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EFFECT OF SALINITY ON TILAPIA'S GROWTH

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ABSTRACT

Tilapia or popularly known as "Tilapia" is one of the important fish species in aquaculture or aquaculture systems in the world. Tilapia is a euryhaline fish, in which tilapia has a good level of physiological adaptation to a wide range of salinity. From the results of the research that has been done, it is proven that tilapia can live at a salinity concentration of 10-15 ppt using osmoregulation. The osmoregulation process in the body of tilapia has a close relationship with salinity, the higher or lower the salinity of water in an environment will have an impact on different osmoregulation processes in the body of tilapia. The advantages of tilapia include having a relatively fast growth with relatively large body size. Too high salinity levels in the waters can affect changes in chloride cell function which disrupt the absorption of energy that should be used for growth. The purpose of this article is to compare the growth of tilapia under different salinity treatments. The growth of tilapia weight is not directly or inversely proportional to the salinity value, the higher the salinity value does not necessarily mean that the weight growth of tilapia will increase, as well as the lower salinity the growth of tilapia weight is also not necessarily an increase.

KeyWords

Tilapia, *Oreochromis niloticus*, salinity, growth, osmoregulation

Introduction

Human needs for fish can be obtained through natural catches, it can also be obtained from cultivation. The increasing need for fish consumption is in line with the increasing population, so it is necessary to increase fish production [1]. Tilapia or *Oreochromis niloticus* is a type of fish that is highly economical and is an important commodity in the freshwater fish business in the world [2]. In addition to being one of the most popular types of fish to be cultivated in fresh water today, tilapia aquaculture production has increased every year by an average of 34.85% per year from 2010 of 464,191 tons and increased in 2013 to 1,110,810 tons nationally [3].

The advantages of tilapia include that it is easy to breed and has high survival and has a relatively fast growth with a relatively large body size [2]. Besides being able to live in freshwater, tilapia is also able to adapt to brackish waters [4]. Fish can adjust the saltiness stretch by osmoregulation. Diverse pathways are included in this adjustment; they are included primarily in osmotic homeostasis support in fishes. Fish in marine or freshwater utilizes vitality to hold particles in or off their bodies separately through osmoregulation. Fish too have distinctive development at a few saline conditions [5].

Cultivation of tilapia is not widely carried out in brackish water media, but there is considerable potential for cultivation because there is still a lot of land or ponds that are less productive for shrimp and there are rice fields that are inundated by tide, so that these ponds can be used as a place for rearing tilapia [1]. It can also be done to enlarge tilapia in sea water because tilapia can survive a wide range of salinity (*euryhaline*). This ability is supported by chloride cells in the gills, improved intestinal permeability, and filtering power of the kidneys against salt [2]. Salinity is one of the factors that can affect the biological processes of living things, for example the rate of growth, the amount of food consumed, and survival [6]. Too high salinity levels in waters can affect changes in the function of chloride cells which disrupt the absorption of energy that should be used for growth [7].

Salinity

Salinity can be defined as the amount of salt content dissolved in water [8]. Salinity (‰) is defined as the mass in grams of dissolved inorganic matter in 1 kg of seawater after all Br^- and I^- have been replaced by the equivalent quantity of Cl^-, and all HCO_3^- and CO_3^{2-} have been converted to oxide. In terms of salinity, marine waters range from 33 ‰ to 37 ‰, with an average of 35 ‰ [9]. High and low salinity are very dependent on evaporation, rainfall, *run off*, and melting of polar ice. The high intensity of sunlight causes greater evaporation so that the salinity will be higher, the high rainfall causes the salinity to decrease. The increasing number of freshwater flows into the sea reduces the salinity of seawater. This was followed by melting polar ice which entered the sea [10].

Salt consists of several compounds, namely sodium chloride, magnesium sulfate, potassium nitrate, and sodium bicarbonate which dissolve into ions [8]. Nitrate and chloride are the dominant substances in seawater, as are the concentrations of magnesium, calcium and sulfate ions. Saltiness within the seas is consistent but is more variable along the coast where seawater is weakened with freshwater from runoff or the purging of waterways. This brackish water shapes a boundary isolating marine and freshwater living beings. [11]. When fish are constrained to bargain with distinctive salinities, depending on marine or freshwater fish, they spend more vitality to hold their homeostasis and develop less since osmoregulation breakdown, fish spend more vitality to hold sodium and chloride particles in their bodies or take off them. [12].

To begin with, the definition of saltiness is not based on the properties of IAPSO Standard Seawater. Instep, the finest gauges of the concentrations of the imperative inorganic components of Standard Seawater are utilized in TEOS-10 to precisely characterize manufactured seawater with Reference Composition (Table 1). For viable and verifiable reasons, the definition of Reference Composition disregards broken up organic matter, as well as most gasses, although it's something else that incorporates the foremost imperative constituents in genuine low-nutrient seawater [8].

