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Life Sciences Group

International Journal of Veterinary Science and Research

DOI http://dx.doi.org/10.17352/ijvsr.000016

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Dates: Received: 25 January, 2017; **Accepted:** 13 February, 2017; **Published:** 14 February, 2017

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Review Article

Largemouth Bass Pond Culture in China: A Review

Abstract

Largemouth bass *micropterus salmoides* natives to freshwater area of North America, which is a kind of famous global economic fish, and belongs to Centrarchidae, Perciformes in taxonomy. The fish has been extensively cultured all over the world, due to it some advantageous traits such as delicious meat, strong disease resistance and fast growth speed. This review will summarize the studies aimed at the pond culture technology of largemouth bass in China from artificial breeding, offspring culture, fingerling and commercial fish culture, to diseases prevention. Which should be useful for further studies and the aquaculture industry.

Introduction

Largemouth bass was first introduced into China in Guangdong province in the early 1980s of last century. Since then, this kind fish was quickly spread to culture in other provinces, following with a rapid improvement of the production. As a result, the largemouth bass culture industry has become an important composition of Chinese fishery. To date, the fish was mainly cultured in pond, especially largely culture in the province of Guangdong, Sichuan and Zhejiang, and it has become the major freshwater aquaculture species in China. The average yield of this fish can reach about 37500 kg/ha in Guangdong province, so the pond culture technology is worthy to spread.

According to the market demand, the largemouth bass pond culture technology is divided into four stages, including the artificial breeding, fry rearing, fingerling rearing and marketable fish culture. The average level of pond culture technology is relatively high, but the development of aquaculture technology in different regions is not balanced. Based on the four culture stages mentioned above, this paper summarize the technology of pond culture by combining the literatures of recent years with the practical experience of the aquaculture work, which should be useful for the largemouth bass industry development.

Artificial Breeding

Broodstock cultivation: The artificial breeding of largemouth bass is mainly performed in southern China region. Usually, healthy fishes (1-1.5 kg, 2-3 years old) are selected to be as the candidate broodstock, and then put them into ponds with the male and female ratio 1:1 or 3:2. The breeding ponds are primary earthen ponds outside. Each pond area is required about 0.2 hectare with the water depth of 1.5-2 m, the slow flowing water is also needed. As a filtering fish, some silver carps can be cultured in the pond to regulate the water quality and improve the pond usage rate [1].

The stocking density of broodstock should be 0.2-0.5 kg/m^2, which also could appropriately adjust according to the water quality and the pond condition. During the breeding season, high quality food must be provided to ensure the gonad development, such as fresh fish and compound feed are required, which need to be feed 1-2 times a day, and a 3-5% daily feeding amount of the total weight is necessary. Reducing the amount of food suitably one month before spawning, and pouring fresh water into the pond for 1-2 hours every 2-3 days to promote gonad maturation. The pond aerator should be turned on when it is necessary [1].

Preparation for artificial spawning: The breeding season of largemouth bass is mainly from the early April to the middle of May, when the water temperature is 18-26. Based on the pond condition, broodstock should be transfered to the spawning pools at suitable time. The spawning pools could be either cement pool or earthen pool.

The cement pool area is required about 10-30 m^2 and with the water depth of 0.4-0.5 m. Putting the pebbles at the bottom of the cement pool, and putting some artificial nests, which are made from the soft grass or polyethylene mesh in the pond, then use the stone to fix the artificial nests. Finally put one pair broodstock into the pond every 1-2 m^2.

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The earthen ponds area is required about 500-1500 m^2 with the water depth of 0.4-1 m. use the same method to set the artificial nests in the earthen pond [2,3]. Finally put 20-30 pairs of broodstocks in the earthen pond every 667 m^2.

The injection of oxytocin: The reproduction of appropriate water temperature was 18-26, with 20-24 is better. In the process of production, oxytocin is injected into the fish body when the water temperature reaches the condition, and the main oxytocin used for injection including LRH-A_2 and HCG. According to the specific circumstances, the numbers of injection time need 1 or 2 times by intraperitoneal injection (IP injection). For one-time injection, the LRH-A_2 dose of injection need 5 g/kg of female fish bodyweight, while the HCG need a dose of injection at 800-1000 IU, meanwhile, the dose should be half for male fish [4]. For two-times injection, the 30% of total dose should be used in the first injection, and the rest for the second injection. The interval time between the two injection actions need 9-12 hours.

The spawning and hatching: The effect time of oxytocic hormone is about 1-2 days, and classically the fertilized egg will be found adhere to the fish nest mesh, then move the fertilized egg to hatching pools together with the fish nest mesh. The hatching time of fertilized eggs is related to the water temperature, and the time is 45 hours when the water temperature is 18-21, but only 32 hours when the temperature is 22-23. It is best to maintain the micro flowing water during the whole incubation process to ensure high dissolved oxygen in the water. The newly hatched larvae is only 0.7 cm in length and can swim in the cluster. The fry should be remain in the original pool at this time, and the fry begin to feed when the yolk is absorbed completely in three days after hatching [2]. Removing the fish nest and transferring the fry in the fry-rearing pond when all the fry could swim freely, then the stage of fry culture is starting.

