Journal of Wildlife and Conservation Medicine
p-ISSN: 3090-5656; e-ISSN: 3109-8436
https://journal.ipb.ac.id/index.php/jwcm

Samosir *et al.*
Vol 1 No 2, December 2025, Pp 55–61
DOI: 10.29244/jwcm.1.2.55

Research **OPEN ACCESS**

Assessment of reproductive organs of *Varanus salvator* harvested from Riau Province, Indonesia

Hartina Samosir*, Septiwanti Septiwanti, Fitra Yati, Olivia Tirta Asih Manurung

Natural Resources Conservation Agency (BBKSDA) of Riau, the Directorate General of Nature Resources and Ecosystem Conservation, the Ministry of Forestry of the Republic of Indonesia, Pekanbaru, Indonesia

Abstract

Background More than half of Indonesia's national harvest quota for *Varanus salvator* originates from Sumatra, with Riau Province being one of the top five contributors on the island. Researchers from the National Research and Innovation Agency of the Republic of Indonesia have conducted studies on the reproductive organs of this species in North and South Sumatra, but Riau has not yet been studied. This kind of research is necessary to evaluate whether the commercial harvesting of monitor lizards in Riau is sustainable.

Objective The present study aimed to investigate sexual dimorphism, reproductive organs, population reproductive rates, and body size morphometrics of *V. salvator* in Riau Province, Indonesia.

Methods A total of 660 *V. salvator* were measured for their snout–vent length (SVL) and body mass. For reproductive assessment, direct gonadal inspections were performed after the animals were slaughtered and skinned. The parameters recorded included sex and gonadal condition (testes or ovaries) to evaluate sexual maturity and reproductive trends within the harvested population. All animals were euthanized following standard animal welfare procedures by staff at the slaughterhouse.

Results The sex ratio of the study population was 58.48% males (n = 386) and 41.52% females (n = 274). Analysis of the reproductive organs, along with SVL and body mass, showed that males were larger than females. Females reached reproductive maturity at approximately 40 cm SVL, as indicated by the presence of developing follicles. Males of similar SVL exhibited enlargement of the right testis, suggesting the onset of reproductive maturity.

Conclusion The assessment of the reproductive organs of *V. salvator* harvested from Riau Province, Indonesia, showed that for males, a larger body size correlates with a longer SVL and larger testis size. Similarly, for females, larger body size is associated with a longer SVL and larger secondary follicles.

Keywords Sexual dimorphism | snout–vent length | reproductive organs | *Varanus salvator* | body mass

Introduction

Varanus salvator, known as the water monitor, is a highly adaptable and resilient species. This reptile species can be found in Indonesia, Malaysia, Sri Lanka, and India. In Indonesia, this species is distributed across the main islands, including Kalimantan, Sumatra, Sulawesi, and Java, as well as smaller islands such as Nias, Enggano, Bangka, Bali, Lombok, Sumbawa, Flores, Wetar, and Natuna (Kurniati *et al.*, 2025). Administratively, this species is distributed across 32 out of the 38 provinces in Indonesia. This species can be found at elevations of 0–1800 m above sea level (Quah *et al.* 2021). The lifespan of *V. salvator* is up to 15 years, and potentially live for more than 20 years, under certain conditions, such as good care and environment, as well as a healthy diet (Briggs, 2020).

The *V. salvator* is a large reptiles that serve as both a predator and a scavenger, playing crucial ecological roles within complex trophic webs (Uyeda *et al.*, 2015). Beyond its ecological role, this lizard is valued for its skin in the commercial leather industry (Shine *et al.*, 1996), as an exotic pet, and for its meat in certain regions (Arida *et al.*, 2021).

As one of the most commonly traded reptile species worldwide, this lizard is intensely harvested for its leather,

*Corresponding author Email: hartinasamo@gmail.com

which is used in the production of handbags, shoes, and other fashion accessories. From 1979 to 2023, the trade records indicate that a significant portion of the species' skin exports (Kurniati *et al.*, 2025). Indonesia is the primary source of the harvested *V. salvator*. Between 1979 and 2023, Indonesia has exported *V. salvator* to international markets in 41 countries, based on the CITES Trade Database. Singapore and Japan are the largest importers of the Indonesian *V. salvator*, which exceeds three million specimens since 1979. Italy and Mexico follow as the second and third largest importers. Reflecting their strong leather industries, particularly for luxury goods. China also ranks high, likely driven by demand for exotic leather. Japan, Spain, the United States of America, France, Hong Kong, and Germany complete the list, with relatively smaller import volumes (Kurniati *et al.*, 2025).

