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Native Species in Barito Upstream at South Kalimantan, Indonesia: Sex Ratio and Length-Weight Relationship of Seluang Batang Fish (*Rasbora Argyrotaenia* Blkr 1850)

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ABSTRACT

The study was carried out to provide scientific data on the sex ratio and length-weight relationships of Seluang Batang (*R. argyrotaenia*) in Barito upstream of South Kalimantan, located on 2°57'36.10" S 114°5'37.92" E; 3°01'07.86" S 114°45'29.28" E. Taking of samples by the method of Ford-Walford plot lasts for one year with a fixed time interval decision which is one month. Data obtained by comparing the sex ratio between the number of male and females and multiplied by 100%. The chi-square analysis was used to test the hypothesis difference in the number of male and female fish. Analysis of length-weight relationship of fish with regression test and were calculated using a cubic pattern. The results showed that the sex ratio of *R. argyrotaenia* male and female was 3: 1 and the growth pattern of male and female fish showed negative allometric.

Keywords: Sex Ratio, Length-Weight Relationship, *Rasbora argyrotaenia*, Barito upstream

INTRODUCTION

Freshwaters fish in the tropics have higher levels of diversity than in temperate regions (Allan and Castillo, 2007; Dudgeon *et al*., 2006; Stiassny, 1999). Food Agricultural Organization (2010) states that freshwater fish production has contributed greatly to the food security and livelihoods of the world. Stiassny (1996) states that 25% of total world fishery potential coming from the freshwater fishery. The Borneo Island has a diversity of fish species relatively higher in the Asian region (Winemiller *et al*. 2008). South Kalimantan itself has the potential of wetland area in South Kalimantan is about one million hectares. A total of 140 fish species was found from this region (Prasetyo and Asyari, 2003).

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The rate of exploitation in 2014 reached 65,665.6 tons/year (Department of Fisheries and Marine of South Kalimantan Province, 2015). Seluang Batang (*Rasbora argyrotaenia*) is one of commercially important fish species sourced of the Barito river, creek and swamp waters surrounding the associate (Department of Fisheries and Marine of South Kalimantan Province, 2015; Rosadi, 2009). Barito River has the depths of 8-10 m and a width of 400-750 m, is the main river that is mutually associated with creeks and swamps (floodplain) vicinity, 90% are still affected by the tidal Java (River Basin Agency of Kalimantan II, 2012; Department of Fisheries and Marine of Barito Kuala Regency, 2008). Some aspects of *R. argyrotaenia* fishery has been widely reported to describe their morphology (Bleeker, 1859; Kottelat *et al*. 1993) and mtDNA (Liao *et al*. 2010), fish biology aspects (Sterba, 1969; Axelrod *et al*. 1991; Doi, 1997; Dina, 2011; Sulistiarto, 2012), the aquatic environment (habitat) aspects (Rosadi *et al*. 2014; Sulistiarto, 1998; Baensch and Riehl, 1985),

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patterns of reproduction and growth in ex-situ (Said and Mayasari, 2010) as well as study on fishing activity of this species (Rosadi *et al*. 2015).

The research on fishery resources in the waters of tropical rivers for decades rated lagging when compared with studies in the temperate waters (Matthews and Heins, 1987; Dudgeon, 2000; Winemiller *et al*. 2008). At present, scientific data on the sex ratio and length-weight relationships of *R. argyrotaenia* are lack. It is therefore more information on reproductive biology of this species is required as the stock assessment database based on a specific geographical location.

MATERIALS AND METHODS

Study Site

The study was carried out on Barito upstream, South Kalimantan, located at 2°57'36.10" S 114°5'37.92" E; 3°01'07.86" S 114°45'29.28" E determined with GPS (Garmin Etrex, Taiwan). The water depth varied from 8 to 10 m; the same fishing grounds as those used by commercial fishermen.

Data Collection

The samples of *R. argyrotaenia* were collected during gillnet operations from April 2012 - May 2013. The gillnet made of nylon monofilament, mesh sizes varied between 20 mm and 30 mm with 150 m long and 2 m high.