It should be noted that the largemouth bass is one kind of multiple spawning fish, so the brood stocks can spawn again if breeding condition is exist [5,6].

Fry Culture

The overview of fry culture: The fry culture means that feeding the larva fish from which is just begin to eat food to the fingerling stage that the body length is about 3 cm, and this fingerling is also called summer fingerling because of it is cultured usually in the summer in China. At this cultivation stage, the fry of largemouth bass is small and poor adaptability. The model of fry culture including ement pond culture and earth pond culture, and the whole stage will last about 30 days depend on the water temperature.

Cement pond culture: The cement pool area is required for 30-50 m^2 with the water depth of 1 m, and equipped with separate inlet, drainage and aeration equipment. Thoroughly clean and disinfect the pool before the larva fish entering the pool, then move the larva fish to the pond and the density is required for 2000 tails/m^2 [7].

The small zooplankton should be fed at the beginning of the breeding season, such as rotifers or artemia larvae, and the frequency should be 2-3 times every day. The food should be at 5-7 % bodyweight and properly adjust according to the feeding condition. We had better to transfer the fry in the earth pond when the fish grow to 1.5-2 cm long, and reduce the cultivation density properly. At this time, the fry should be fed with macrozooplankton zooplankton, such as the cladocerans, copepods and tubificidae. The food intake of fry increased gradually when the body length is above 2cm, so we start to feed fish pulp, then feed the small pieces of fish gradually.

Earth pond culture: The earth Pond area is required for 667-2000 m^2 with water depth of 1-1.5 m, and also need to equip with separate inlet, drainage and aeration equipment the same with cement pool. Using the medicine such as quicklime and tea seed meal to clean and disinfect the pond thoroughly before the larva fish entering the pool, then add nutrients into the pond to raise the reproduction level of the rotifer, cladocera and copepod, which is the food of the larva fish, so their biomass will peak in turn. The feeding density of larva fish is 50000 tails per 667 m^2.

Starting to feed tubificidae and fish pulp when the fish grows to 2 cm long. The daily feeding amount accounts for 5%-10% of the fish weight, and make the appropriate adjustment according to the weather and feeding condition of fish. The fry grow to 3 cm long need about 30 days, then transfer the fry to different ponds according to the different length of body, meanwhile the stage of fingerling culture is starting [8].

Management key points: Adding fresh water into the pond regularly to improve the growth rate and survival rate of fry. The frequency at one time per 5-7 days is better, while exchange part of the original water in the pond. Using the net to filter out the rough fish and injurious insect, and to avoid the water flowing into the bottom of the pool directly to make the water muddy.

Largemouth bass is one kind of carnivorous and fierce fish, and the differentiation of individual size occur easily in the process of culture, then the fish will kill each other especially when the food supply is insufficient. So the adequate food should be provided first, and make sure that the fry in the one pond is the same batch and the body length is tidy.

In the culture process, we should screen out the fish of different sizes to do the graded feeding, in order to ensure the size of fries are similar in the same pond, especially when the water temperature maintains at 20-24 to keep the rapid growth rate of fry.

Fingerling Culture

The overview of fingerling rearing: The fingerling culture means that feeding the fingerling fish from 3 cm to about 5-6 cm long, or even longer. After 4-5 months of careful feeding, generally speaking, the summer fingerling will grow to 13-20 cm in length and 40-200 g in weight, which is called large size fingerling.

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Culture teachnology: The pond area is required for 667-2000 m^2 with water depth of 1-1.5 m, and the breeding facilities are should be full equipped. The stocking density of summer fingerlings is 20000-30000 after cleaning and disinfecting the pond. The specific stocking density is determined according to water quality conditions and breeding needs. If the water quality is good, fish stocking density could be more higher, otherwise should be lower. If we want to cut down the breeding time, it is appropriate to reduce the stocking density.

In this breeding process, the fingerling should be screened in time, and fed in different ponds according to the body size, meanwhile the culture density should be reduced with the gradual growth of fingerling. The stocking density for 5 cm long fingerling is 10000 tails per 667 m^2, while for 10 cm long fingerling is 5000-6000 tails. The practice has proved that the cultivation method mentioned above that screening in time and graded feeding is the important to improve the survival rate of fingerlings [9-11].

The main food for fingerling is the fish surimi and pieces, also including some artificial compound feed. The feeding frequency are 2-3 times per day, and the feeding amount is 5-10% of the bodyweight. If the water temperature is appropriate and the management is correct, the fingerling size will reach to 10 cm or longer for 2 months, then we should transfer the fingerling to the pond for marketable fish culture.