In some areas, water monitor meat is processed into various dishes. Consumers of monitor lizard meat are increasing because it is believed to act as an *aphrodisiac* and has properties that can treat itching, soften the skin, treat burns, and firm the breasts (Gaulke & Horn, 2004). In some local areas, intensive hunting could lead to declines in sub-populations.

According to the Ministerial Regulation No. P.106/MENLHK/SETJEN/KUM/1/12/2018 on protected plant and animal species, *V. salvator* is classified as a non-protected species under Indonesian Law. However, despite its unprotected status, the harvest and trade of this species are strictly regulated under Law No. 7/1999 on the Preservation of Wild Flora and Fauna and Minister of Forestry Decree No. 447/Kpts-II/2003, which governs the administration of harvesting, capture, and distribution of wild plant and animal specimens. As previously mentioned, the harvesting of common water monitors from the wild is subject to strict quota regulations, which are established by the Management Authority based on recommendations from the Scientific Authority to ensure sustainability. The total harvest must not exceed the provincial quota that has been allocated, ensuring that wild populations remain stable and are not over-exploited.

Indonesia has implemented strict size regulations for harvesting specimens from the wild to ensure sustainable population management. In general, the minimum size limit for individuals that can be legally harvested is snout–vent length (SVL) of 40 cm, which corresponds to a belly width of 25 cm—a regulation also reflected in the annual quota document. Another regulation is that gravid females are prohibited from being harvested. These restrictions ensure that only adults are harvested, allowing them to reproduce both before and after reaching the body-size range that makes them most at risk of being harvested (Kurniati *et al.*, 2025).

The National Research and Innovation Agency of the Republic of Indonesia (BRIN) conducted surveys at several slaughterhouses across North Sumatra, South Sumatra, South Kalimantan, and West Java. To determine the sex and reproductive condition of each water monitor, we conducted direct gonadal inspections after the animals were slaughtered and skinned. The recorded parameters included SVL, sex, and gonadal condition (testes or ovaries) to assess sexual maturity and reproductive trends within the harvested population. In analyzing harvested population trends, we compared the data collected in 2019 and 2022 from North Sumatra and South Sumatra with historical records from previous studies by Shine *et al.* (1996). Survey results in North Sumatra show the sample size of 2019 was small due to insufficient time allocated for data collection. Nevertheless, overall, harvested individuals were predominantly adults, both males and females, in all surveyed years. Throughout the surveyed years, the most frequently harvested size class for both sexes was 52.5 cm. In South Sumatra, the sample size was almost similar in general in all years. The most frequently harvested size class for males was 52.5 cm, similar to North Sumatra, but for females, the most commonly harvested size class varied across different survey years. In South Kalimantan and West Java, harvested individuals were also predominantly adults, with only two immature individuals recorded. In South Kalimantan, the most commonly harvested size class was SVL 47.5 cm in males and SVL 57.5 cm in females, while in West Java, the SVL was 57.5 cm for both males and females. Both regions, South Kalimantan and West Java, exhibited larger maturation sizes than North Sumatra and South Sumatra (Kurniati *et al.*, 2025).

Since 1975, *V. salvator* has been listed under CITES Appendix II, which means that while international trade is permissible, it must be strictly regulated to ensure a long-term population sustainability of this species. According to the wildlife harvest quota for 2024, issued under Decree No. 234/KSDAE/KKHSG/KSA.2/12/2023, over 50% of Indonesia's national harvest quota for *V. salvator* comes from Sumatra (Directorate General of Nature Resources and Ecosystem Conservation, 2024). Riau Province is one of the largest contributors to the quota for Sumatra. Most hunters of *V. salvator* in Sumatra are skilled individuals funded by middlemen or reptile dealers (Kurniati & Riyanto, 2008).

