

TIK-82 Relationship of Mouth Opening and Length Growth to Feed Size of Snakehead Larvae (Channa Striata)

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RELATIONSHIP OF MOUTH OPENING AND LENGTH GROWTH TO FEED SIZE OF SNAKEHEAD LARVAE (*CHANNA STRIATA*)

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ABSTRACT

The main factor causing the critical point in the larval rearing phase is the determination of the type of feed as initial feed. The purpose of this study was to examine the relationship between the development of mouth opening and the total length of snakehead fish larvae (*Channa striata*) for the accuracy of natural feeding. Research method Samples were taken from 3 stocked basins, 3 larvae tail were taken from day 3 to 35 day after hatching (HA). Measurement of mouth opening by measuring the maxillae of the larvae mouth with a digital micrometer every day starting on 3-day AH. Measurement of the total length of larvae on AH day 3, 10, 19, 28 and 35. Calculation using the formula Shirota (1970) were analyzed descriptively and calculated the percentage of the size of the mouth opening with the total length of the larvae. The data are presented in tables and graphs, the analysis is analyzed linear regression and descriptively. The results of this study were that the mouth opening of snakehead fish larvae on the 3rd to 5th day AH was less than 1 mm, the size of the larval mouth opening on the 6th day AH reached 1.41 mm and on the 35th day it reached the size of 2.58 mm. The relationship of larval mouth opening to larval length from 6 to 35-day AH was allometric negative, the size of the mouth opening decreased according to the increase in length and age of the larvae. The measured mouth opening makes it easy to feed the natural larvae accordingly.

KEY WORDS

Mouth opening, total length, snakehead larvae, natural food.

Fish larvae can grow more optimally by giving natural food at the right period according to the size of the larva's mouth opening, if the selection of the type of feed given is not right with the larva's mouth opening it can cause larvae cannot eat the natural food provided so that growth and survival are low (Mahardika *et al.*, 2017). Larval growth and survival are highly dependent on the development of early life which is very critical, especially when the period of endogenous nutrient turnover turns into exogenous feed consumption (Sulaeman & Fotedar, 2018) According to Houde, (2002), high mortality usually occurs during feed changes, in the endogenous to exogenous phase.

The main factor causing the critical point in the larval rearing phase is the determination of the type of feed as the first feed which is not appropriate for its growth (Sorgeloos & Lavens (1996) in Mahardhika *et al.*, 2017). In fish hatchery activities, the larval phase is a critical phase because in that phase there is much mortality that occurs when the yolk runs out even though the fish have not found suitable food. Fish larvae in early life obtain nutrients to grow from egg yolks as endogenous feeding (Mariska *et al.*, 2013). The size of the mouth opening and esophageal diameter of the larvae are the determining factors in taking food particles (Ronnestad *et al.*, 2013). The lack of suitable live food for fish larvae with small mouth openings is an obstacle to continuing the life cycle of many commercially important fish species (Holt, 2003 in Basford *et al.*, 2019). Hartman (1983) in Dabrowski (1984) studied freshwater fish larvae, observed several early-life feeding strategies, swimming skills and speed, and found that early survival was limited



by feeding behavior, followed by mouth opening size and finally by size available food particles.

The amount and type of food consumed by a species of fish, usually depends on the age, place, and time Effendie (1997). According to Priyadi *et al.*, (2010) natural food given to fish must have a smaller size than the mouth opening of fish larvae and have good nutritional content. Research on mouth opening and its relationship with the initial feed of snakehead fish larvae on moina feeding (Amornsakun *et al.*, 2011). The relationship between length and weight and with different pellet feed ingredients (Sugumaran *et al.*, 2018). Establishing a general relationship between mouth characteristics, trophic level and body length for a large number of species that differ in size, shape and habitat will make it possible to estimate the trophic level of the species (Karachle & Stergio, 2011). The relationship between mouth opening and length of snakehead fish larvae on the size of natural feed has not been studied. Based on the description of the problem above, it is necessary to research the measurement of the mouth opening and length of snakehead fish larvae so that the provision of natural feed after the egg yolk period become exogenous feed can be given according to the size of the mouth opening of snakehead fish larvae. The purpose of this study was to examine the relationship between the development of mouth opening and the total length of snakehead fish larvae (*Channa striata*) for the accuracy of natural feeding.

