Fisheries Journal, 15 (6), 3117-3124 (2025)
http://doi.org/10.29303/jp.v15i6.1939

BIOLOGY REPRODUCTION OF SNAKEHEAD FISH (*Channa* sp.) AT PELUS RIVER BANYUMAS REGENCY

Aspek Biologi Reproduksi Ikan Gabus (*Channa* sp.) pada Sungai Pelus Kabupaten Banyumas

Muhammad Azharul Rijal*, Dewi Susylowati, Ikhsan Pratama

Aquaculture Study Program, Muhammadiyah University of Purwokerto

KH Ahmad Dahlan Street, PO Box 202, Purwokerto

*Corresponding author: MAzharulRijal@ump.ac.id

(Received October 30th 2025; Accepted December 28th 2025)

ABSTRACT

The Pelus River is one of several rivers in Banyumas Regency. The Pelus River is 20 km long and flows into the Klawing River in the Sokaraja area. Snakehead fish is an endemic fish from Asia, which belongs to the Channidae family of fish that has high economic value. Fish biology studies can be one of the basic references during the fish domestication process. This research method is a survey with a purposive random sampling technique. There are three research stations: upstream, middle, and downstream. At the research station there are three sampling points. The results of this study on the sex ratio are 1:1.9 which indicates an abnormal comparison in the Pelus River. In the aspect of fish reproductive biology, the HSI value of Snakehead Fish (*Channa* sp.) ranges from 0.76 - 1.04%, this HSI value is still relatively low because it is still below 2%. The GSI value of Snakehead Fish (*Channa* sp.) ranges from 0.23% to 0.38%. The GSI value is still below the standard gonad maturity of 4% for fish ready to spawn. The VSI value of the Snakehead Fish (*Channa* sp.) ranges from 3.45% - 3.57%, meaning that the VSI value is still in a condition towards the level of gonad maturity for spawning. The HSI, GSI, and VSI values are below normal for fish, this is because at the time of sampling the Snakehead fish had finished at the peak of fish spawning. The peak spawning of Snakehead fish occurs from December to April. The water quality of the Pelus River is still in good condition for fish life and towards the spawning of Snakehead Fish (Channa sp.).

Keywords: Reproductive Biology, Snakehead Fish, Pelus River, Water Quality, Sex Ratio

ABSTRAK

Sungai Pelus merupakan satu dari beberapa Sungai yang terdapat pada Kabupaten Banyumas. Panjang Sungai Pelus Adalah 20 km dan bermuara pada Sungai Klawing pada daerah Sokaraja. Ikan Gabus adalah salah satu ikan endemic dari Asia, yang termasuk pada golongan ikan famili Channidae yang memiliki ekonomis yang tinggi. Studi biologi ikan dapat menjadi salah satu acuan dasar saat prosos domestikasi ikan. Metode penelitian ini adalah survei dengan teknik pengambilan sampling *purposive random sampling*. Terdapat tiga stasiun penelitian yaitu hulu, tengah, hilir. Pada stasiun penelitian ada tiga titik sampling. Hasil dari penelitian ini pada

nisbah kelamin terdapat 1:1,9 yang mengindikasikan terjadi perbandingan tidak normal pada Sungai Pelus. Pada aspek biologi reproduksi ikan Nilai HSI Ikan Gabus (*Channa* sp.) berkisar pada nilai 0,76 – 1,04 %, nilai HSI ini masih tergolong rendah karena masih dibawah 2%. Nilai GSI Ikan Gabus (*Channa* sp.) berkisar pada 0,23 % hingga 0,38%. Nilai GSI ini masih dibawah standar kematangan gonad yaitu 4% bagi ikan yang siap untuk memijah. Nilai VSI Ikan Gabus (*Channa* sp.) berkisar 3,45% - 3,57% berarti nilai VSI ini masih dalam kondisi menuju tingkat kematangan gonad untuk pemijahan. Nilai HSI, GSI dan VSI memiliki dibawah normal ikan, hal ini dikarena kan pada saat pengambilan sampel ikan Gabus sudah selesai pada puncak pemijahan ikan. Puncak pemijahan ikan Gabus terjadi pada Bulan Desember hingga April. Kualitas air Sungai Pelus masih dalam kondisi yang baik untuk kehidupan ikan dan menuju pemijahan ikan Ikan Gabus (*Channa* sp.).