The BRIN research has been conducted in two major provinces in Sumatra (North and South Sumatra), but not yet in Riau, which is among the top five contributors to export quotas in the region. Thus, this study examined whether commercial monitor lizard harvesting in Riau is sustainable. This can be achieved by examining the reproductive organs of *V. salvator* in Riau (for example, determining whether harvested monitor lizards are predominantly adults or juveniles, and males or females).

Methods

Location and Period of Research

Sampling was conducted from July to September 2025 at five slaughterhouses in Riau Province, located in Siak, Pekanbaru, Kampar, Indragiri Hulu, and Rokan Hilir Regencies. A total of 660 *V. salvator* from five slaughterhouses intentionally caught and killed for their skin, meat, and bile (used for medicinal purposes) were used in this study.

Examination Methods

The *V. salvator* were killed in accordance with the animal welfare guidelines by staff at the slaughterhouse. The SVL and weight of the *V. salvator* were measured. After removing the skin, the carcasses were inspected to determine sex

(based on gonads), fat-body mass (based on a subjective 4-point scale, ranging from 0 to 3), and reproductive organs. Documentation of the measurements during the study and the morphological appearance of the male and female reproductive organs of the *V. salvator* are presented in **Figure 1**.

The parameters recorded in the present study included sex and gonadal condition (testes or ovaries) to assess sexual maturity and reproductive trends within the harvested population. Females were classified as juveniles if they possessed thin, ribbon-like oviducts and had no ovarian follicles exceeding 10 mm. Males were classified as juveniles if their efferent ducts appeared clear, while those with opaque and convoluted efferent ducts, indicating the presence of sperm, were classified as mature. The number and size of ovarian follicles and the clutch size (number of eggs) of females were recorded. For males, the length and width of the right testis were also measured. Additionally, we noted the presence of vitellogenic follicles in females. After these assessments, the carcasses were returned to the slaughterhouse staff.

Data analysis

The raw data obtained from the measurements were imported into Microsoft Excel. Relevant data points were organized and presented in graphs to visually represent the findings, highlighting key trends. Additionally, the data were displayed in tables to clearly describe the quantitative information.

Figure 1 Specimen observation and the morphological appearance of the reproductive organs of *Varanus salvator*. (A) measurement of the reproductive organs in the slaughterhouse; (B) male reproductive organ of an adult *V. salvator* showing a pair of testes (arrowhead); (C) female reproductive organs, showing secondary follicles (arrowhead) of an adult individual; and (D) the clutch consisting of several eggs on each side (arrowhead) in a gravid female.

Results

Sex Ratio

The sex ratio of *V. salvator* in Riau was predominantly male, comprising 58.48% males (n = 386) and 41.52% females (n = 274). This trend was consistent across all five surveyed districts. The male dominance was particularly evident in Siak (69.44% males), Kampar (69.23% males), Indragiri Hulu (59.26% males), and Rokan Hilir (56.68% males). In contrast, the sample from Pekanbaru included only a single female individual, resulting in a recorded male percentage of 0% for that district. Complete data is presented in **Table 1**.

Reproductive Organs

Male *V. salvator* exhibited a greater average body mass (4,675.92 ± 3,244.38 g) and a relatively long SVL (58.97 ± 11.96 cm) (**Table 2**). Most *V. salvator* examined in the present study were adults, consisting of 381 out of 386 males (98.70%) and 233 out of 274 females (85.04%).

Table 1 Sex ratio in *Varanus salvator* from several slaughterhouses in Riau Province

Districts	Number of male	Number of female	Total sample (%)	Male ratio	Female ratio
Siak	25	11	36 (5.45)	69,44	30,56
Kampar	9	4	13 (1.97)	69,23	30,77
Indragiri Hulu	144	99	243 (36.82)	59,26	40,74
Rokan Hilir	208	159	367 (55.61)	56,68	43,32
Pekanbaru	-	1	1 (0.15)	-	100
Riau Province (Total)	**386**	**274**	**660 (100)**	**58,48**	**41,52**

In general, a trend can be seen for the size of the right testicle to increase in line with body weight. Nevertheless, the distribution data we obtained showed that those with large body weights could have smaller testicular sizes compared to those with small body weights. Measurements of reproductive males indicate that right testicular enlargement begins at body weights as low as 1,000 g, indicating the onset of reproductive readiness (**Figure 2A**).

