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Growth Pattern, Condition Factor and First Capture-Maturity Size of Nile Tilapia (Oreochromis Niloticus) in a Fish Pond

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Abstract: *This study aims to investigate growth pattern, condition factor and first capture-maturity size of Nile tilapia (Oreochromis Niloticus) reared in a fish pond (30×15×1.85 m³ with a water depth of 0.53 m).Fish of different sizes (96.99±34.57 mm TL and 22.86±27.47 g weight) were sampled using the light traps. Most of catch was found in size classes of 90-99mm and 11-20 g. Female exhibited significantly larger body sizes and higher weight-to-length ratios (W/TL) compared to males (P<0.001). Both male and female Nile tilapia showed isometric growth patterns (b = 2.99-3.01) and were considered to be in good condition based on their condition factor (K = 1.80-1.82). The size at first capture (L_c = 96.74-175.50 mm) was greater than the size at first maturity (L_m = 72.63-101.58 mm), indicating that the fish having a high change of spawning.The research findings provided valuable insights for aquaculturists to optimize their fish farming business.*

Keywords: *Length-weight relationship, isometric, capture-maturity size, light traps*

1. Introduction

The Nile tilapia (*Oreochromis niloticus* Linnaeus, 1758) is an economically important freshwater species that plays a major role in aquaculture and fisheries not only in Indonesia, but also in other countries. This is due to its high-quality and flavorful flesh, good consumer acceptance, ease of breeding, rapid growth, efficient omnivorous food habits, and also adaptable to adverse environmental conditions [1-3]. Beside served as retaurant culiner, the flesh fillet of Nile tilapia is also produced for export markets[4].

In the wild, Nile tilapia can be caught by gillnets, cast net, and seine nets[2,5,6].It can also be commercially cultured in earthen ponds, cages, raceways, tanks, and brakish water [7,8]. However, uncontrolled spawning in production ponds often causes over population, resulting in competition for food, reduced growth, and lower yields of marketable size fish. Introducing fish predators (e.g., snakehead) or partial monthly harvesting using a cast net three months post-stocking can be a good option for controlling excessive recruitment in ponds[9,10].

Recently, emphirical studies are not only focused on its breeding biology [11], biomass and shape characteristics[12], morphometric characteristics[13], anthropogenic impacts on morphological divergence [2], length-weight relationship [14], and condition factor [5], but also economic profitability of this species [15]. Information on fish health condition reared in the pond is needed for fish farmers or aquaculture manegers to ensure the success of their business or prepare appropriate actions if problem being occurred. Therefore, the present study was performed to investigate growth patternand condition factor including the size at first capture of this species to provide some recommendations for future study.

2. Materials And Methods

The research was conducted in a 30x15x1.85 m^3 concrete pond with a water depth of 0.53 m belongs to the Faculty of Fisheries and Marine Science, Lambung Mangkurat University, Indonesia. According to the Wet Laboratory staff, about 400 individuals of Nile tilapia (70-150 mm in total length) were stocked in the pond for two months before the trials. Meanwhile, the size of the fish at harvest ranged from 43 to 193 mm TL, indicating that some of the adult fish have spawned and then newly hatched fry grown up to become juveniles. During experimental fishing, they were fed twice a day with commercial pellets at a feeding ratio of 5% body weight/day. During the study, water

transparency, measured with a Secchi disk, was 28.35 cm, and turbidity was 38 NTU. Surface water temperature ranged of 29.0-32.5 °C.

The traps made of Polyamide (PA) nylon monofilament (31.75 mm stretched mesh size), was fastened around two wire ring frames (dia. 2 mm); the upper and lower perimeters of the trap were1540 mm with a diameter of 490 mm. The net height was 270 mm with a hanging ratio of 0.45. The traps were associated with LED underwater lamps with light intensity of 8.4-3116 lx, measured by a light-meter LX-100 (Lutron, Taiwan), powered by 3 V dry-cell batteries.

The light traps were lowered in the pond, spaced about 3 m apart, and left them overnight. We identified the sex, counted and measured for their size and weight in the morning, then moved traps to different spots for the next night. Fishing trials were conducted consistently over 14 nights. The growth pattern of fish was analyzed using the following formula [16]: $W = aL^b$, where W is the total weight (g), L is the total length (mm), a is the constant, and b is the slope showing the growth coefficient. If a fish retains the same shape, it means the fish grew isometrically (b = 3). When weight increases more than length (b > 3), it exhibits positive allometric growth. When length increases more than weight (b < 3), the fish exhibits negative allometric growth. The condition factor (K) of fish was calculated using the following formula: $K = 100W/L^3$, where K is the Fulton's condition factor, L is the total length (cm) and W is body weight (g).The length at first capture (Lc) and the length at first maturity (Lm) were also estimated to determine the potential for spawning [17].

The t-test was applied to determine significant differences in a ratio of body size and condition factor between males and females. The mean differences were analyzed using one-way analysis of variance (ANOVA). All statistical tests were evaluated at a 95% confidence level using SPSS 28.0 software program.

3. Results and Discussion

A total of 102 individuals of Nile tilapia comprising 57 males and 45 females of different sizes were investigated. The body sizes of fish ranged of 43-193 mm TL (96.99±34.57 mm) and 1-133g weight (22.86±27.47 g). Females (116.64±40.30 mm and 37.91±35.69 g) were considered larger than males (81.47±18.00 mm and 10.98±5.87 g). They also had a ratio of weight to total length (W/TL) considerably higher than males (P<0.001). No significant difference was observed in a ratio of body depth to total length (BD/TL) between males and females (P>0.05). Most of catch was found in size classes between 90 and 99mm (23.26-31.48%) and between 11and 20 g.For time being, we did not describe on how phototaxis responses in Nile tilapia existed, but it will be explored in subsequent topic.

