The growth and reproduction of Seren (*Diplocheilichthys pleurotaenia*) in the Jatigede Reservoir Sumedang Regency Province of West Java

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Abstract. The research was conducted to find out the growth and productive pattern of Seren fish in Jatigede Sumedang Reservoir of West Java during the period of November 2016 to December 2016. The research used survey method with quantitative descriptive data analysis. Seren fish samples used in the study was 30 individuals collected in November 2016 and 41 individuals collected December 2016. The parameters observed namely were sex, gonads maturity level and index and fecundity. The results show that the average length of seren fish was 147 mm and the largest one was 273 mm. The fish growth patterns were allometrically negative. The condition factor ranged from 0.973 to 1.105. The ratio of nutritional fish seren was balanced between male and female fish. Gonad Maturity Index of male seren fish and female seren were relatively similar. The GMI male fish ranged between 0.285 to 11.055 % while the female GMI fish ranged from 1.23 to 11.76 %. The Seren fish of 225 mm has average fecundity of 10,032 grains, fish fitting 260 mm average 23,471 grains, there was a relationship between the addition of length size and fecundity.

1. Introduction

The Jatigede Reservoir has high fishery resources potential including indigenous fish Cimanuk River, introduction fish and restocking fish. The Sergeant Fish [1, 2, 3, 4, 5] is one of the fish found in the Cimanuk river basin and in Jatigede Reservoir. Seren is a fish consumption and it has a tasty meat and relatively less bones. So that the fish has high potential for aquaculture. It has also high potential for export commodity due to high abundant resource and big market opportunity.

The absence of management of fishery resources in the Jatigede Reservoir, especially on fishing activities conducted by communities would affect to fish community. Capture fishery activities conducted by the communities pay less attention to the sustainability of fish populations, so it is feared can cause to extinction of the indigenous fish in the Cimanuk River that has adapted to Jatigede Reservoir.

Fishery biological studies cover aspects of growth and reproduction as basic factor in the determination of fishery resources management policy both in capture fishery activities and conservation efforts of fish resources. This research aims to determine the growth and reproduction aspect of Seren fish in Jatigede Reservoir.
2. Materials and Methods

2.1. Materials
Fish samples were obtained from fishermen that catch the fish in Jatigede Reservoir around Sukamenak Village area, Darmaraja Sub-district from November to December 2016. The fish species (*Diplocheilichtys pleurotaenia*) was identified using some references book [1, 2, 3, 4, 5, 6, 7, 8, 9] and was to identified at LIPPI Cibinong, West Java Province. There were 30 individuals fish collected in November 2016 and 41 fish in December 2016. The fish was measured their total length and weight individually using millimeter block and electric balance, respectively, then egg diameter using micrometric microscope (1 μm accuracy). The fish was measured that Gonad Maturity index, fecundity using dissecting set, petri dish, dropper and measuring cup. The fish samples were obtained from Jatigede Reservoir in Sukamenak water area, Darmaraja sub District in November and December 2016. Research on growth and reproductive aspect analysis was conducted at Aquaculture laboratory Faculty of Fishery and Marine Science Universitas Padjadjaran Jatinangor. Fish identification at laboratory Indonesian Institute of Science, Cibinong Bogor Regency, Province of West Java.

2.2. Data analysis

2.2.1. Long-weight relations. The determination of fish growth pattern was done by calculating the relation of the weight length as described [9] as follows:

\[ W = aL^b \]  

where:
- \( W \) = fish weight (g)
- \( L \) = fish length (mm)
- \( a, b \) = constants

The relationship between the length and weight was analysed using regression equation \( (R^2) \) to know the influence of each variable, and analysed correlation value \( (r) \) to know the relationship between variables.

2.2.2. Conditional factor. Analysis of condition factors using the metric system [9] with the formula:

\[ K = 10^5WL^3 \]  

where:
- \( K \) = condition factor
- \( W \) = weight of fish (g)
- \( L \) = length of fish (mm)

2.2.3. Sex ratio. According to [10], the sex ratio is calculated by comparing the number of male and female fish obtained as follows:

\[ X = \frac{J}{B} \]  

where:
- \( X \) = sex ratio
- \( J \) = number of male fish
- \( B \) = number of female fish
2.2.4. Gonad maturity index (GMI). Calculation of Gonad Maturity Index/Gonado Somatic Index refers to method of fishery biology [9] with the following formula:

\[ GMI = \frac{B_g}{B_t} \times 100\% \]  

where:
GMI = gonad maturity index (%)
Bg = gonad weight (g)
Bt = Body weight of (g)