Measurements of the male reproductive organs showed that enlargement of the right testis begins at approximately 40 cm SVL, indicating the onset of reproductive readiness (**Figure 2B**). Based on SVL data collected, sexual maturity in *V. salvator* generally occurs at SVL ≥40 cm. A small number of individuals below this threshold may appear large-bodied but remain immature, likely due to variation in capture locations or differences in food availability influencing body condition.

Based on our data, secondary follicles can be found in individuals weighing between 2,000 and 8,000 g. In general, the heavier the female *V. salvator,* the larger the secondary follicle area. However, our sampling period, from July to September, did not include April and October, unlike the study in South Sumatra. Thus, the trend in body weight compared to secondary follicle size is more random and widespread (**Figure 3A**).

Female reproductive status increased with SVL. Body size (often measured by SVL) is closely related to reproductive capacity. Secondary follicles were observed in females ≥40 cm SVL, while gravid individuals occurred from approximately 50 cm SVL (**Figure 3B**). Clutch size, based on counts of oviduct embryos, ranged from 8 to 19, with a mean of 9.93 (**Figure 3C, D**).

Discussion

Indonesia enforces strict regulations for harvesting V. salvator. The minimum legal size is an SVL of 40 cm, and harvesting gravid females is prohibited. These measures are crucial for ensuring sustainable reproduction (Kurniati *et al.*, 2025).

The findings in the present study may differ from those in other regions. The size differences at maturity between males and females, or between locations, are part of the reproductive strategies developed by water monitor lizards. Given the widespread distribution of this species, adaptation to local biotic and climatic diversity, commonly referred to as reproductive variation or diversity (Zug *et al.*, 1979; Ramírez-Bautista *et al.*, 2015; Setyawatiningsih, 2016), is likely due to the presence of environmental factors. including temperature and food availability, as well as genetic factors, such as reproductive methods. Environmental factors have a greater influence than genetics (Cruz-Elizalde & Ramírez-Bautista, 2016; Setyawatiningsih *et al.*, 2016). Depending on geographic location, number of samples collected, and sampling time. Due to the short sampling period, we cannot yet conclude the seasonal reproductive schedule of either males or females in this article. According to Shine *et al.* (1998), the body size of males is larger at the same age and has a larger SVL ratio, while the body size of females is smaller at the same age and has a smaller SVL ratio.

Table 2 Sexual dimorphism in *Varanus salvator* harvested and used in the present study during July–September 2025

Trait	Sex		Total
	Male	Female	
Sample Size	386	274	660
Average mass (g)	4675.92 ± 3244.38	3321.90 ± 1578.20	4113.80 ± 2761.73
Average SVL (m)	58.97 ± 11.96	53.67 ± 7.80	56.76 ± 10.74
Mature among harvested	381	233	614
Immature among harvested	5	41	46
% Mature among harvested	98.70	85.04	183.74
% Immature among harvested	1.30	14.96	16.26
% Gravid among harvested	-	6.00	-
Average mass (g)	4690.56 ± 3260.30	3637.12 ± 1491.50	4290.81 ± 2773.61
Average- SVL(m)	59.04 ± 11.98	55.57 ± 6.63	57.72 ± 10.41
Average of eggs (per female)	-	6.89 ± 1.83	-