Management key points: After summer fingerlings entering the pond, the enough food should be supported in time to make sure that the growth rate of most fingerlings is same, then the internecine condition of the fingerling will decrease and Survival rate will increase [12].

In addition, the scientific way of feeding is also important. First of all, the pond should set a feeding area, and make all the fingerlings feed in this area to Increase the feeding efficiency. Secondly, we should extend the feeding time as far as possible, so that every fish can eat the food and get full. Otherwise, the food which not be eat by fish in time will sink to the bottom, not only to waste food, but also cause deterioration of water quality [13].

Commercial Fish Culture

Pond conditions: The pond area is required for 0.3-0.5 ha with water depth of 1.5-2 m, and the other equipment is the same with the fingerling pond. In addition, the pond needs to be equipped with the aerator and standby generator enough because of the high breeding density. Transferring the fingerling in the pond in one week before cleaning and disinfecting the pond completely [14].

Breeding methods: Transferring the fingerling of 10 cm long to the pond. The fingerling should be healthy with tidy size to avoid or reduce the phenomenon of cannibalism. The stocking density of the fingerling is about 3 tails per m^2, and the density can be raised if the feeding condition is good. The fingerling need to be disinfected by 3-5 % salt water before entering the pond to kill parasites and pathogenic bacteria. Because of the fingerling is enough to get hurt and high oxygen demand, so we must move it into the pond in the sunny morning, and not to do it in the gale or stormy weather [15].

Some small amount of silver carp, bighead carp and grass carp can be cultured mix with the largemouth bass in the pond to regulate water quality by purging feed residue and controlling the growth of plankton, but the body size should more longer than 10 cm.

Management key points: The correct feeding way: In the first few days after entering the pond, the fingerling need to adapt to the environment and do not to eat food right now, so we should properly feed in the following 2-3 days. The good fish feed including ice fresh fish and artificial compound feed. The ice fresh fish should not be spoiled, and cut it to the appropriate size. The protein content of artificial compound feed should be 40-45 %. The feeding is required for at least two times per day, and the feeding amount is 5-10 % about the fish body weight for feed with the ice fresh fish, but 3-8% for feed with the artificial compound feed. In addition, the feeding amount should be adjusted properly according to the weather, water temperature and feeding situation. For example, the feeding amount should be raised from July to September, because both the water temperature and growth speed of fish are at high levels, but the amount should be reduced in December due to the low water temperature. Meanwhile, the feed type cannot be too simple, and sometimes we must add vitamins and minerals in the food, in order to maintain the normal nutritional requirements of largemouth bass [16-18].

The graded feeding: In the breeding process, we should screen out the different grades of fish in time according to the size of the fish, and the screening frequency at one time per month is better, and then remove the fish of the same size in the same pond to breed. The screening work should be carried out in the morning with good weather when the water temperature is low relatively, and not to do it when the weather is burning hot or cold. It is worth caution that food deprivation is essential before screening and the aerator need open to avoid hurting fish in the screening operation.

The water quality: In the natural environment, the fish likes staying in the clear flowing water, so it is important to keep the water clean, the water need to be updated 1 time per 10-15 days, and the amount accounts for about 1/3 of the pond water each time [19]. Probiotics also can be used to maintain water quality if necessary.

The Prevention and Treatment of Fish Diseases

In fact, fish diseases are frequent occurrence because of the farmers constantly improve the pond culture density for the higher yield and benefit. Some diseases will bring huge economic losses to farmers if it happens, so the prevention of diseases is very important. In order to prevent diseases and improve the water quality, the farmer must sprinkle lime water or chlorine dioxide into the pond one time per 10-15 days [20,21].

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In addition, farmers should regularly check that whether the disease is happened, and treat actions must be taken as soon as possible. Some common diseases, symptoms and the primary prevention methods are listed below.

The sodden branchial disease: The fish gills show a white color and some part of them are rotten when the disease happened. In addition, the sick fish usually swim alone and eat few food. The treatment way is to use the 3% salt solution soak sick fish for 10-15 minutes, meanwhile feed the oral antibiotic drugs or sulfa-drugs [22].

The enteritis disease: The sick fish usually shows a swollen abdomen and anus, and the yellow blood outflow from the anus if we press the abdomen lightly. The treatment way is to use the chlorine dioxide disinfect the culture water, meanwhile add the oxytetracycline in the fish food to feed.

The nocardiosis disease: The appetite of sick fish is getting worse, and the body color changes to black. The kidney and muscle appear the white bulging pustule. The treatment way is to kill all the pathogenic bacteria by using the disinfectants before the fish entering the pond, and using the glutaraldehyde disinfect the culture water at the epidemic season of disease [23].

Acknowledgements

This work was supported by the National Natural Science Funds (No. 31402305), the Educational Commission of Sichuan Province of China (No. KYTD201009; No. 15ZA0285), the department of science and technology of Sichuan Province of China (No. 2015JY0262) and the scientific research project of Neijiang Normal University (No. 16JC08; No. 16CZ05).

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