Kata Kunci: Biologi Reproduksi, Ikan Gabus, Sungai Pelus, Kualitas Air, Nisbah Kelamin

INTRODUCTION

Pelus River is one of several rivers located in Banyumas Regency. The length of the Pelus River is 20 km and it discharges into the Klawing River in the Sokaraja area (Rayhan *et al.*, 2023). The watershed (Daerah Aliran Sungai/DAS) flows from the upstream area in Baturraden District to the downstream area in Sokaraja District. The downstream section of the Pelus River has been extensively bordered by residential settlements (Lukmanulhakim *et al.*, 2023). Communities around the Pelus River conduct fishing exploitation activities, resulting in a continuous decline in fish populations and catch yields in the Pelus River (Susanto & Rijal, 2021). The decrease in fish population due to fishing catches has led to the establishment of a Regional Regulation (Perda) concerning fish exploitation in the Pelus River. One of the fish species exploited through capture fisheries is snakehead fish (*Channa* sp.). Snakehead fish is a species with high economic value and still relies heavily on capture from rivers.

Snakehead fish is one of the endemic fish species from Asia and belongs to the family Channidae (Zhao *et al.*, 2021). In Indonesia, snakehead fish has local names such as Haruan fish (Banjarmasin), Kocolan fish (Jakarta), and Bogo fish (Java) (Maulana *et al.*, 2021). Snakehead fish has a high economic value ranging from IDR 35,000 to 60,000 per kg (Cahyanti *et al.*, 2021). The utilization of snakehead fish is not limited to consumption; its albumin is also used for pharmaceutical purposes (Agussyarif *et al.*, 2022). This broad utilization has caused the population in rivers to continue declining. One effort to maintain the snakehead fish population is through aquaculture activities. Preliminary information regarding snakehead fish aquaculture requires an understanding of the reproductive biology aspects of snakehead fish (Djumanto *et al.*, 2020).

Fish biology studies can serve as one of the basic references in the process of fish domestication (Anisa *et al.*, 2022). Reproduction is the ability of individuals to produce offspring so that extinction does not occur. Fish physiological conditions are strongly influenced by physiological and environmental conditions. Ecological factors play an important role in fish physiology. Temperature, salinity, and photoperiod greatly affect fish survival, body metabolism, growth, and reproduction (Ha *et al.*, 2021). Parameters in reproductive biology may include gonadosomatic index, gonadal maturity level, hepatosomatic index, viscerosomatic index, and fish fecundity (Rijal *et al.*, 2023). The purpose of this study is to determine the reproductive biology aspects of snakehead fish in the Pelus River, which include gonadal maturity level, gonadosomatic index, hepatosomatic index, sex ratio, and fecundity.

METHODS

The method used was a survey, with the sampling technique employing purposive random sampling. The research location was the Pelus River watershed (DAS) in Banyumas Regency. The research location was divided into three major areas, namely the upstream, middle, and downstream sections of the Pelus River. The upstream section of the river is located in Rempoah Village, Baturraden District, while the middle section is located in Karangwangkal District, and the downstream section is located in Sokaraja District. Each location was divided into three observation stations. At each observation station, sampling was conducted at the riverbank, middle, and opposite riverbank. The study was conducted for four months, namely April, May, June, and July 2025.

In this study, the observed data variables consisted of reproductive biology variables and environmental parameter variables. The reproductive biology variables of snakehead fish included gonadosomatic index, viscerosomatic index, hepatosomatic index, gonadal maturity level, sex ratio, fecundity, and egg diameter. Meanwhile, the environmental variables measured included dissolved oxygen, acidity (pH), water transparency, current velocity, and temperature.