2.2.5. Fecundity. Fecundity of fish is determined by using gravimetric method by formula [9]:

\[ F = \frac{B_g}{B_s} \times F_s \]  

where:
F = total number of eggs (grains)
Fs = number of eggs on some gonads (grains)
Bg = weight of all gonads (g)
Bs = partial weight of gonads (g)

3. Results and Discussion

3.1. Weight distribution
Seren fish caught in the Jatigede Reservoir was vary in size, smallest size was 147 mm and weight was 64.90 g, while the largest size was 273 mm and weight was 255.32 g. The total length size catch in November 2016 was found mostly at interval between 147 and 171 mm (43 %) (figure 1a). In December 2016 the size majority was found at interval between 232 and 245 mm (37 %) (figure 1b).

![Figure 1](image1.png)

**Figure 1.** Weight distribution. (a) November 2016 and (b) December 2016.

Most Seren that caught in November are relatively smaller than Seren that caught in December. This indicates that Seren overall grow most in November and in December the growth are focused in reproduction organ.

3.2. Weight-length relation
The growth pattern of the Seren fish was allometric negative with the regression equation of length weight relationship in November 2016 i.e. log \( W = 1.6166 \log L^{-1.6481} \) (figure 2a), and in December that was log \( W = 2.7906 \log L^{-1.4412} \) (figure 2b). The correlation value on the long relationship of fish
Seren weight ranged from 0.9308 to 0.9547 which showed very strong relationship [11]. The regression value of the relationship of weight lengths ranged from 0.8663 to 0.9115, meaning 86.63 to 91.15 % growth length affects weight growth.

3.3. Condition factor
Seren fish condition factor in November 2016 ranged from 0.973 to 1.088 (figure 3a), while in December 2016 ranged from 1.029 to 1.105 (figure 3b), the low level of condition factor in November was due to the small dominant fish caught in which the growth of seren fish in size between 147 to 171 mm. In November the maximum condition factor was reached at the size interval between 222 to 246 mm, (figure 3a) meanwhile in December was reached at interval size between 218 to 231 mm (figure 3b). Achieving the maximum condition factor at that size, because the fish’s gonad is in mature condition (GML IV). The process of formation of reproductive cells peaked at GML IV [12], so that the condition factor will be high and will decrease after the completion fish spawn or the GML V.

3.4. Sex ratio
The sex ratio of fish in November 2016 showed the male and female ratio was 47:53 % or 1:1, whereas in December 2016 the male and female ratio was 59:41 % or 3:2. The chi square test of sex ratio in November showed that \( \chi^2 \text{ count} = 0.36 < \chi^2 \text{ table} = 3.84 \) means the ratio between male fish and female fish was balanced (1:1) (figure 4a). The result of chi square test of sex ratio of fish in December showed that \( \chi^2 \text{ count} = 3.24 < \chi^2 \text{ table} = 3.84 \) means the ratio between male fish and female fish is balanced (1:1) (figure 4b).
3.5. Gonad maturity level

Male gonad maturity level of male Seren was generally at stage I and II, while in female Seren was at stage IV. In November 2016, male Seren was mostly in the condition of GML II of 8 fish, whereas in female Seren mostly at the condition of GML IV counted 10 fish (figure 5). In December 2016, male Seren is mostly in GML I condition as much as 18 fish, whereas in female seren most at GML IV condition are 13 fish (figure 6). It shows that female Seren fish have a chance to spawn every month.

**Figure 4.** Seren sex ratio. (a) November 2016 and (b) December 2016.

**Figure 5.** Male fishes gonad maturity level. (a) November 2016 and (b) December 2016.

**Figure 6.** Female fishes gonad maturity level. (a) November 2016 and (b) December 2016.
3.6. Gonad maturity index
The gonad maturity index in male Seren ranged between 0.29 to 11.06 % (figure 7) while in female seren ranged between 1.19 to 11.76 % (figure 8). The GMI value of the Seren fish increased from GML I to the maximum IKG value in GML IV and the GML value decreased again in GML V.