MATERIALS AND METHODS OF RESEARCH

This research was conducted for 3 (three) months, located in Sungai Abid Village, Sungai Tiung Village, Cempaka District, Banjarbaru City, South Kalimantan Province. The materials used in this study where snakehead fish larvae after the egg yolk period was 3 days old and natural feed was chicken egg yolk emulsion, *Artemia* sp., *Daphnia* sp., and silkworms (tubifex). The instruments used for the maintenance of a basin with a diameter of 40 cm and a height of 30 cm, blowers, aeration hoses, and digital micrometers.

Snakehead fish larvae were obtained from domesticated broodstock. Spawning is done naturally and semi-artificial in spawning ponds with a ratio of male and female broodstock 1:1. The eggs that hatch are immediately reared in spawning ponds. When the rearing basin is ready, the larvae are transferred to the larval rearing basins.

Samples were taken from 3 stocked basins; 3 larvae were taken every day from day 3 to day 35 After hatching (AH). Larvae were selected based on physical observation of healthy larvae, with natural feeding. Measurements were made on:

(1) The total length of the larvae on days 3,10,19,28 and 35 After Hatching (AH).

(2) Measurement of mouth opening by measuring the maxillae of the larval mouth with a digital micrometer every day starting on day 3 AH, referring to the Shirota method (1970) by placing the fish on top of the gauges by pressing gently until the fish mouth opening open at degree the openings 90 degree and take measurements of length maxillae larvae. Shirota (1970) formula is as follows:

$$D = \sqrt{2AB}$$

Where: D = Larvae Mouth Opening (mm); AB = Larvae Mouth Maxillae Size (mm).

(3) Percentage of mouth opening size with total larval length calculated based on Shirota (1970) formula comparison as follows:

$$\text{Percentage of Mouth Opening} = \frac{\text{Size of Mouth Opening (D)}}{\text{Total Length of Fish}} \times 100\%$$

The parameter data observed in this study were analyzed linear regression and descriptively, the results were presented in tables and graphs. The relationship between the development of mouth



opening and larval length growth was analyzed by linear regression. Linear regression is a technique to quantify the relationship, which can be seen in a graph made between two variables, the relationship between the mouth opening of the larvae and the larvae length.

RESULTS OF STUDY

Size of mouth opening Snakehead fish larvae data in the form of graphs are calculated based on the formula Shirota (1970) can be seen in Figure 1.

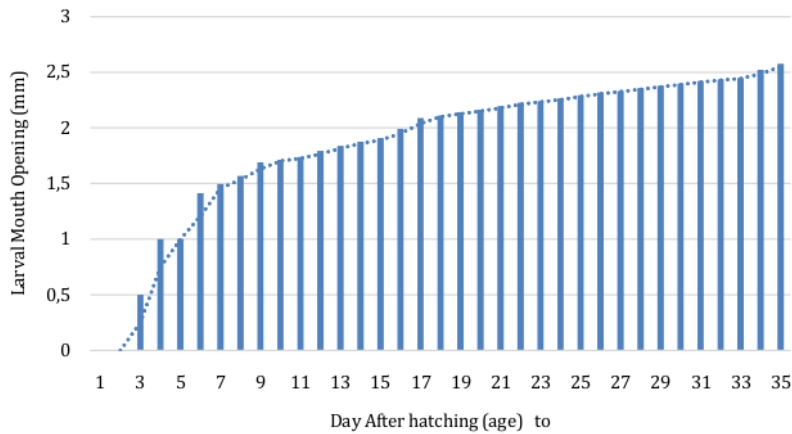


Figure 1 – The mouth opening of the snakehead fish larvae (Source: primary data, 2021)

