in Florida in the 1970s by crossing a normal colored female Zanzibar tilapia with a red-gold Mozambique tilapia. A third strain of red tilapia was developed in Israel from a mutant pink Nile tilapia crossed with wild Blue tilapia. All three original strains have been crossed with other red tilapia of unreported origin or with wild *Oreochomis* species. Consequently most red tilapia in the Americas are mosaics of uncertain origin. The confused and rapidly changing genetic composition of red tilapia, as well as the lack of "head-to-head" growth comparisons between the different lines, make it difficult for a producer to identify a "best" red strain.

Other strains of tilapia selected for color include true breeding gold and yellow Mozambique lines and a "Rocky Mountain white" tilapia (a true breeding line originating from an aberrant Blue tilapia, subsequently crossed with Nile tilapia). Most strains selected for color do not grow well enough for food fish culture.

Identifying the species of an individual fish is further complicated by natural crossbreeding that has occurred between species. Electrophoresis is often used to determine the species composition of a group of tilapia.

Reproduction

In all *Oreochomis* species the male excavates a nest in the pond bottom (generally in water shallower than 3 feet) and mates with several females. After a short mating ritual the female spawns in the nest (about two to four eggs per gram of brood female), the male fertilizes the eggs, and she then holds and incubates the eggs in her mouth (buccal cavity) until they hatch. Fry remain in the female's mouth though yolk sac absorption and often seek refuge in her mouth for several days after they begin to feed.

Sexual maturity in tilapia is a function of age, size and environmental conditions. The Mozambique tilapia reaches sexual maturity at a smaller size and younger age than the Nile and Blue tilapias. Tilapia populations in large lakes mature at a later age and larger size than the same species raised in small farm ponds. For example, the Nile tilapia matures at about 10 to 12 months and 3/4 to 1 pound (350 to 500 grams) in several East African lakes. Under good growth conditions this same species will reach sexual maturity in farm ponds at an age of 5 to 6 months and 5 to 7 ounces (150 to 200 grams). When growth is slow, sexual maturity in Nile tilapia is delayed a month or two but stunted fish may spawn at a weight of less than 1 ounce (20 grams). Under good growing conditions in ponds, the Mozambique tilapia may reach sexual maturity in as little as 3 months of age, when they seldom weigh more than 2 to 4 ounces (60 to 100 grams). In poorly fertilized ponds sexually mature Mozambique tilapia may be as small as 1/2 ounce (15 grams).

Fish farming strategies that prevent overcrowding and stunting include: 1) cage farming where eggs fall through the mesh to the pond bottom before the female can collect them for brooding; 2) polyculture with a predator fish, such as fingerling largemouth bass, at 400 per acre; and 3) culture of only males (monosex). All-male culture is desirable in ponds not only to prevent overpopulation and stunting but also because males grow about twice as fast as females. Methods of obtaining predominately male fish include: 1) manually separating the sexes based on visual examination of the genital papilla of juvenile fish ("hand-sexing"); 2) hybridizing between two selected species that produce all-male offspring (for example, Nile or Mozambique females crossed with Blue or Zanzibar males); 3) feeding a male hormone-treated feed to newly hatched fry for 3 to 4 weeks to produce reproductively functional males ("sex reversal"); or 4) YY male technology (currently under development and not yet a commercial option).

The sex of a 1-ounce (25-gram) tilapia fingerling can be determined by examining the genital papilla located immediately behind the anus (Fig. 1). In males the genital papilla has only one opening (the urinary pore of the ureter) through which both milt and urine pass. In females the eggs exit through a separate oviduct and only urine passes through the urinary pore. Placing a drop of dye (methylene blue or food coloring) on the genital region helps to highlight the papilla and its openings.

Feeding behavior and nutrition requirements

Tilapia ingest a wide variety of natural food organisms, including plankton, some aquatic macrophytes, planktonic and benthic

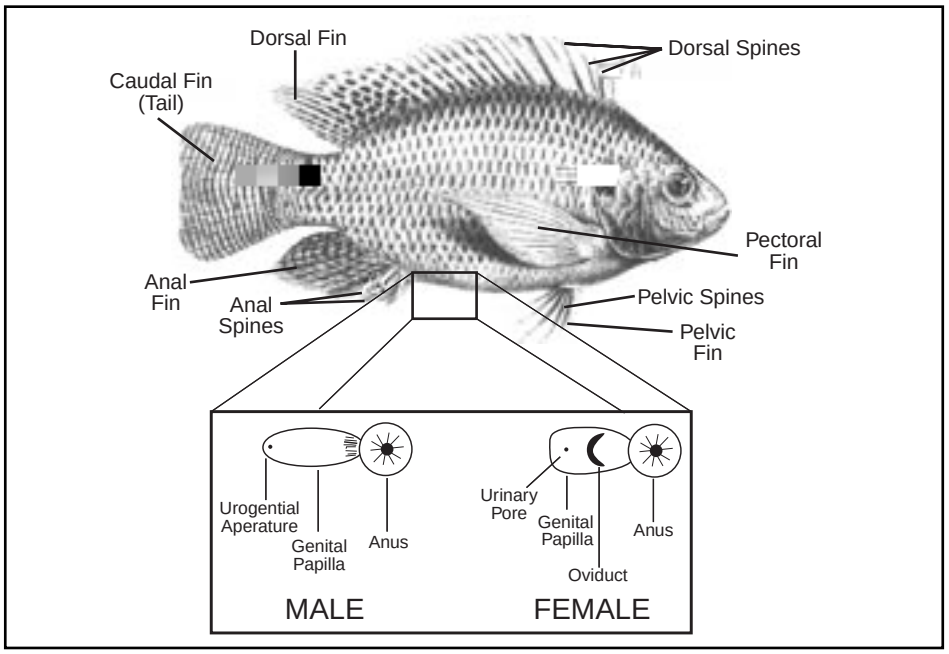

Figure 1. Fins and genital papilla of the Nile tilapia.

aquatic invertebrates, larval fish, detritus, and decomposing organic matter. With heavy supplemental feeding, natural food organisms typically account for 30 to 50 percent of tilapia growth. (In supplementally fed channel catfish only 5 to 10 percent of growth can be traced to ingestion of natural food organisms.)

Tilapia are often considered filter feeders because they can efficiently harvest plankton fr