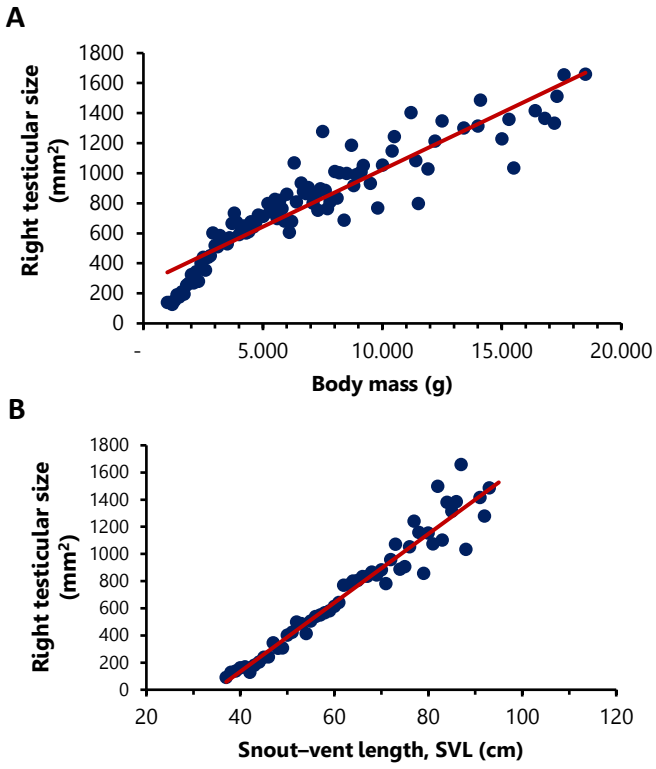

Figure 2 Comparative size of the right testis of *Varanus salvator* in Riau Province (July–September 2025), showing the trend of the right testicular size compared to (A) body mass and (B) the snout–vent length.

In this study, reproductive organs parameters were evaluated mainly in relation to snout–vent length (SVL). As shown in **Figure 3D**, females exceeding 50 cm SVL exhibited higher reproductive output, as indicated by the greater number of eggs recorded. Previous research conducted by Shine *et al.* (1996) and Shine *et al.* (1998) on a larger sample size showed a correlation between increasing SVL and egg number (Shine *et al.*, 1996; 1998). The correlation between increasing SVL and clutch size would affect clutch size, not egg size (Shine *et al.*, 1996; Thompson & Pianka, 2001; Setyawatiningsih, 2016). Compared to other varanid species, water monitors exhibit high variation in egg number and clutch weight. A larger egg count results in larger females having heavier clutches (Thompson & Pianka, 2001). Consequently, gravid females should not be harvested, and the implementation of a minimum capture threshold of >40 cm SVL should be reinforced. This regulation must be clearly communicated to collectors to prevent the capture of gravid individuals or to ensure their release back into the wild if unintentionally captured.

Data from Southern Sumatra indicates that all adult females in the samples gathered in April and August were in a state of reproductive activity, although this was less apparent in October. The egg-laying season extends from April through at least October, with most female *V. salvator* producing several clutches annually (Shine *et al.*, 1996). Larger females tend to begin breeding earlier in the year compared to the smaller ones. Clutch sizes are positively correlated with maternal body size, with the number of eggs ranging from 5