Total length was measured to the nearest millimeter. Weight was determined with a digital balance to an accuracy of 0.1 g. Retrieval of samples by the method of Ford-Walford plot lasts for one year with a fixed load time interval which is one month (King, 1995). The samples were taken randomly from both fish landing sites and on board.

Data Analysis

Analysis of the Sex Ratio was performed by comparing the number of male and females and then multiplied by 100%. The chi-square analysis is used to test the hypothesis difference in the number of male and female.

The length-weight relationship analysis of *R. argyrotaenia* regression test was calculated using a cubic pattern (Pauly, 1984; Efendie, 2002) with the formulation:

$$W = a\, L^{b}$$

$$\ln W = \ln a + b \ln L$$

W as the fish's body weight (g), L as fish length (mm), *a* as the intercept and slope b. Correlation parameters on length-weight relationship of *R. argyrotaenia* can be seen from the value of *b* (as probe closeness level relations between the two parameters). The *b* values represent the body shape of the fish. If the value of $b = 3$ indicating an isometric growth pattern where the length balanced with weight gain. If the value $b \neq 3$, it meant allometric growth patterns. The value of $b < 3$ means that negative allometric growth more dominant of length (slim). Value $b > 3$ means that the positive allometric growth more dominant of weight (plump) (Shukor *et al*. 2008; Amani *et al*. 2011; Yuanda *et al*. 2012)

To confirm the closeness of the relationship between the two parameters (value *b*) t_{test} (Efendie, 2002) with the formulation:

$$t_{test} = \frac{3 - b}{Sb}$$

b as the calculated value ratio of the length and weight of fish, *Sb* as the standard deviation value *b*

The hypothesis used in the study is H_0 (the null hypothesis) when the value of $b = 3$, then the growth patterns of fish body is isometric. While H_1 (alternative hypothesis) when the value of $b \neq 3$, the pattern of growth of fish body is allometric.

When the t-test used, the decision is made as follows If $t_{count} > t\text{-}_{table}$, then reject H_0 (value $b \neq 3$) it meant that length and weight relationship is either positive allometric ($b > 3$) or negative allometric ($b < 3$). If $t_{count} < t\text{-}_{table}$, then accept H_0 (b value = 3) or fish length and weight relationship was isometric.

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RESULT AND DISCUSSION

Sex ratio of Male and Female

A total of 2.381 specimens were colected throughout the study period. It is comprised 1.751 male (73.54%) and 630 female (26.46%) with the sex ratio of 3:1. The results of the chi-square analysis one end to the actual value and the expectation value generating probability value of 3.94598-19, where as the observations on the alpha value of 0.05 (95% confidence level), then p (3.94598-19) < alpha of 0.05 so that the alternative hypothesis (H_1) is accepted, there is a difference in the number of males and females. The sex ratio fish that live clustered generally be optimal if males and females 2: 1 (Yeni Rahman *et al*., 2013). According to Said and Mayasari (2010) the fish reproduction of *R. argyrotaenia* ex-situ achieve the optimal level sex ratio of male and female 2 : 1. While Ball and Rao (1984) states that the male and female ratio from the normal waters is 1: 1.

In the same cohort the body shape of males Rasbora fish is slimmer than females (Sterba, 1969). According to Nikolsky (1963), the size of female reproduction in general is larger than that of male because of having a great fecundity in stock. While Lagler *et al*. (1977) suggest that genetic factors are the cause of the difference in size between the sexes in fish. In addition, the number of female fish that produce a new individual in the process of reproduction (fertility) could affect fish stocks in the waters (Dodds, 2002).

Length-Weight Relationship

The analysis results of the length-weight relationship of *R. argyrotaenia* show that correlation coefficient (multiple R) between male and female was almost the same, with the value of 0.975 and 0.971 respectively.

A total of 1,751 males were evaluated. The Length-weight relationship of the male was stated as $W = 1{,}553 \times 10^{-5} L^{2{,}859}$, with the R^2 value was 0.951 which meant that variations in weight of the fish were influenced by variation in the length of fish by 95.1 percent, with the value of standard Error b (SE*b*) of 0.015. It means that small deviations regression coefficient of variable length of the fish and has contributed significantly to the variable weight of the fish (Fig. 3a). A total of 629 females were analyzed.

