钟圳

SHOU - Ichthyology

4/15/2018

Mozambique tilapia (*Oreochromis mossambicus*)

1. Introduction

The Mozambique tilapia belongs to the group of fish which is the ray-finned fishes, order Perciformes, family Cichlid, genus Oreochromis. The Mozambique tilapia (Oreochromis mossambicus) is a tilapiine cichlid fish. It is native to the coastal regions and the lower reaches of rivers in southern Africa, from the Zambezi River delta to Bushman River in the eastern Cape. (Wikipedia, 2018) It is known as black tilapia in Colombia and as blue kurper in South Africa. Due to human introductions, it is now found in many tropical and subtropical habitats around the globe. It can become an invasive species because of its robust nature. Dull colored, the Mozambique tilapia often lives up to a decade in its native habitats. These features make it a good species for aquaculture because it readily adapts to new situations. However, in Guangdong and Guagnxi of China, the tilapia is so common that the price is very low. Mozambique tilapiahas becomes a serious invasive species, breaking the local ecological balance and ecological environment. Tilapia

has few natural enemies,so after it was introduced to China,it is breeding more and more.Now,it was the disaster for the local fishes and other aquatic plants in Gangdong and Guangxi province.It’s hard for us to control the number and protect the the local specieses.I just want to find some good ways to solve the problems.

2.Original description

Peters, W. (C. H.) 1852 [ref. 18539]

Diagnosen von neuen Flussfischen aus Mossambique. Monatsberichte der Königlichen Preussischen Akademie der Wissenschaften zu Berlin 1852: 275-276, 681-685.

Diagnoses of new river fish from Mossambique. Monthly reports of the Royal Prussian Academy of Sciences Berlin 1852: 275-276, 681-685.

3. General description

The length of the body of maturity is ranging from 6 to 28 centimeters. The max length of male is 39.0 centimeters.The common length is 35.0 centimeters.(fishbase.org,2018)The max weight is up to 1.13 kilograms.The oldest age reported is 11 years.The Mozambique tilapia have some features.It has a long snout.It also has 14 to 20 lower gill-rakers.Dorsal soft rays in total is 10 to 13.The dorsal spines in total is 15 to 18.The anal soft rays is 7 to 12 and anal spines is 3.It has 28 to 31 vertebrae.There are relatively large scales on the forehead, starting with 2 scales between the eyes followed by 9 scales up to the dorsal fin.Adult males usually have enlarged jaws,so they often develop a pointed,duckbill-like snout,often causing the upper profile to become conave,but

upper profile convex in smaller specimens. They have very fine pharyngeal teeth, the dentigerous area is with narrow lobes, the blade in adults is longer than dentigerous area. The genital papilla of males is simple or with a shallow distal notch and the caudal fin is not densely scaled. Female and non-breeding male is silvery with 2-5 mid-lateral blotches and some of a more dorsal series. Breeding male is black with white lower parts of head and has red margins to dorsal and caudal fins.

4. Distribution and Abundance

The Mozambique tilapia is native to coastal regions and the lower reaches of rivers in southern Africa, from the Zambezi River delta to Bushman River in the eastern Cape. Several countries reported adverse ecological impact after wide introduction for aquaculture, because they escaped and established itself in the wild in many countries and often outcompet local species. In our common life, they can be found in reservoirs, rivers, creeks, drains, swamps and tidal creeks. And they are commonly over mud bottoms, often in well-vegetated areas. In warm weedy pools of sluggish streams, canals, and ponds, they are also there. Most common in blind estuaries and coastal lakes, but usually absent from permanently open estuaries and open sea and from fast-flowing waters. Normally not found at high altitudes.