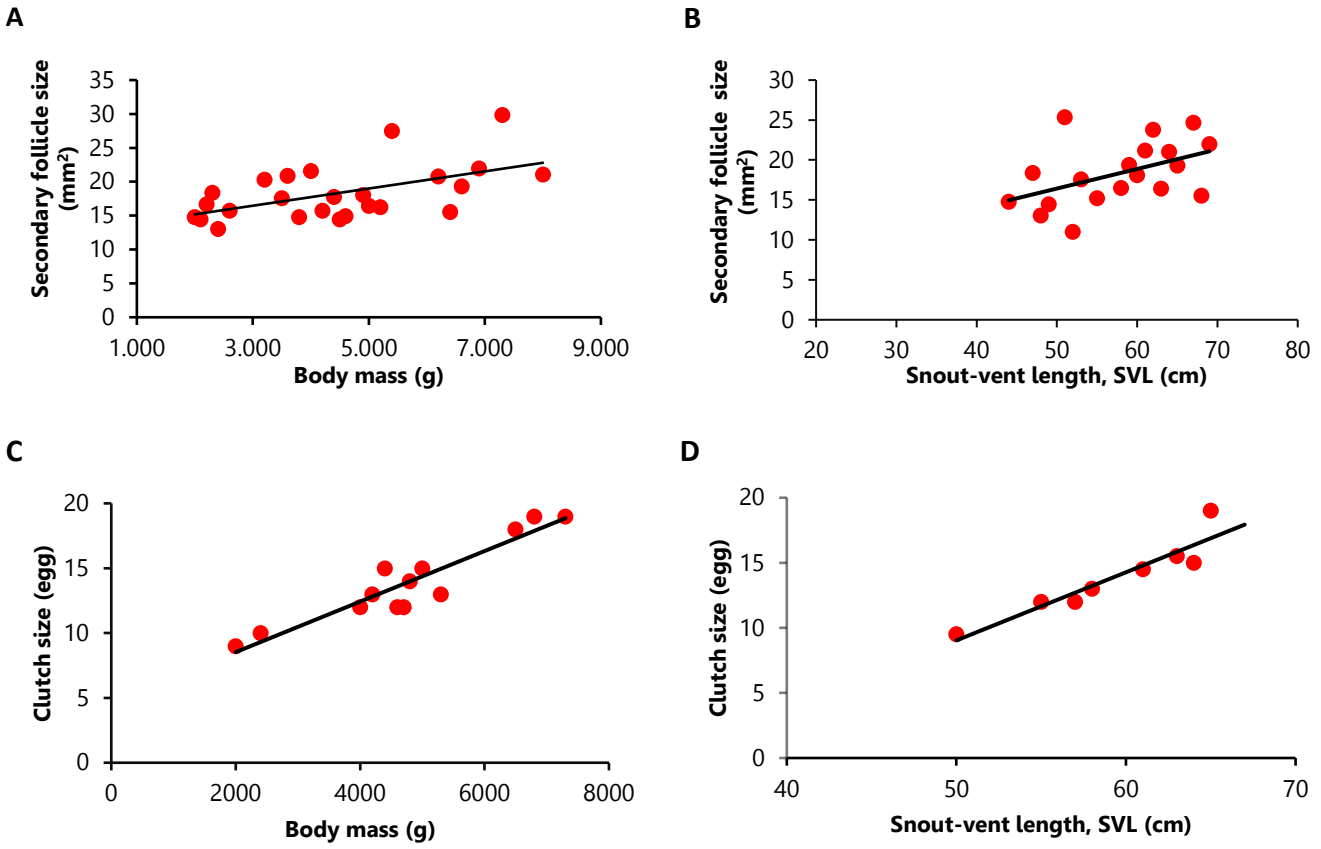

Figure 3 Comparative size of the female reproductive organ of *Varanus salvator* in Riau Province, showing the trend of secondary follicular and clutch sizes. Secondary follicle size compared to (A) body mass and (B) snout–vent length (SVL); Clutch size compared to (C) body mass, and (D) SVL.

to 22 eggs (Shine *et al.*, 1996). Heavier females generally have sufficient energy (fat reserves) to produce secondary follicles (mature/egg-ready follicles). The presence of secondary follicles indicates that the monitor *V. salvator* is in its reproductive phase. In *V. salvator,* follicle development occurs seasonally, and heavier females tend to produce more follicles. Although gravid females represented a small proportion of the sample, their capture should be minimized to reduce impacts on reproductive females. According to Kurniati *et al.* (2025), the minimum harvestable size for *V. salvator* is an SVL of 40 cm.

Our findings show that the testicular size increases with body size and age, especially SVL, which is also consistent with the findings reported by Mahfud *et al.* (2015). However, our distribution data shows that even individuals with large body weights have smaller testicular sizes compared to those with smaller body weights. This observation aligns with Shine *et al.* (1996), who also note that there is no established standard for adult testicular size in male water monitors.

Males are generally larger than females, reaching maturity at approximately 40 cm SVL, while females mature at about 50 cm SVL (Shine *et al.*, 1996; 1998). Maturation occurs when individuals reach a small percentage of their maximum size, which is typical in larger reptile species. Adult males are bulkier than females and have longer tails, although their fat reserves are similar between the two sexes (Shine *et al.*, 1996). The smallest adult male examined weighed 1.0 kg (105 cm total length; SVL 38 cm) and was also the shortest SVL. The largest adult male we examined weighed 18.5 kg (213 cm total length; SVL 87 cm) and measured the longest SVL at 73.5 cm (189 cm total length; 9.2 kg). The largest adult female we examined weighed 8.0 kg (158 cm total length; SVL 64 cm) and measured the longest SVL at 69.0 cm (177 cm total length; 6.9 kg). The smallest adult female we examined weighed 2.0 kg (120 cm total length; SVL 44 cm) and was also the shortest SVL. Based on previous research, the size of male monitor lizards from East Java has entered the adult category at a size of 43–44 cm SVL (Aliffudin, 2022), from Medan 40–44 cm (Shine *et al.*, 1996), and Riau SVL 50 cm (Setyawatiningsih, 2016).