The length-weight relationship of the female was stated as $W = 1{,}291 \times 10^{-5} L^{2{,}915}$ with the value of R^2 was 0.944 which meant that the fish weight variations were influenced by variation in the length of fish by 94.4 percent, with the value of Standart error of b (SE*b*) of 0.028. It shows a little deviation regression coefficient variable length of the fish and makes a significant contribution to the variable weight of males (Fig. 3b).

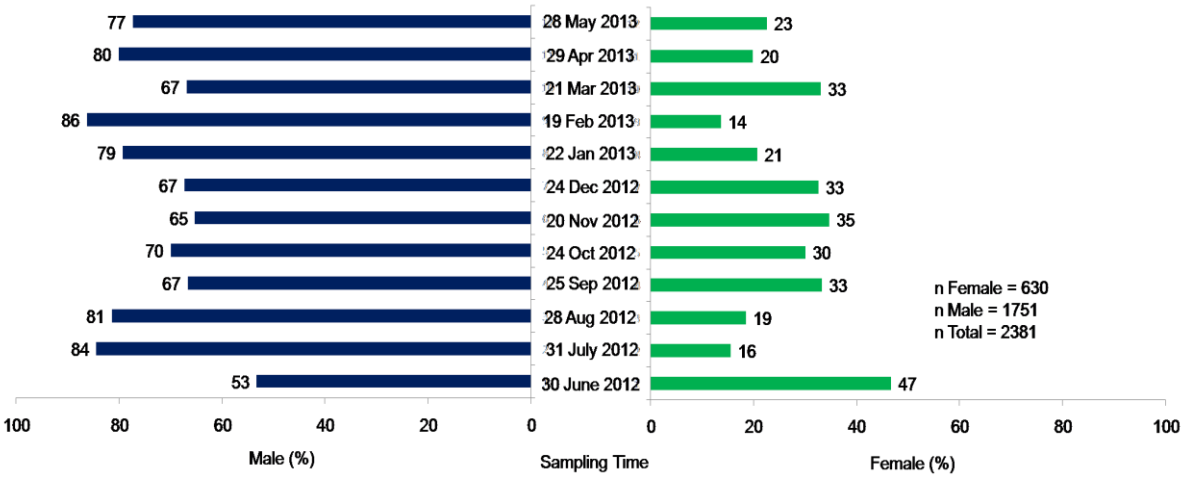

Figure 1. Sex ratio of *R. argyrotaenia* based on sampling time

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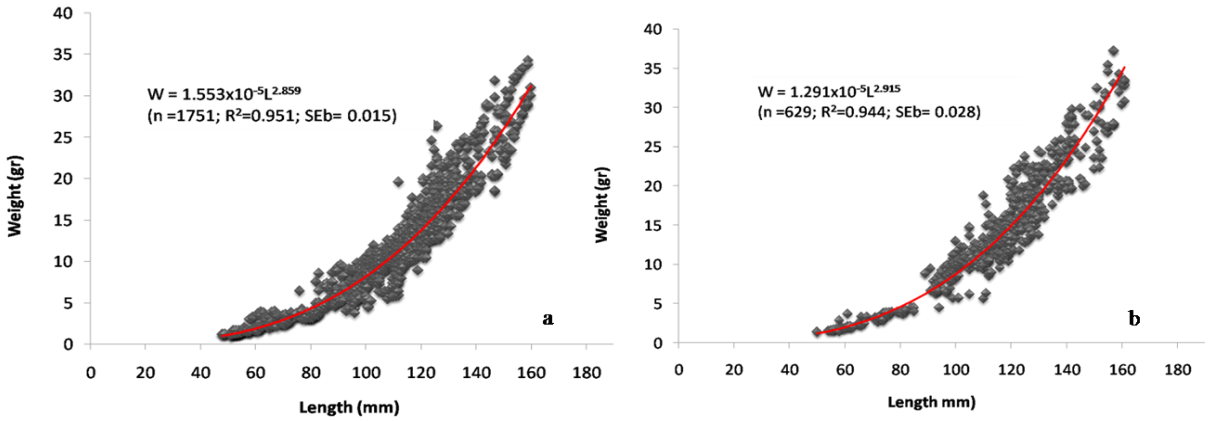