5. Habitat Requirements

Tilapia is a remarkably robust and fecund fish, readily adapting to available food sources and breeding under suboptimal conditions, so they can become a dangerous invasive species. They are widely distrubuted in the benthopelagic which is 1 to 12 meters deep of freshwater and brackish, usually in tropical. They are able to survive

extreme reduction of temporary water bodies and highly euryhaline.Usually grows and reproduces in fresh, brackish and seawater.They can live in the water which is usually 17 ° C to 35° C.It is incredible that they can also tolerates brackish water and survives temperatures below 50 ° F (10 ° C) and above 100 ° F (38 ° C).Sustained water temperatures of 55 degrees are lethal to Mozambique tilapia.So they are afraid of hot water,so when cooking,do’t worry about they are jumping and struggling,just put them in hot water to overpower them.According to some datas,the latitude and longitude in the earth where they are is 11° S - 31° S, 19° E - 41 ° E.Can be reared under hyper-saline conditions. Tolerates low dissolved oxygen levels and can utilise atmospheric oxygen when water oxygen levels drop.Mainly diurnal. May form schools.Reaches sexual maturity at 15 centimeter length, but stunted fish may breed at 6-7 centimeters and at an age of just over 2 months. Fecundity high. Extended temperature range 8-42 ° C, natural temperature range 17-35° C, with salinity-dependent difference in temperature tolerance.

6. Biology

Mozambique tilapia, like other fish such as Nile tilapia and trout, are opportunistic omnivores and will feed mainly on algae and phytoplankton but also takes some zooplankton,small insects and their larvae, shrimps, earthworms and aquatic macrophytes.Feeding patterns vary depending on which food source is the most abundant and the most accessible at the time. In captivity, Mozambique tilapias have been known to learn how to feed themselves using demand feeders.Hence they can adapt to a new environment very quick,so they are widely raised.During commercial feeding,

the fish may energetically jump out of the water for food. Juveniles are carnivorous/omnivorous, adults tend to be herbivorous or detritus feeders. Large individuals have been reported to prey on small fishes, and occasionally cannibalise their own young. Exhibits considerable plasticity in feeding habits as well as in reproductive biology. So it is easy to raise. In the first step in the reproductive cycle for Mozambique tilapia, males excavate a nest into which a female can lay her eggs. After the eggs are laid, the male fertilizes them. Then the female stores the eggs in her mouth until the fry hatch; this act is called mouthbrooding. One of the main reasons behind the aggressive actions of Mozambique tilapias is access to reproductive mates. The designation of Mozambique tilapias as an invasive species rests on their life-history traits: Tilapias exhibit high levels of parental care as well as the capacity to spawn multiple broods through an extended reproductive season, both contributing to their success in varying environments. In the lek system, males congregate and display themselves to attract females for matings. Thus, mating success is highly skewed towards dominant males, who tend to be larger, more aggressive, and more effective at defending territories. Dominant males also build larger nests for the spawn. During courtship rituals, acoustic communication is widely used by the males to attract females. Studies have shown that females are attracted to dominant males who produce lower peak frequencies as well as higher pulse rates. At the end of mating, males guard the nest while females take both the eggs and the sperm into their mouth. Due to this, Mozambique tilapias can occupy many niches during spawning since the young can be transported in the mouth. These

proficient reproductive strategies may be the cause behind their invasive tendencies.Male Mozambique tilapias synchronize breeding behavior in terms of courtship activity and territoriality in order to take advantage of female spawning synchrony. One of the costs associated with this synchronization is the increase in competition among males, which are already high on the dominance hierarchy. As a result, different mating tactics have evolved in these species. Males may mimic females and sneak reproduction attempts when the dominant male is occupied. Likewise, another strategy for males is to exist as a floater, travelling between territories in an attempt to find a mate. Nevertheless, it is the dominant males who have the greatest reproductive advantage.So the tilapia is polygamous.Although Mozambique tilapias generally live in rivers and lagoons, they can also colonize fast-flowing areas of water such as creeks and streams.

7. Importance and Management

Mozambique tilapia are hardy individuals that are easy to raise and harvest, making them a good aquacultural species.Excellent palatability,with small head and large dress-out weight,and filets without small bones.They have a mild, white flesh that is appealing to consumers.Used extensively in biological, physiological and behavioural research.Translocated and introduced for aquaculture, sport fishing,stocking man-made lakes and biological control of nuisance plants and animals.Tilapia are very susceptible to diseases such as whirling disease and ich.Mozambique tilapia are resistant to wide varieties of water quality issues and pollution levels. Because of these abilities they have been used as bioassay organisms to generate metal toxicity data for risk assessments of local

freshwater species in South Africa rivers.Eurytopic; a most successful and vagile invader.

