MedCrave
Step into the World of Research

Journal of Aquaculture & Marine Biology

Review Article

Open Access

CrossMark

A review of the physiology and biology of Nile tilapia (*Oreochromis niloticus*)

Abstract

Tilapia is the name of a group of cichlid fish living in Africa that in the last half century, aquaculture in the tropics and subtropics have begun to breed. Cultivated species of tilapia can usually be distinguished from each other by different patterns of strips on the tail fin. Nile tilapia have brightly colored stripes on their tail fins and adult male have gray or pink pigments on their throat. These Species are usually more resistant to hypoxia, high salinity, high temperatures, and high levels of ammonia in the breeding water than other freshwater farmed species.

Keywords: oreochromis, cichlid fish, ecology

Volume 10 Issue 5 - 2021

Mohammad Forouhar Vajargah
Department of Fisheries, University of Guilan, Iran

Correspondence: Mohammad Forouhar Vajargah, Department of Fisheries, Faculty of Natural Resources, University of Guilan, Iran, Email mohammad.forouhar@yahoo.com

Received: December 12, 2021 | **Published:** December 30, 2021

Introduction

The Nile tilapia was one of the first species bred by humans. Indexes of ancient tombs in Egypt dating back 3,000 years show that the breeding of this fish has its roots in our civilization at least to this day. It is also referred to as Peter's Sandfish because he referred to it as "the food of the ummah" in St. Peter's Gospel. The Nile tilapia is still the most widely grown tilapia in Africa today. This species was introduced to Iran in 1999 and its pilot breeding was done in Bafgh region of Yazd. This provoked a strong reaction from environmental activists because tilapia can act as a parasitic fish by entering non-native waters and causing problems for the local ecosystem and native fish. Despite these ongoing conflicts, licenses are now being issued to breed this species in fully CCTV systems.[1,2]

The characteristics that make this species suitable for breeding are the ability to tolerate low water quality and the wide range of natural foods used by them. The limitations for industrial breeding of this species are mainly due to the fact that the Nile tilapia is unable to withstand water temperatures around 10°C and below, and the premature maturation of this fish causes it to reach the size demanded by the reproductive market. Although this is true of non-hybrid species of tilapia and the purebred species of Nile tilapia, and Iran, because of its large share of soil in the tropics, does not have the problem of providing the right temperature for growing tilapia, the provinces where tilapia can be grown for legally available breeders are mostly tropical.

Classification

Tilapia is the name of a group of cichlid fish living in Africa. This group of cichlids includes 3 important genera in terms of human breeding ability: *Oreochromis* goldfish, *Sarotherodon*: sawdust, and *Tilapia*: (tilapia). Many characteristics distinguish these genera from each other, but the most important are the reproductive characteristics. All species of tilapia nest; the fertilized eggs in this nest are protected by a productive fish. It is important to remember that the Nile tilapia is actually an emerald and does not belong to the *Tilapia* genus, the scientific name of this fish is *Oreochromis niloticus* speaks for itself. Species of both the genus Armor and sawdust are so-called mouthbrooders. They fertilize the eggs in a nest but quickly pick them up with their mouths and keep them there for a few days after hatching during the so-called "sleeping period". In cormorants, only female fish breed orally, while among *Sarotherodon*, this is done by both sexes.[3]

In the last half century, aquaculture in the tropics and subtropics has begun to grow tilapia (commonly known as). Today, all major tilapia farms outside Africa have grown zucchini, and 90% of the volume of commercial tilapia produced outside Africa is Nile tilapia. Less cultivated species include Blue Tilapia, Mozambican Tilapia and Zanzibar Tilapia. The scientific names of tilapia species have undergone many changes over the past 30 years, leading to confusion. The scientific names given to the Nile were Tilapia nilotica and Sarotherodon niloticus. This fish is now known as Oreochromis niloticus.

Physical features

The appearance of the tilapia is very similar to that of the sunfish or crappie, but it can easily be identified by its disconnected lateral line, which is characteristic of the cichlid family. Their body shape is compressed on the side and they have long dorsal fins. The front of their dorsal fins is full of sharp bumps. These razors are visible on the ends of the memory fins and the anterior fins of the fish. Wide vertical lines are usually seen on juvenile stages and sometimes the body of the adult fish.[4] (Figure 1)

Figure 1 Nile tilapia.