3.1. Growth Pattern

Nile tilapia showed an isometric growth pattern (Figure1), which means that length and weight were growing at the same rate. The *b* values obtained for males and females were 2.9954 and 3.0109 respectively, as indicated by their curve equations: $W = 0.00002TL^{2.9954}$ and $W = 0.00002TL^{3.0109}$. The determination coefficient (R^2) values for males and females were 0.9038 and 0.9581, indicating that more than 95% of the variability of the weight was explained by the length. The regression coefficient (r) of males and females were 0.9507 and 0.9788, found to be higher than 0.5, showing that the length-weight relationship was positively correlated. The trend lines of curves intersected each other, indicating an identical growth pattern between males and females

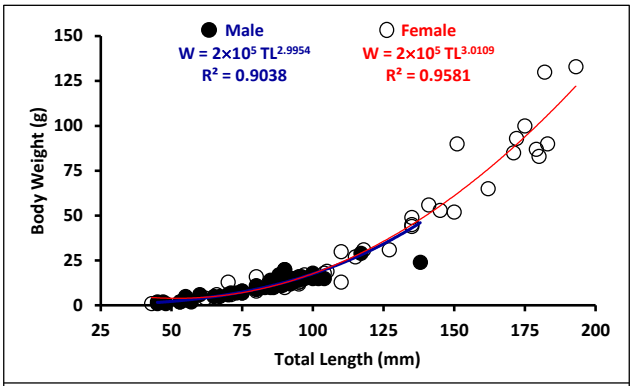

Figure 1. *The relative growth curves for males and females Nile tilapia sampled from a fish pond, and fish showed isometric growth patterns.*

Such isometric growth pattern of Nile tilapia in our study was also reported in the previous studies [13,18,19]. Some researchers confirmed that Nile tilapia had a positive allometric growth pattern [11,20,21], while other scientists reported that Nile tilapia showed negative allometric growth [22,23,24]. Variation in slope may be attributed to sampling size variation, life stages, and environmental factors such as food and space [25,26].The ratio of body weight to total length of Nile tilapia in the present study was comparatively smaller than that of Nile tilapia collected from Kegati Aquaculture Station, Kenya [5] or from a fish farming in Chachoengsao Province, Thailand [13].

3.2. Factor Condition

There was no significant difference in the factor condition (K) between males and females (P>0.05). The mean K values obtained for males and females were 1.80±0.41 and 1.82±0.46respectively, indicating that Nile tilapia in the pond were healthy. These K values agreed favorably with the values recorded for Nile tilapia from other regions [1,6,18]. Variation in the value of the mean K may be attributed to the biological interaction involving in traspecific competition for food and space between species including sex, stages of maturity, condition of stomach contents and availability of food [6,18,20]. Information on the condition factor of fish is considered necessary for aquaculture system management particularly to understand specific conditions and the health of fish being cultured. The K value is also a useful basis for monitoring feeding intensity, age, and growth increment in fish [25].

3.3. First Capture-Maturity Size

The estimated length at first capture (Lc) of Nile tilapia in the pond was 96.74 mm for males and 175.50 mm for females (Figure 2). While the sizes at first maturity (Lm) of males and females were predicted at 72.63 mm and 101.58 mm, respectively. Since fish typically reach sexual maturity before their first capture, the fish population has a high potential for spawning. This means that a large portion of the fish population (87.25%) is mature and ready to spawn, which significantly contributes to the overall reproductive capacity of the species. Aquaculturists can utilize the results of this research to optimize their fish farming practices.

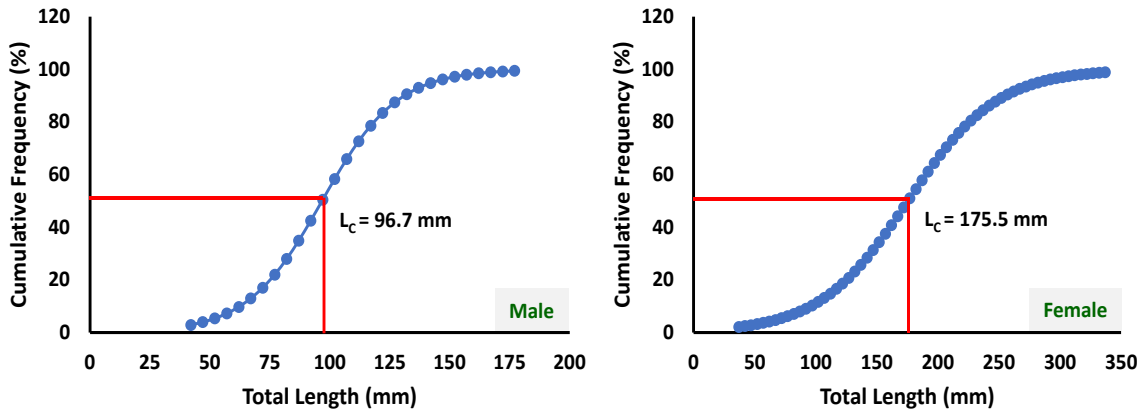

Figure 2. *The estimated length at first captuer of male and female Nile tilapia in a fish pound.*

4. CONCLUSION

Nile tilapia reared in a fish pond showed isometric growth pattern and they were in good condition. They also have a high chance of spawning indicated by the size at first capture was greater than the size at first maturity.This study provides insights to boost fish farm efficiency.

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