Data Collection Methods

Fish Reproductive Variables

Snakehead fish were collected from the Pelus River using fishing rods and nets. The sampling locations for snakehead fish were at three stations, namely the upstream, middle, and downstream sections of the river. The collected snakehead fish were gathered and dissected on the following day. Dissection was carried out at the Aquaculture Laboratory, Faculty of Agriculture and Fisheries, Universitas Muhammadiyah Purwokerto. After dissection, the following measurements were conducted:

Gonadal Somatic Index

The Gonadal Somatic Index (GSI) was obtained by weighing the total body weight of fish samples at the end of the study. Subsequently, dissection was performed and the gonads were removed. The gonads were carefully weighed using a high-precision balance. The GSI was then calculated using the formula (Azharul Rijal & Pratama, 2024)(Azharul Rijal & Pratama, 2024):

$$\text{GSI (\%)} = \frac{WG}{H} \text{ x } 100\%$$

Description:
GSI : Gonadal Somatic Ink
WG : Gonad Weight
W : Fish Body Weight

Viceral Somatic Index

The Viceral Somatic Index (VSI) is obtained by weighing the total weight of fish samples at the end of the study. Dissection is then performed to remove all body parts. The internal organs are carefully weighed on a highly accurate scale. The calculation is then carried out using the following formula (Rijal *et al*., 2023):

$$\text{VSI (\%)} = \frac{WV}{H} \text{ x } 100\%$$

Description:
VSI : Visceral Somatic Index

WV : Internal Organ Weight
W : Fish Body Weight

Hepatosomatic Index

The Hepatosomatic Index (HSI) is obtained by weighing the total weight of the fish sample at the end of the study. The liver is then dissected and removed. The liver is carefully weighed on a highly accurate scale. It is then calculated using the following formula (Rijal *et al*., 2023):

$$\text{HSI (\%)} = \frac{WH}{W} \text{ x } 100\%$$

Description:
HSI : Hepatosomatic Ink
WH : Liver Weight
W : Fish Body Weight

Sex Ratio

The sex ratio can be calculated using the following formula according to (Anisa *et al*., 2022):

$$X = \frac{n}{N} \text{ x } 100\%$$

Description:
X: Sex ratio
N: Number of males or females
N: Total number of male and female fish

Environmental quality variables

The environmental quality of the Pelus River was observed at three locations: the upstream, middle, and downstream. Each research location was divided into three observation stations. At each observation station, measurements were taken at the riverbank, middle, and downstream to reflect the water quality of the Pelus River. Measurements included dissolved oxygen, acidity, clarity, current strength, and temperature. Water quality measurements were performed using a tool called a water quality checker. Water quality measurements were conducted in situ.

RESULTS

The results of the study on the reproductive biology of the Snakehead Fish (*Channa* sp.) from June to September 2025 are presented in Tables 1 and 2. Table 3 presents the results of water quality parameters.

Table 1. Comparison of sex ratios of Snakehead Fish (*Channa* sp.) caught from June to September 2025 in the Pelus River.

Month	Number of catches	Gender		Sex ratio
		Male	Female	
June	8	7	1	1 : 7
July	20	12	8	1 : 1,5
August	12	9	3	1 : 3
September	10	5	5	1 : 1
Total	50	33	17	1 : 1,9

Table 1 shows the number of fish caught during the study from June to September 2025. A total of 50 fish were caught. The sex ratio during the study ranged from 1:0.14 to 1:1.9. More males were caught than females. The total sex ratio during the study was 1:1.9.

Table 2. Results of the Average Hepatosomatic Index, Gonadal Somatic Index, and Viceral Somatic Index Calculations for Snakehead Fish (*Channa* sp.) caught in the Pelus River

Month	Parameter		
	Hepato Somatic Index	*Gonadal Somatic Index*	*Viceral Somatic Index*
June	1,04 %	0,26 %	3,49 %
July	1,58 %	0,35 %	3,45 %
August	0,95 %	0,23 %	3,57 %
September	0,76 %	0,38 %	3,54 %

Table 2 shows the average values for the Hepato-Somatic Index (HSI), Gonadal Somatic Index (GSI), and Visceral Somatic Index (VSI). During the study, from June to September, HSI values ranged from 0.09% to 1.58%. GSI values ranged from 0.00% to 4.51%, while VSI values ranged from 1.53% to 7.37%.

Table 3. Range of water quality parameters in the Pelus River during the study, June–September 2025.