Male *V. salvator* exhibits a greater SVL and body mass than females. However, the reproductive status of males and females differs slightly. Males' bodies weigh 1,000 g and have an SVL of ≥40 cm, being classified as reproductively mature. Females weigh approximately 2,000 g and have an SVL of ≥40 cm, being classified as reproductively mature. Assessment of reproductive organs of *V. salvator* harvested from Riau Province, Indonesia, the larger the body size and the longer the SVL, the larger the size of the testes and secondary follicles obtained.

Conclusion

This assessment of the reproductive organs of *V. salvator* harvested from Riau Province, Indonesia, indicates that larger male body sizes correspond to longer SVL and larger testicular sizes. Similarly, for females, larger body sizes are associated with longer SVLs and larger secondary follicles. Further studies are needed to validate the onset of sexual maturity in both male and female *V. salvator*. Additionally, collecting physical morphometric data, especially from pregnant individuals, is essential to ensure that pregnant females can be released into the wild instead of being slaughtered.

Acknowledgments Authors thank the Natural Resources Conservation Agency of Riau (BBKSDA) for logistical assistance and financial support.

Specimen collection Specimen collection was conducted considering a limitation of no more than 2.5% of the quota for 2025 in Riau Province. This is in accordance with the Decree of the Director General of Nature Resources and Ecosystem Conservation at the Ministry of Forestry of the Republic of Indonesia, No. 277/2024, which outlines the wildlife harvest quota for the year 2025.

Funding This research was funded by the DIPA (*Daftar Isian Pelaksanaan Anggaran*) Fund of the BBKSDA Riau in 2025.

Conflict of interest All authors declare no conflict of interest in this research.

Author contribution HS: Writing–original draft preparation, writing–review and editing, investigation, formal analysis, data curation; SS: Project administration, data curation, investigation, formal analysis, supervision; FY: Investigation, funding acquisition, project administration; OTAM: Investigation; funding acquisition; resources; data curation. All the authors have read and agreed to the published version of the manuscript.

Availability of data and materials The data that support the findings of this study are available from the corresponding author upon reasonable request.

Received 2 October 2025 | **Revised** 20 December 2025
Accepted 27 December 2025 | **Published online** 31 December 2025

References

Aliffudin MF. 2022. Dimorfisme dan status fase reproduksi pada biawak air (*Varanus salvator bivittatus* (Kuhl, 1820) yang diambil dari pengepul di Wilayah Jawa Timur. Undergraduate Thesis. Surabaya (ID): Universitas Islam Negeri Sunan Ampel Surabaya.

Arida E, Boscha E, Fauzi MA, Ardiantoro A. 2021. Beliefs in the dietary benefits of water monitor, *Varanus salvator* meat in Western Java, Indonesia. *Journal of Tropical Ethnobiology*, 4(1):21–32. DOI: 10.46359/jte.v4i1.53.

Briggs H. 2020. Asian water monitor 101: care, size, lifespan & more!. Link https://reptiledirect.com/asian-water-monitor/. Accessed on 06 March 2025.

Cruz-Elizalde R, Ramírez-Bautista A. 2016. Reproductive cycles and reproductive strategies among populations of the Rose-bellied Lizard *Sceloporus variabilis* (Squamata: Phrynosomatidae) from central Mexico. *Ecology and Evolution*, 6(6):1753–1768. DOI: 10.1002/ece3.1998.

Directorate General of Nature Resources and Ecosystem Conservation. 2024. Kuota Pengambilan Tumbuhan Alam dan Penangkapan Satwa Liar Periode Tahun 2024. Jakarta (ID): Directorate General of Nature Resources and Ecosystem Conservation, the Ministry of Forestry of the Republic of Indonesia.

Gaulke M, Horn H-G. 2004. *Varanus salvator* (nominate form). *In*: Pianka ER, King DR, King RA (eds). Varanoid lizards of the world. Indiana (US): Indiana University Press. Pp 244–257.