![Figure 7. Male fishes gonad maturity index. (a) November 2016 and (b) December 2016.](image1)

![Figure 8. Female fishes gonad maturity index. (a) November 2016 and (b) December 2016.](image2)

3.7. Length and fecundity value relation
Seren fish with length 225 mm has an average fecundity value of 10,032 grains, Seren fish with length 260 mm has average fecundity value 23,471 grains. Length relationship with fecundity in seren fish in November 2016 following equation \( \log F = 7.903 \log L^{14.65} \) with value \( R^2 = 0.5291 \) means 52.91 % the length influence fecundity value (figure 9 (a)). In December 2016, the length relationship with fecundity equation follows the \( \log F = 0.6858 \log L^{2.6598} \) with the value \( R^2 = 0.0197 \) means 1.97 % of the length of the fecundity as can be seen in figure 9.
3.8. The first size of mature gonad

Seren that caught in November and December are in GLM I to GLM V, there are no fish that length 147 to 203 mm that the gonad is already ripe. Seren fish that have been ripe gonad first and have spawn at least 1 times is on the size of 204 to 222 mm (figure 10).

Based on the size distribution, Seren that caught in November to December 2016 in Jatigede Reservoir experienced growth and development. In November the smallest fish caught a total length of 147 mm and was the most caught fish, whereas in December the smallest fish caught a total length of 190 mm and the most caught fish measured the total length between 232 to 245 mm as much 37%.

The growth pattern is allometrically negative, meaning that the length increase is relatively faster than the weight gain, but there is a close correlation between the length increase and the weight, meaning that if there is a long increase followed by weight gain.

The fish condition factor in December was relatively better than in November. In December, the condition factor of the total length between 218 to 231 mm was 1.105 while in November the condition factor of the total length between 222 to 246 mm is 1.088. The occurrence of an increase in the condition of the condition closely related to the development of reproductive organs is the level of gonad maturity. In December there are many female fish that are ready to be mijah female fish with maturity level of gonad IV, these fish added weight is bigger than the length increase, morphology of fish look plump and mathematically can be seen from regression equation as follows, at month November ie log W = 1.6166 log L -1.6481 and in December that is log W = 2.7906 log L -4.4422.
4. Conclusion and Suggestion

4.1. Conclusion
Based on the research results, it can be concluded that Seren fish has a negative allometric growth pattern. The condition factor ranges from 0.973–1.105. Sex ratio of male and female Seren 1:1. The Maturity Index of Gonad of male and female Seren are relatively similar. The Seren fish of measuring 225 mm average fecundity of 10,032 grains, fish size 260 mm fecundity average 23,471 grains. Moreover, there is a relationship between the addition of length size and fecundity. We suggest that the 5 inch mesh sizes are safe for the Seren fish sustainability in the Jatigede Reservoir.

4.2. Suggestion
It is necessary to conduct long-term research in order to know the exact growth pattern and peak spawning.

References
[1] Karnasuta J 1993 Systematic Revision of Southeastern Asiatic Cyprinid Fish Genus Osteochilus with Description of Two New Species and a New Subspecies (Thailand: Kasetsart University Fishery Research Bulletin) p 105
[2] Kottelat M, A J Whitten, S N Kartikasari and S Wirjoatmodjo 1993 Freshwater Fishes of Western Indonesia and Sulawesi (Hong Kong: Periplus Editions) p 260
[3] Kottelat M, A J Whitten 1996 Freshwater Fishes of Western Indonesia & Sulawesi: Additions and Corrections (Hong Kong: Periplus Editions) p 8
[4] Kottelat M 2001 Fishes of Laos (Srilanka: WHT Publications) p 198
[5] Kottelat M 2013 The Fishes of the Inland Waters of Southeast Asia: a Catalogue and Core Bibliography of the Fishes Know to Occur in Freshwaters, Mangroves and Estuaries (Singapore: The Raffles Bulletin of Zoology) p 663
[6] Hadiaty R K and Siebert D J 1998 Rev. Fr. Aquariol 22 1–4
[7] Nelson J S 2006 Fishes of the Word 4th Ed. [New Jersey: John Willey & Sons, Inc.] p 601
[8] Hui T H and M Kottelat 2009 Ichthyol. Explor. Freshwaters 20 13-69
[9] Herawati T 2017 Modul Praktikum Biologi Perikanan (Sumedang: Unpad Press)
[10] Haryani G S 1998 Analisa Histologi Gonad Ikan-ikan di Perairan Danau Semayang (Cibinong: Limnology Research Center LIPI) pp 632–637
[11] Sugiyono 2012 Metode Penelitian Kuantitatif Kualitatif dan R&D (Bandung: Alfabeta) p 380
[12] Mote N 2014 Biologi Reproduksi Ikan Brek (Barbonymus balleroides Cuvier & Val. 1842) di Sungai Serayu Kabupaten Banjarnegara Provinsi Jawa Tengah (Bogor: Bogor Agricultural Institute)