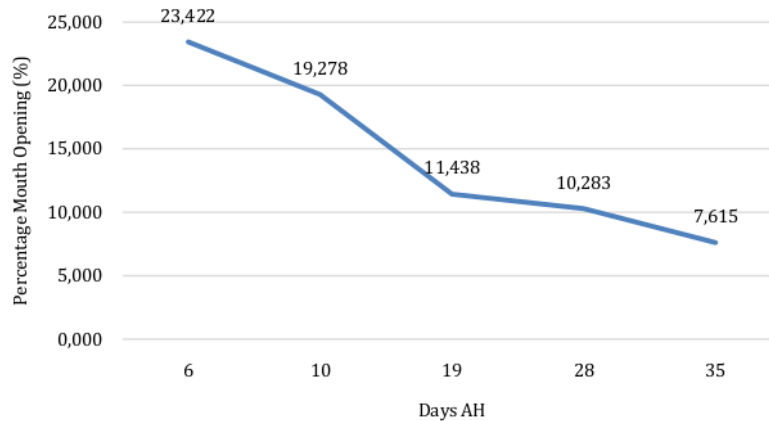


Figure 2 – Snakehead Larvae Mouth percentage Aperture Size (Source: Primary data, 2021)

The width of the mouth opening of the larvae for 35 days AH maintenance increased with increasing age of snakehead fish larvae; at the age of 3 days AH the mouth size was less than 1 mm. On the 4th day there was a development of the width of the mouth opening, the width of the mouth opening on the 6-day AH (1.41 mm) was greater than 1mm, on the 10-day AH it reached 1.71mm, the 19th day AH the size was 2.14mm, on the 28-day AH (2.36mm) and on the



AH day 35 was 2.58 mm.

The percentage of the size of the mouth opening based on the method of Shirota (1970), measured from the comparison between the size of the mouth opening and the total length of the larvae can be seen in Table 1 and Figure 2.

Table 1 – Percentage of Mouth Opening Size of Total Length Snakehead Fish Larvae

Day AH	Mouth Opening (mm)	Total Length (mm)	Percentage of BM (%)
6	1.41	6.02	23.42
10	1.71	8.87	19.28
19	2.14	18.71	11.44
28	2.36	22.95	10.28
35	2.58	33.88	7.62

The calculation mouth opening size (D) starting from day 6 to day 35 AH ranged from ≤ 1 - 2.58 mm. The total length of the larvae ranged from 6.02-33.88 mm, so the percentage of mouth opening to the total length of fish can be seen in Figure 2., percentage of the day 1-35 range between 7.62% - 23.42%, with the size of the mouth opening ranged from ≤ 1 – 2.58 mm. The lowest percentage of mouth opening was obtained on the 35 day AH of measurement, which was 7.62% with a total length of 33.88 mm larvae. The percentage of mouth opening to total length decreased with age and the total length of larvae increased. The relationship between the development of mouth opening and the growth of the total length of larvae fish based on the regression relationship can be seen in Figure 3.