Ribbon patterns and color scheme (morphology)

Cultivated species of tilapia can usually be distinguished from each other by different patterns of strips on the tail fin. Nile tilapia have

brightly colored stripes on their tail fins, in blue tilapia these strips are detached, in Mozambican tilapia these stripes are either absent or very weak-Male Mozambican tilapia also have nasal cavities facing upwards. The color pattern on the body and fins may also distinguish the species. Adult male Nile tilapia have gray or pink pigments on their pharynx, while Mozambican tilapia have a yellowish tint. However, differentiating tilapia species based on body color spectrum is usually not a reliable method because the environment, stage of sexual maturation, and food source in particular affect the intensity of color expression on their skin.[5]

Due to its resemblance to oceanic redfish, the red tilapia has become a better-selling market and inevitably has become very popular with growers. The first red tilapias were produced by genetic manipulation. They emerged in Taiwan in the late 1960s as a result of a fusion of a transgenic red-orange Mozambican tilapia and an ordinary indigo tilapia. The new fish was named the Taiwanese Red Tilapia. Another strain of red tilapia was created in Florida in the 1970s by mixing a regular-colored Zanzibar female tilapia with a red-gold Mozambican male tilapia.A third strain of red tilapia was created in occupied Palestine by a combination of a pink transgenic Nile tilapia and a wild blue tilapia. All three major strains have been bred to date with other unknown breeds of red tilapia or other goldfish. For this reason, most red tilapias in the United States are impure breeds of unknown origin. Frequent ambiguities and changes in the recorded norms of red tilapia genetics without laboratory studies on the head-to-head growth of the main lineage breeds have left producers with the problem of which side of this fish really grows better?

Reproduction

In all juveniles, the male builds a hollow space as a nest. These nests are usually built on the bottom of the water bed in water shallower than 3 feet. There, male fish fertilize with several female fish. In this process, after a short breeding ceremony, the female fish lays eggs in the nest (about 2 to 4 eggs per gram of productive fish weight), the male fish fertilizes the eggs and then the female fish removes and holds them in its mouth until the hatches. The hatched fish remain in the female fish's mouth until they consume the contents of their yolk sac. Sometimes this breeding continues for a few more days until the fish is able to feed autonomouslyon the environment.

Tilapia sexual maturity depends on environmental factors, age and size. Tilapia that live in larger populations in large ponds or ponds mature at larger sizes and older ages than smaller communities. For example, Nile tilapia in East African ponds mature under favorable environmental conditions in 10 to 12 months and weigh 350 to 500 grams. These numbers vary from 5 to 6 months and 150 to 200grams for fish kept in breeding ponds under equal conditions. When the growth process is slow, puberty in Nile tilapia is delayed by 1 to 2 months, in contrast to the offspring that may be born weighing less than 20grams.

Strategies that can prevent tilapia from overcrowding in your pool:

Cage breeding, which causes the eggs to fall to the bottom of the pond before the female can pick them up.

Polyculture of tilapia with an invasive species such as large-mouthed perch (400 heads per hectare).

Raising male monosex in the pond is not only to prevent unborn childbirth but also because the male tilapia grows twice as fast as the female.[6]

Methods for creating a pool that consists only of male tilapia:

1. Separation of male fish manually based on visual examination of juvenile fish papillae (manual method)
2. Establishing interbreeding between two species whose only reproduction is male tilapia (for example, Nile or Mozambique female with blue male or Zanzibar)
3. Feed freshly hatched fish with food containing male sex hormones for 3 to 4 weeks.[7]
4. YY male technology that is currently being developed and is not a commercial option.

The sex of a 25-gram tilapia finger can be examined by examining the genital papilla, which is exactly adjacent to the anus. In males, the genital papilla has only one opening (urethra) through which both urine and sexual fluids pass. In females, however, the eggs have a mass output for themselves. Applying a drop of food coloring or methylene blue can help explain the papilla and its ducts.

Nutritional behavior and nutritional needs:

Tilapia consume a wide range of natural organisms as food, including plankton, some aquatic macrophysics, fish larvae, and decaying organic tissue. When artificial foods are used to fully feed tilapia, these natural organisms still account for 30 to 50 percent of tilapia growth in dense systems. Tilapias are often considered filter feeders because they can feed on plankton. However, tilapia fish do not do this, like real filter feeder fish, using gill spines such as silver carp.[8,9,10,11,12] The gills of tilapia secrete mucus that traps plankton. This mucus enriched with plankton is then swallowed. Digestion of plant material in tilapia takes place along the intestine, which is usually up to 6 times the length of the fish's body. A tilapia normally absorbs 30 to 60 percent of the protein in algae. Green-blue algae have a more efficient digestion process than green algae. In general, tilapia consume so much natural food that herds of 2,700 pounds of fish can be raised per hectare of earthen pond without the need for complementary foods just by fertilizing the pond. The nutritional value of the natural foods in the pool, however, is of particular importance; this naturally includes the dots of dense breeding ponds that feed the fish with artificial food. In high-feed pools with little (or no) water exchange, natural nutrients in the water can provide about one-third of the nutrients needed for tilapia to grow. In general, tilapia both digest animal protein as well as catfish and absorb plant protein well, especially if they are high in fiber. Tilapia need the same 10 essential amino acids that other hydroponic fish usually need to grow, and the amount needed is the same as most. The protein required for maximum growth in tilapia depends on the quality of the protein and the size of the fish, and up to 50% conversion ratio has been reported in their fingertips.

Environmental needs

Tilapia are usually more resistant to hypoxia, high salinity, high temperatures, and high levels of ammonia in breeding water than other farmed freshwater species.

Conclusion

Tilapia is a good fish for hydroponic fish breeders to produce. They reproduce easily, use a wide range of natural and artificial foods, cope with low water quality and grow rapidly in warm water. These features, in addition to the low initial cost, make tilapia the most widely grown fish in the tropics and subtropics.

Citation: Vajargah MF.A review of the physiology and biology of Nile tilapia (*Oreochromis niloticus*). *J Aquac Mar Biol.* 2021;10(5):244–246.
DOI: 10.15406/jamb.2021.10.00328

Conflicts of interest

The author declares that there are no conflicts of interest.

Funding

None.

Acknowledgment

None.

References

1. Azami, Jaber, Mehdi Rezaei, Narges. Biological status and different perspectives of Nile tilapia (*Oreochromis niloticus*) breeding in Iran, *Journal of Aquatic Exploitation and Breeding.* 1395;15 (4):1–12.
2. Alizadeh M, Bemani, A. Environment Impact Assessment of tilapia(Tilapianilotica) farming project in brachish water of Bafgh. 2012.
3. Sattari M, Shahsouni D, Shabanipour N, et al. Ichthyology (1): Anatomy and physiology. *Naghsh Mehr Publication*. 2002;p.659.
4. Sattari M, Shahsevandi D, Shafiee S, et al. Ichthyology (systematic). Haghshenas Publication. 2003;p.198– 199.
5. Montajami S, Hajiahmadyan M, Forouhar Vajargah M, et al. Effect of symbiotic (Biominimbo) on growth performance and survival rate of Texas cichlid (*Herichthys cyanoguttatus*) larvae. *Global Veterinaria.* 2012; 9(3):358–361.
6. Yalsuyi AM, Vajargah MF. Recent advance on aspect of fisheries: A review. *Journal of Coastal Life Medicine*. 2017;5(4):141– 148.
7. Forouhar Vajargah M, Imanpoor MR, Shabani A, et al. Effect of long-term exposure of silver nanoparticles on growth indices, hematological and biochemical parameters and gonad histology of male goldfish (*Carassius auratus gibelio*). *Microscopy research and technique*. 2019;82(7):1224–1230.
8. Forouhar Vajargah M, Hedayati A. Toxicity effects of cadmium in grass carp (ctenopharyngodon idella) and big head carp (hypophthalmichthys nobilis). Cadernos de Biblioteconomia, *Arquivística e Documentação*. 2017;19(1).
9. Forouhar Vajargah M, Mohammadi Yalsuyi A, Hedayati A. Acute toxicity of povidone– iodine (Betadine) in common carp (Cyprinuscarpio L. 1758). *Pollution.* 2017;3(4):589–593.
10. Yalsuyi AM, Hedayati A, Vajargah MF, et al. Examining the toxicity of cadmium chloride in common carp (Cyprinuscarpio) and goldfish (Carassiusauratus). *Journal of Environmental Treatment Techniques*. 2017;5(2):83– 86.
11. Vajargah MF, Yalsuyi AM, Hedayati A. Effects of dietary Kemin multi–enzyme on survival rate of common carp (Cyprinuscarpio) exposed to abamectin. 2018.
12. Yalsuyi AM, Vajargah MF, Hajimoradloo A, et al. Evaluation of behavioral changes and tissue damages in common carp (Cyprinuscarpio) after exposure to the herbicide glyphosate. *Veterinary Sciences*. 2021;8(10):218.