Parameters	Range	Average	Water Quality Standards (PP No. 82 of 2001)
Dissolved Oxygen	4,68 – 8,25 ppm	5,86 ppm	> 3
Temperature	25,1 – 31,2 °C	27,8 °C	Deviation 3 (25 – 32 °C)
Potential Hydrogen (pH)	6 – 7	6,3	6 – 9
Current Strength	0,40 – 1,63 m/s	0,88 m/s	-
Brightness	25 – 65 cm	52,4 cm	-

Table 3. Shows the range and average values of water quality parameters during the study from June to September 2025.

DISCUSSION

The total number of Snakehead fish (*Channa* sp.) caught during the study was 50 individuals, consisting of 33 males and 17 females. The overall sex ratio of snakehead fish was 1 : 1.9 (male). This sex ratio indicates that the population composition of snakehead fish in the Pelus River is unbalanced (Fatah *et al.*, 2023) (Susanto & Rijal, 2021). This ratio value indicates the need for a higher proportion of females to increase reproductive success. Snakehead fish are a type of fish that naturally exhibit a 1 : 1 sex ratio during the spawning process (Selviana *et al.*, 2020). Changes toward a 1 : 1 sex ratio can be influenced by several factors, including distribution patterns, activity, and fish distribution within the river. In addition, age and the amount of nutrients consumed by fish also affect the process of sex distribution (Rijal *et al.*, 2025). Information on sex ratio can serve as important information for determining the potential spawning biomass of fish. Fish spawning strategies depend on environmental and food factors. Fish species generally have a 1 : 1 sex ratio; however, there is no clear difference between a 1 : 1 ratio or a higher ratio in freshwater fish (Mian *et al.*, 2020).

The Gonadal Somatic Index (GSI) is one of the important parameters in fish biological aspects because it provides an overview of fish reproduction and describes the spawning period. Research conducted by Chandra Yadav (2022) stated that the peak spawning of snakehead fish (*Channa* sp.) occurs in May and June, indicating that the low GSI values

observed from June to September in this study are due to the spawning peak having already occurred. Research conducted by Fatah *et al.* (2023) stated that the highest GSI peak in snakehead fish occurs in December and January. This study recorded GSI values ranging from 0.26% to 0.38%. These values indicate that the fish were not yet ready for spawning and that no mature gonads were present for spawning. Appropriate and ready-to-spawn GSI values in fish are those exceeding 4% (Ansyari, 2021) (Nazir *et al.*, 2024).

The Hepato Somatic Index (HSI) is one of the parameters that can be used to describe the phase and level of egg development in fish. HSI is used as an indicator of energy reserves in the fish body during gonadal maturation (Noor Yasin *et al.*, 2022). The percentage value of HSI depends on liver weight and body weight. The liver serves as the site of steroid synthesis activity of estradiol 17β in the blood, which in the liver is converted into vitellogenin (Noor Yasin *et al.*, 2022) (Rawat *et al.*, 2020). HSI values indicate liver performance in vitellogenin activity during the early stages of gonadal maturation (Rijal *et al.*, 2021). In this study, HSI values ranged from 0.76% to 1.04%. A suitable HSI range for the gonadal maturation process is above 2%; therefore, the HSI values observed in this study indicate a post-spawning condition, with metabolic processes directed toward gonadal development (Noor Yasin *et al.*, 2022) (Mian *et al.*, 2020).

The Visceral Somatic Index (VSI) is related to the utilization of energy required by fish for gonadal development. Gonadal development involves the accumulation of fat and protein reserves contained in developing eggs. The required proteins and lipids originate from the visceral organs and liver of the fish; therefore, GSI, HSI, and VSI values are interrelated during the gonadal maturation process. This study recorded VSI values ranging from 3.45% to 3.57%, indicating that VSI values were still within the normal stage of gonadal development in snakehead fish (*Channa* sp.) (Rijal *et al.*, 2025).

The results of water quality measurements during the study at the research stations generally indicated conditions that were still suitable for fish survival. Overall water quality results were compared with the water quality standards according to Government Regulation No. 82 of 2001.