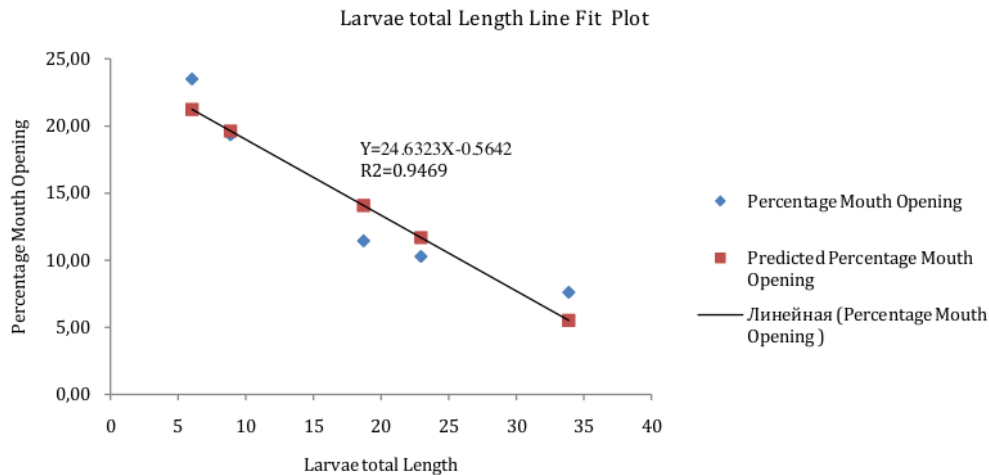


Figure 3 – Relationship of % mouth opening with total length growth of larvae

Based on the scatter plot graph, it can be seen that the data plot points form a straight line pattern from bottom right to top left, this indicates a negative linear relationship between variables coefficient of determination $R^2 = 0.9469$. This value means that 94.69% of the independent variable (X) can explain the dependent variable (Y) and only 5.31% is explained by other variables. Natural food is given starting on day 3 after the expiration of the indigenous egg yolk given feed in the form of egg yolk chicken, artemia, Daphnia, silk worms and pellets. The results of measuring the mouth opening of the snakehead fish larvae are in Figure 3. The size of the larval mouth opening on the 3day AH or the first day of measurement has not reached 1mm until



5day AH. Larvae mouth opening on 6day AH when feeding *Artemia* sp., i.e. 1.41 mm. Larvae mouth opening on 10 day AH when feeding *Daphnia* sp., i.e, 1.71 mm. The larval mouth opening on 19 day AH when feeding silkworms was 2.14 mm. The larval mouth opening on 28 day AH when feeding pellets was 2.58 mm.

DISCUSSION OF RESULTS

The results of the measurement of the mouth opening of the larvae increased in size with increasing age of the larvae. The size of the mouth opening of the snakehead fish larvae can only be measured when it enters the age of 6 days, where the larva's mouth is fully formed and can be opened to measure its length. When the size of the mouth opening can be measured, the size of the larval mouth opening at the age of 6 days AH is 1.41 mm.

Percentage of mouth opening size from total length based on Table 1. That is the percentage of the size of the mouth opening to the total length of larvae at the beginning of life until the age of 10 days. This is presumably because the larvae do not yet have perfect organs, so that at the beginning of life, there is more development of the mouth and digestive organs than the growth of the length of the larvae. According to Effendie (2002), larval life is divided into two phases, namely pro and post larvae. Pro larva is a phase where the larvae still rely on egg yolks, have a shape that does not resemble an adult fish and do not yet have perfect organs, such as a mouth. While post larva is the phase where the egg yolk has run out, the organs have started to look and have started to resemble adult fish. According to Kohno *et al* (1997), in the pro larval phase, there are several developmental processes such as morphogenesis, organogenesis and metamorphosis. In the pro larval phase, there has not been much growth in length and weight because all the energy obtained from the feed consumed in the pro larval phase is mostly used for the three processes of morphogenesis, organogenesis and metamorphosis. Meanwhile, on the 10th day onwards, the larvae are already in the post larval phase where the larval body organs have begun to form and have begun to resemble the shape of an adult fish, so that the energy obtained from feed can be used for long growth, this causes length growth faster than on the development of the mouth opening, resulting in a decrease in the percentage of the size of the mouth opening from the total length.

The growth of fish body length increased, but on the other hand the development of larval mouth openings slowed, so that the relationship between larval length and mouth opening was *allometric negative*. This is in accordance with the opinion Karachle & Stergiou (2011) is generally a species of carnivorous fish has a tendency to have a mouth bigger than the fish omnivore.

Development of wide mouth opening in vertical descent, compared to growth of fish body length on carnivorous fish, is very dependent on the structure of the skull fish head. Some carnivorous fish have a vertical mouth opening relationship with the total length of the fish which is negative allometric.

Decreased mouth opening size of fish larvae due snakehead head on at the beginning of life, the diameter of the head is larger than the diameter of the body, when it enters the seed phase, the size of the head and body becomes balanced and straight with the body. The more mature snakehead fish according to Suardika *et al.*, (2019). The head of the fish is large with a slightly flat body shape like the head of a snakehead, the body is round and elongated like a guided missile or torpedo. According to (song *et al* 2013, Yulintine 2017 in Arisuryanti *et al* 2020) It is easily recognized by its long sub-cylindrical body and a compressed head like a snake with a round shape.