Figure 3. (a) Length-Weight Relationship of *R.argyrotaenia* (male)
(b) Length-Weight Relationship of *R.argyrotaenia* (Female)

The t-test shows that the growth pattern of both male and female was a negative allometric, which meant that the length of fish body is more dominant than the weight (slim) (Effendie, 2002). The result of the calculation of the value b t test ($\alpha = 0.05$) for the male shows that t_{count} (9.0106) was higher than t_{table} (1.645). It means the growth pattern of males was negative allometric with the values b ranged from 2.829 to 2.890. As for the female, t_{count} (2.9596) was also higher than t_{table} of (1.645). It means that growth pattern of females was also negative allometric with the values b was ranged from 2.860 to 2.972. The range of values b between males and females did not show a significant difference, according Tsounami *et al.* (2006) and Bagenal (1978), the difference value b (slope) in fish caused by the difference between the sexes fish.

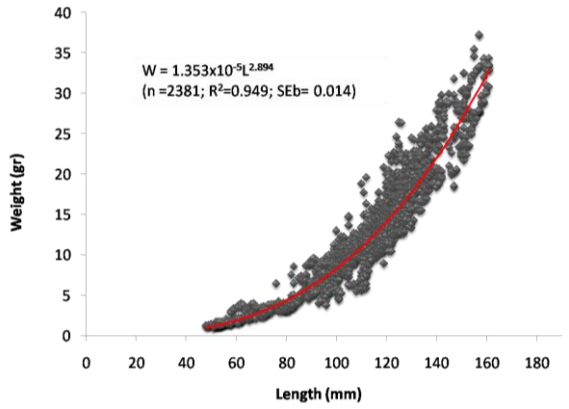

Figure 4. Length-Weight Relationship of *R.argyrotaenia* (Male and Female)

Based on the range of the value of b is obtained, the range did not show a significant difference between males and females. The similar results were also demonstrated in the length-weight relationship of total male and female (Fig. 4).

Lagler *et al.* (1977) explained that the value b could fluctuate between 2.5 to 4 and most close to the value 3. The range of value *b* in this study was clearly difined. It is thought to be caused by the fulfillment of the number of samples as stated by Gulland (1980).

Unique attributes like a fish body shape will help us understand why certain species are able to survive in the waters, and also can provide clues about environmental factors that can be adapted by fish (Allan and Castillo, 2007). Dodds (2002) states that the relationship between the length and weight of the fish can be used to assess the condition of the fish, a fish that has a high weight per unit length of the fish is considered healthy and in good shape.

Some researches related to the length-weight relationship of *R. argyrotaenia* were also reported by other studies. Sulistiarto (2012) conducted experiment in the flood plain of the Rungan river at Central Kalimantan and calculated the value *b* was less than 3 with a negative allometric growth pattern. Arsyad and Syaefudin (2010) focused on the Musi river of South Sumatra with the value *b* was 2.09 indicating a negative allometric growth pattern. The similar results were also reported in others species (Sunil,

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2000; Zahid, 2008; Kumar *et al*. 2006). It is quite the contrary with Dina (2008) in Maninjau lake at West Sumatra with positive allometric growth pattern (value of $b > 3$) and also Sidthimunka (1973) in the waters of Thailand with the value *b* was 3.03. Other researches focused on juvenile fish of the *R. sumatrana* (genus Rasbora) in Aceh made by Zakeyudin (2012) with the value *b* was 3.64.

Different growth patterns that represented the value of *b* in length-weight relationship of the fish was influenced among others by the growth phase of fish, fish size, availability of food, sex, gonad development, the health of fish and spawning period (Miranda *et al*. 2006; Andreu-Soler *et al*., 2006; Tsounami *et al*. 2006) and Kharat *et al*. (2008) suggested that the difference in the number and variety of fish sizes that were sampled in the study may lead to differences in the range of values *b*. Dodds (2002) explains that the indices of fish length and weight relationship can be used to assess the relative condition of individual fish habitat or to compare the condition of fish populations in different habitats.

CONCLUSION

The sex ratio of male and female of *R. argyrotaenia* sampled from Barito upstream of South Kalimantan was 3 : 1 and the growth pattern of this species was negative allometric.

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