CONCLUSION

The study on the reproductive biology aspects of snakehead fish (*Channa* sp.) caught in the Pelus River during June–September 2025 can be concluded as follows: the sex ratio of 1 : 1.9 indicates an unbalanced condition. The HSI values of snakehead fish (*Channa* sp.) ranged from 0.76% to 1.04%, which are still considered low because they are below 2%. The GSI values of snakehead fish (*Channa* sp.) ranged from 0.23% to 0.38%. These GSI values are still below the gonadal maturity standard of 4% for fish ready to spawn. The VSI values of snakehead fish (*Channa* sp.) ranged from 3.45% to 3.57%, indicating that VSI values were still approaching the level of gonadal maturity for spawning. The water quality of the Pelus River remains in good condition to support fish life and toward the spawning of snakehead fish (*Channa* sp.).

ACKNOWLEDGMENTS

We express our gratitude to the Institute for Research and Community Service of Universitas Muhammadiyah Purwokerto for funding this research until its completion. Appreciation is also extended to all parties who assisted during the research process and the preparation of the article until its publication.

REFERENCE

Agussyarif, H., Talitha Tiara, A., & Akhmad, M. (2022). The Spawning Rate of Snakehead Fish (*Channa striata*, Bloch 1793) with Natural and Semi-Natural Methods. *Russian Journal of Agricultural and Socio-Economic Sciences (RJOAS)*, *125*(5), 279–287. https://doi.org/10.18551/rjoas.2022-05.33

Anisa, N., Prayogo, N. A. A., Rukayah, S., & Lestari, W. (2022). Biologi Reproduksi Ikan Gabus (*Channa striata* Bloch, 1793) yang Tertangkap di Waduk PB. Soedirman, Kabupaten Banjarnegara. *MAIYAH*, *1*(1), 1–11. https://doi.org/10.20884/1.maiyah.2022.1.1.6631

Ansyari, P. (2021). Sex Ratio, Gonad Maturity Level and Gonado-Somatic Index of Snakehead (*Channa striata*) from Danau Bangkau, Indonesia. *AACL Bioflux*, *14*(6), 3326–3334. http://www.bioflux.com.ro/docs/2021.3326-3334.pdf

Cahyanti, W., Saputra, A., & Kristanto, A. H. (2021). Performa Reproduksi dan Larva Ikan Gabus (*Channa striata* Blkr) dengan Beberapa Teknik Pemijahan. *Jurnal Riset Akuakultur*, *16*(2), 99–106. https://doi.org/10.15578/jra.16.2.2021.99-106

Chandra Yadav, K. (2022). Study of Gonado-Somatic Index (GSI) of Male and Female Striated Murrel *Channa striatus* (Bloch, 1793) in Etawah District. *International Journal of Fisheries and Aquatic Studies*, *10*(1), 31–34. https://doi.org/10.22271/fish.2022.v10.i1a.2621

Djumanto, Setyobudi, E., Simanjuntak, C. P. H., & Rahardjo, M. F. (2020). Estimating the Spawning and Growth of Striped Snakehead *Channa striata* Bloch, 1793 in Lake Rawa Pening Indonesia. *Scientific Reports*, *10*(1), 19572. https://doi.org/10.1038/s41598-020-76825-5

Fatah, K., Riani, E., & Pratomo, H. (2023). Reproductive Biology of Striped Snakehead (*Channa striata*, Bloch, 1793) in Floodplain of Lubuk Lampam, South Sumatra. *Sainmatika: Jurnal Ilmiah Matematika dan Ilmu Pengetahuan Alam*, *20*(2), 102–113. https://doi.org/10.31851/sainmatika.v20i2.12828

Ha, N. T. K., Thuy, L. T. N., Em, N. T., Phuong, N. T., & Huong, D. T. T. (2021). Effects of Salinity on Selected Reproductive Physiological Parameters of Striped Snakehead Fish *Channa striata*. *AACL Bioflux*, *14*(6), 3465–3476. http://www.bioflux.com.ro/docs/2021.3465-3476.pdf

Lukmanulhakim, R. C., Hidayati, N. V., & Baedowi, M. (2023). Analisis Kandungan Logam Berat Kadmium (Cd) dan Kromium (Cr) pada Matriks Air di Sungai Pelus Kabupaten Banyumas, Jawa Tengah. *MAIYAH*, *2*(1), 41–50. https://doi.org/10.20884/1.maiyah.2023.2.1.8295

Maulana, M. H., Wicaksono, R. D., & Suciyono. (2021). Differences Size of *Channa striata* Broodstock and the Number of Eggs Produced in Natural Spawning. *IOP Conference Series: Earth and Environmental Science*, *718*(1), 012046. https://doi.org/10.1088/1755-1315/718/1/012046

Mian, S., Wahab, A., & Mohammed, S. (2020). Reproductive Biology of *Channa punctatus*. *Bulletin of Environment, Pharmacology and Life Sciences*, *9*(2), 52–59.