The size of the larval mouth opening is one of the things that must be considered in determining the type of natural feed to be given to fish larvae. The size of the feed that is too large that exceeds the size of the mouth opening can cause the larvae to not be able to eat the



natural feed provided, causing the larvae to starve and end in death. According to Effendie *et al.* (1997), suitable feed requirements for fish larvae are small, smaller than the larva's mouth opening. According to Munikumar *et al.* 2015. The right size of feed is very important when the larvae eat to match the size of their mouth openings. War *et al.*, (2011) that the larger the size of the larvae, the level of the size of the feed to be consumed will be even greater, according to the size of the mouth opening. Snakehead fish are predators, eating a variety of invertebrates such as crustaceans and insects, and occasionally vertebrates including small fish and tadpoles (Courtenay & Williams, 2004).

The natural feeding of snakehead fish larvae in this study was started with egg yolks at the age of 3 days in three basins. At the larvae age of 3 days AH, the mouth opening could not be measured so that feeding with chicken egg yolk emulsion was considered to be in accordance with the size of the larva's mouth opening. The next type of feed given was *Artemia* sp. starting at the age of 5 days AH (mouth size <1 mm), on the 6th day AH the mouth size was 1.41 mm. According to Susanto *et al.*, (2000) the size of local and imported *Artemia* nauplius at hatching is about 0.40-0.48 mm and the second instar size is about 0.6 mm. Thus, feeding *Artemia* sp. at the age of 5 days is in accordance with the size of the mouth opening of the larvae.

The next type of feed given was *Daphnia* sp. at 9 days of age. At this age, the size of the larval mouth opening is 1.69 mm. According to Pangkey (2019) Usually *Daphnia* is 0.1-3.0 mm in size, thus, feeding *Daphnia* sp. at the age of 9 days AH is in accordance with the size of the mouth opening of the larvae at the age of 13 days AH. The size of the mouth opening of the larvae is 2.93 mm. According to Khairuman & Sihombing, (2018) Silkworms (*Tubifex sp.*) are red worms with a body length of 1-2 cm with a diameter of 0.5 mm. Pennak, (1978) silkworms (*Tubifex sp.*)

have an average diameter of 0.5 mm with a length of 4 cm, thus feeding silkworms. at the age of 13 days is in accordance with the size of the mouth opening of the larvae. According to Fariedah & Widodo (2016) natural feeding of silk worms on snakehead fish larvae showed a survival rate of 63.05%. The lack of suitable natural food for fish larvae with small mouth openings is an obstacle to the survival of many commercially important fish species (Holt 2003 in Basford *et al.*, 2019). According to Priyambodo & Wahyuningsih (2000) fish larvae will be attracted to natural feed that moves and then catches it as prey. The nature of the natural feed that moves, but is not too active can stimulate and make it easier for fish larvae to prey on it. According to Jamienso in Yusuf (2016) *Tubifex sp.* has an attractive reddish color and a distinctive smell so that the larvae are attracted to *Tubifex sp.* and are live food whose movement is waving at the bottom of the cultivation container so that the larvae are attracted to eat it. Dabrowski (1984) stated that the size of the mouth opening is a criterion to consider when feeding fish larvae, either in the form of natural feed or in the form of formulations. Based on the results of the calculation of the fish's mouth opening, it can be estimated the type and size of natural food that is in accordance with its mouth opening, so that it can overcome the critical phase of life of snakehead fish larvae.

CONCLUSION

The mouth opening of snakehead fish larvae on the 3rd day after hatching on the 5th day was less than 1 mm, the size of the larval mouth opening on the 6th day reached 1.41 mm and on the 35th day it reached the size of 2.58mm. The relationship between larval mouth opening and larval length from days 6-35 is negative allometric, the size of the mouth opening decreases according to the increase in length and age of the fish. The size of the mouth opening that has been measured makes it easy to feed the larvae naturally according to the mouth opening.



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