Table 1. Reference Composition of seawater with SP ≡ 35.000 and SR ≡ 35.16504 g/kg [8]

Reference Composition	mmol/kg	mg/kg
Na^+	468.9675	10781.45
Mg_2^+	52.8170	1283.72
Ca_2^+	10.2820	412.08
K^+	10.2077	399.10
Sr_2^+	0.0907	7.94
Cl^-	545.8695	19352.71
SO_4^{2-}	28.2353	2712.35
Br^-	0.8421	67.29
F^-	0.0683	1.30
HCO_3^-	1.7178	104.81
CO_3^{2-}	0.2389	14.34
$B(OH)_3$	0.3143	19.43
$B(OH)_4^-$	0.1008	7.94
CO_2	0.0097	0.43
OH^-	0.0080	0.14
Observed Variations seen in real seawater		
O_2	0-0.3	0-10
N_2	0.4	14
$Si(OH)_4$	0-0.17	0-16
NO_3^-	0-0.04	0-2
PO_4^-	0-0.003	0-0.2
ΔCa^+	0-0.1	0-4
ΔHCO_3^-	0-0.3	0-20
Dissolved Organic Matter (DOM)	–	0-2

Concentrations in seawater of higher or lower salinities can be found approximately by scaling all values up or down by the same factor. Units of concentration are per kilogram of seawater. Real seawater contains additional constituents which are not included in the Reference Composition but whose concentrations (and their variation) may be larger than 1 mg/kg. Concentrations of these constituents do not increase or decrease with salinity but are largely controlled by biogeochemical processes [8].

Growth of Tilapia

Treatment with a salinity concentration of 30 ‰ showed the highest absolute length growth of red tilapia seed body with the result of 1.9 cm, while the highest yield was obtained in the control treatment, namely 3.39 grams [13]. Not much different from previous studies, the increase in total length and the highest increase in total weight were obtained in the control treatment, namely 1.24 cm and 5.56 grams, respectively [14]. But in this study, the highest absolute weight growth was obtained at 17 ppt treatment, namely an average weight growth of 2.26 g. ANOVA test results showed $P<0.05$ means that salinity affects the absolute weight of red tilapia. At 17 ppt salinity, the available energy is maximally absorbed and used for growth, meaning that the highest absolute weight growth rate limit can be achieved at a salinity level of 17 ppt because if the salinity value is too high it will affect the metabolism of tilapia [15]. The growth of tilapia weight is not directly or inversely proportional to the salinity value, the higher the salinity value does not necessarily mean that the weight growth of tilapia will increase, as well as the lower salinity the growth of tilapia weight is also not necessarily an increase. This is due to tilapia trying to be in an isotonic condition, which is a condition where the body fluid concentration is the same as the concentration of its live medium [16]. Each organism has different abilities to deal with osmoregulation problems in response to changes in osmotic external circles [17].

Unlike the previous ones, the highest average growth occurred at a salinity of 10 ppt, namely 21.23 grams. Meanwhile, the salinity of 30 ppt resulted in a low growth rate of 8.97 grams. However, both 10 and 30 ppt salinity treatments were not significantly different ($p> 0.05$) with salinity 0.15, 20, and 25 ppt with a mean growth of 17.03 grams, 16.78 grams, 13, respectively. 97 grams, and 12.95 grams [18]. The conditions of tilapia seed tested at the salinity of 5, 10, and 15 ppt were still in good condition, but at 20 ppt treatment, the conditions were bad and even died. The gain in length ranged from 0.5–0.6 cm and body weight between 0.7–1.9 grams. The highest increase in size was found in the low salinity treatment, namely 5 ppt (0.6 cm). While the lowest results on body length were obtained by salinity 10 and 15 ppt, but the weight at 10 ppt salinity increased by 0.9 grams and 15 ppt by 0.7 grams. The difference in maintenance time can be a factor in increasing the size of tilapia seeds. The existence of a large number of deaths without one alive at the 20 ppt salinity stage indicates that tilapia seeds are not able to adapt to the initial salinity limit, especially at higher levels. The difference in the ability to adapt to salinity in tested tilapia is mostly related to the lack of energy used for osmoregulation when the test fish experience changes in salinity at low levels (5 and 10 ppt) so that this energy can be used to survive, have a good appetite and grow [19].

Conclusion

Salinity can affect the growth of fish, especially tilapia, but it depends on the initial conditions of the tilapia because fish have their own way of dealing with or adapting to differences in salinity by the energy assistance, they have in the osmoregulation process, because not all fish use the energy they have. have for growth only. The higher the salinity does not justify the growth of tilapia, nor does it justify the growth of tilapia will decline.

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