Current Research

Research 1(enhance immunity)

In south africa,mozambique tilapia is the most widely cultured tilapia species.The success is attributed to several characteristics such as fast growth rates,tolerance of adverse environment conditions and its ability to feed on a variety of food items.In spite of these qualities,fish mortalities caused by bacterial infections are serious.But some people have done a research,using artemisia afra to feed *Oreochromis mossambicus*.Finally they find that the safe dosages of artemisia afra can increase the phagocytosis and lysozyme activity.They also find the diets of artemisia afra enhance immunity of *Oreochromis mossambicus*.(E.M. Mbokane,2018)So it is good news for aquaculture.

Research 2

The increasing cadmium concentration in the lakes and rivers is mainly due to industrial processes and other anthropogenic activities.The toxic effects of cadmium on biological processes of aquatic organisms shouldn’t be ignored.So some researchers put some *Oreochromis mossambicus* in water with low or hig calcium.This study indicates that high-calcium water has a protective effect on cadmium toxicity.(H. B. Pratap,2008)

Research 3

The best method for managing the spread of invasive aquatic species is through the

prevention of new incursions,rather than post-infestation eradication.To avoid widespread establishment of invasive species,it is crucial to detect infestations early when their density is lowest.eDNA technology is gaining momentum as a tool to detect aquatic pests.But the technology’s effectiveness has not been fully explored in tropical systems with their unique climatic challenges.So the researchers modify conventional eDNA protocols for use in tropical environments using the invasive fish,Mozambique tilapia as a detection model.They evaluate the effects of high water temperatures and fish density on the detection of tilapia eDNA.By testing,they find that eDNA technology can be effectively used in tropical ecosystems to detect invasive fish species.(HEATHER L. A. ROBSON,2016)

Research 4

Nanoscience is the study that deals with nanoscale materials between the size 1-100mm.Nanotechnology has gained a great deal of public interst due to the wid applications of nanomaterials in industry,agriculture,business,medicine and pubilc health.Aluminum is the third most abundant element in the earth’s crust in number of biological sciences.Nano sized Al2O3 was reported to be very toxic.Mozambique tilapia as an indicator in ecotoxicological studies is used to evaluate the nano Al2O3.Tilapias are exposed to sub lethal concentrations of Al2O3 NPs for 96h.The results show that the acute exposure to Al2O3 NPs altered the histoarchitecture in various fish tissues. (M.Murali,P.Athif,2018)

Research 5

Nutrition influences growth,reproduction,and health of fish.While availability of

food is a great limiting factor,food-deprivation has diverse effects on tissue and plasma components that can interfere with various physiological functions.Most fishes undergo natural period of fooddeprivation throughout a normal life cycle.So some researchers deprive the food of tilapias for 6 or 12 days and detect different datas.Finally,they find that prolonged exposure to food-deprivation causes suppression of the LH secretory activity in the pituitary gland and disruption in the spermatogenesis in Mozambique tilapia.(R.P.Pikle,2017)

Research 6

Mosquitoes are responsible for the transmission of dreadful diseases such as malaria, yellow fever, dengue fever,chikungunya, filariasis *etc*. in tropical and subtropical countries.Lymphatic filariasis caused by *Wuchereria bancrofti* and *Brugia malayi* is an important public health problem in India. *Culex quinquefasciatus* (*Cx.quinquefasciatus*) is the major vector of *Wuchereria bancrofti*. Use of synthetic pyrethroids has always given top most priority to the mosquito control and prevention.Environmental protection agencies have banned or placed severe restrictions on the use of many pesticides, which were formerly used in mosquito control programmes, and there are now fewer adulticides available than there have been for the last 20 years.Development of strong form of insecticide resistance stimulated interest in alternative control methods like biological control and biopesticides. Biological control, particularly using larvivorous fish, was important to malaria control programmes in the 20th century, particularly in urban and periurban areas for immediate use in developed and developing countries.The best

way to reduce the unmber of mosquitos is to reduce the eggs of mosquitos.So mozambique tilapia is very useful because their food can be modified.The result is that *Oreochromis mossambicus* can eat mosquitoes' eggs to reduce the number of mosquitoes and reduce the infect of diseases at the same time.(Arivoli Subramanian,2016)