Nazir, S., Khan, N., Hussain, D., Bano, S., Batool, M., Asghar, M., Ali, M. A., Hussain, Z., Tanveer, A., & Davies, S. J. (2024). Effects of Synthetic Hormones on Fertilization, Fecundity, Hatching and Gonado-Somatic Index of Giant Snakehead (*Channa marulius*) in Captivity. *Journal of Zoology and Systematics*, *2*(1), 44–52. https://doi.org/10.56946/jzs.v2i1.412

Rawat, A., Raizada, S., Yadav, K. C., & Sahu, V. (2020). Induced Spawning and Embryonic Development of Striped Murrel *Channa striata* (Bloch, 1793) under Indoor Conditions Using Salmon Gonadotropin Releasing Hormone Analogue (sGnRHa). *Indian Journal of Fisheries*, *67*(3), 52–61. https://doi.org/10.21077/ijf.2020.67.3.97091-06

Rayhan, N. N., Arrisqi, A. Z., Putra, R. P., Faizah, F. N., Condro, A., Putri, N. A. V., & Permatasari, E. D. (2023). Struktur Komunitas Makrozoobentos sebagai Bioindikator Perairan Sungai Pelus, Banyumas, Jawa Tengah. *MAIYAH*, *2*(3), 148–156. https://doi.org/10.20884/1.maiyah.2023.2.3.9084

Rijal, M. A., Pratama, I., Susanto, S., & Agung, R. M. (2025). Studi Morfoanatomi Gonad dan Fekunditas Ikan Nilem (*Osteochilus vittatus*) dengan Pakan Suplementasi Tepung Spirulina. *Jurnal Perikanan Unram*, *15*(1), 226–232. https://doi.org/10.29303/jp.v15i1.1329

Rijal, M. A., Purbomartono, C., & Jannah, I. F. (2021). Respon Pertumbuhan Ikan Nila (*Oreochromis niloticus*) yang diberi Pakan Suplementasi Bawang Putih (*Allium sativum*) pada Sistem Bioflok. *SAINTEKS*, *18*(2), 173–183. https://doi.org/10.30595/sainteks.v18i2.11585

Rijal, M. A., Susanto, S., & Izzah, I. M. (2023). Respon Reproduksi dan Pertumbuhan Ikan Nilem (*Osteochilus vittatus*) yang Diberikan Pakan Suplementasi Tepung Spirulina (*Spirulina platensis*). *Sainteks*, *20*(1), 39–48. https://doi.org/10.30595/sainteks.v20i1.16893

Susanto, S., & Rijal, M. A. (2021). The Characteristics of Fish Diversity and Age Structure in Pelus River Area Residency of Banyumas-Indonesia. *Sainteks*, *18*(1), 75–83. https://doi.org/10.30595/sainteks.v18i1.10444

Yasin, N. M., Gunawan, I., & Gultom, E. N. (2022). Analisis Tingkat Kematangan Gonad Ikan Gabus (*Channa striata*) yang Dipacu dengan Penyuntikan Gonadotropin Releasing Hormon dan Anti Dopamine (GnRH-a) Dosis Berbeda. *Jurnal Ilmu Hewani Tropika*, *11*(1), 21–26. https://doi.org/10.35781/jiht.v11i1.233

Zhao, J., Ou, M., Wang, Y., Liu, H., Luo, Q., Zhu, X., Chen, B., & Chen, K. (2021). Breeding of YY Super-Male of Blotched Snakehead (*Channa maculata*) and Production of All-Male Hybrid (*Channa argus* ♀ × *C. maculata* ♂). *Aquaculture*, *538*, 736450. https://doi.org/10.1016/j.aquaculture.2021.736450