Kurniati H, Gonggoli AD, Riyanto A, Anita S, Mumpuni, Herlambang AEN, Sidik I, Atikah TD, Kadafi AM, Kusrini MD, Rini RL, Chandradewi DS, Nugroho J, Rahmawati E, Hamidy A. 2025. Non-deterimental finding (NDF) for Indonesia common water monitor (*Varanus salvator*). Bogor (ID): Secretariat of Scientific Authority for Biodiversity, National Research and Innovation Agency & Directorate General of Nature Resources and Ecosystem Conservation, Ministry of Forestry, Indonesia. Link https://cites.org/sites/ default/files/ndf_material/NDF%20Varanus%20salvator_Final.pdf.

Kurniati H, Riyanto A. 2008. Rapid assessment of reptiles trade and population trend in Sumatra, Indonesia. Cibinong (ID): Zoology Division, Research Center for Biology Indonesian Institute of Sciences (LIPI).

Mahfud, Nisa' C, Winarto A. 2015. Anatomi Organ Reproduksi Jantan Biawak Air Asia, *Varanus salvator* (Reptil: Varanidae). *Acta Veterinaria Indonesiana*, 3(1):1–7. DOI: 10.29244/avi.3.1.1-7.

Quah E, Lwin K, Cota M, Grismer L, Neang T, Wogan G, McGuire J, Wang L, Rao D-Q, Auliya M, Koch A. 2021. *Varanus salvator*. The IUCN Red List of Threatened Species 2021: e.T178214A113138439. DOI: 10.2305/IUCN.UK. 2021-2.RLTS.T178214A113138439.en. Accessed on 06 March 2025.

Ramírez-Bautista A, Luría-Manzano R, Cruz-Elizalde R, Pavón NP, Wilson LD. 2015. Variation in reproduction and sexual dimorphism in the long-tailed spiny lizard, *Sceloporus siniferus*, from the southern Pacific coast of Mexico. *Salamandra*, 51(2):73–82.

Setyawatiningsih SC, Solihin DD, Manalu W, Boediono A, Winarto A. 2016. Female reproductive strategy of common water monitor (*Varanus salvator*) from Riau Region. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 28(1):33–43. Link https://gssrr.org/JournalOfBasicAndApplied/article/view/5866.

Setyawatiningsih SC. 2016. Karakteristik Biawak Air (*Varanus salvator*) asal Wilayah Sumatera: Tinjauan Morfologi, Molekuler, dan Potensi Reproduksi. Thesis. Bogor (ID): Sekolah Pascasarjana Institut Pertanian Bogor.

Shine R, Ambariyanto, Harlow PS, Mumpuni. 1998. Ecological traits of commercially harvested water monitors, *Varanus salvator*, in northern Sumatra. *Wildlife Research,* (25):437–447. DOI: 10.1071/WR97118.

Shine R, Harlow PS, Keogh JS, Boeadi. 1996. Commercial harvesting of giant lizards: the biology of water monitors *Varanus salvator* in southern Sumatra. *Biological Conservation*, 77(2–3):125–134. DOI: 10.1016/0006-3207(96)00008-0.

Thompson GG, Pianka ER. 2001. Allometry of clutch and neonate sizes in monitor lizards (Varanidae: *Varanus*). *Copeia,* 2001(2): 443–458. DOI: 10.1643/0045-8511(2001) 001[0443:AOCANS]2.0.CO;2.

Uyeda LT, Iskandar E, Kyes RC, Wirsing AJ. 2015. Encounter rates, agonistic interactions, and social hierarchy among garbage–feeding water monitor lizards (*Varanus salvator bivittatus)* on Tinjil Island, Indonesia. *Herpetological Conservation and Biology*, 10(2):753–764.

Zug GR, Hedges SB, Sunkel S. 1979. Variation in reproductive parameters of three neotropical snakes, *Coniophanes fissidens, Dipsas catesbyi,* and *Imantodes cenchoa*. Washington: Smithsonian Institution Press. *Smithsonian Contributions to Zoology No. 300*. DOI: 10.5479/si.00810282.300.