9.my viewpoint and conclusion

As for me,tilapia has become one of the major agriculture fishes all over the world because of growing fast and producing more.The reanson may also include that they can eat so many things,tolerate low oxygen,adapt quickly,resist many diseases,breed more and quickly.The data from FAO shows that the production of tilapia is 3,401,000 tons which increased 9.8% compared with last year.Among these countries,China is the largestse country which produces tilapias because Chiness production of tilapias is 39.2% in the world.(Haiying Wang,2014)In China,Guangdong,Guagnxi,Hainan and Fujian Province are the major regions where tilapias were raised.Tilapia is not original inhabitant in China,it was first introduced to China in 1957 from Vietnam.What a coincidence, the first species is what I always talk about——Oreochromis mossambicus.It was the initial beginning of growing tilapias in China in the history.However,the species Oreochromis mossambicus doesn't grow as fast as his brothers and sisters,the body of them is small compared with his brothers,so the king's position was replaced by other tilapias,such as Nile tilapia(Oreochromis niloticus).It is interesting for me to find that it was my college——Shanghai Ocean University introduced GIFT tilapia that advanced the development of tilapias' breed aquatics.Luckily,my topic——

Oreochromis mossambicus went through so many years' contempt, in 2003, finally finds his spring. As the sayings goes, " every dog has its day". By crossbreeding of orange famale Oreochromis mossambicus and male Oreochromis hornorum, getting the all male fish which has the good characteristics from his parents and also can tolerate the salt, so the fish can raised in sea water. Hence, the range of raising tilapias has been further enlarged.

To the point, I want to solve the tilapia disaster, but tilapia is a very important agriculture fish, many fishermen rely on raising them for a living, so it is not possibly to ban it. There is no other way left for me, just like the old sayings goes, " The thing has one way to solve only." There is only one way left——get a balance. As all konwn, the hardest thing is to get a balance. First of all, I want to find tilapias' natural enemies, unfortunatly, there is no other fishes that can do it. But I get to know that snakehead can eat tilapias' s eggs to control the number of tilapias. However, the fierce fish snakehead likes to eat more puny fishes, so it is not a good idea. Then, I find several interesting documents, the researchers use mozambique tilapia for many different experiments. Because tilapia can tolerate low oxygen, adapt quickly, resist many diseases, breed more and quickly, so it like the little white mouse is very appropriate to as an experimental example.

In a word, mozambique tilapia is important for aquaculture and palatable for people to eat. We don' t need to deliberately control the number of tilapias, we can use them for many different uses. Naturally, their number will be stable and won' t damage the ecological system.

10. References

Assessed April 15,2018 at

http://www.fishbase.org/summary/Oreochromis-mossambicus.html

Assessed April 15,2018 at

https://en.wikipedia.org/wiki/Mozambique_tilapia

Assessed April 15,2018 at

http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=18539

M.Muralia, P. Athifa, P. Suganthia, A. Sadiq Bukharia,*, H.E. Syed Mohameda, H. Basub,R.K. Singhalb(2018) Toxicological effect of Al2O3 nanoparticles on histoarchitecture of the freshwater fish Oreochromis mossambicus.Environmental Toxicology and Pharmacology 59,74–81

Haiying Wang, Guangjun Wang*, Jun Xie, Deguang Yu, Wangbao Gong (2014) Present Status of Tilapias Culture in China Mainland.Open Journal of Fisheries Research, 1, 22-28

E.M. Mbokanea,b,., N.A.G. Moyob(2018)A preliminary investigation into the potential effect of Artemisia afra on growth and disease resistance in sub-adults of Oreochromis mossambicus.Aquaculture 482，197–202

H. B. Pratap (2008) Effects of ambient and dietary cadmium on haematological parametres in Oreochromis mossambicus acclimatised to low- and high-calcium water.Comp Clin Pathol 17：133–136

Ambarisha Chabbi and Ganesh C.B.Evidence for the involvement of dopamine in

stress-induced suppression of reproduction in the cichlid fish *Oreochromis Mossambicus*

R.P. Pikle . R. M. Jatiger . C. B. Ganesh(2017)Food-deprivation-induced suppression of pituitary - testicular-axis in the tilapia Oreochromis mossambicus.Int Aquat Res 9:203 - 213

Arivoli Subramanian,Maheswaran R.(2016)Study of mosquito control using larvivorous fish Danio rerio Hamilton and Oreochromis mossambicus Peters.Article . January