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Occurrence and habitat of softshell turtles (Testudines: Trionychidae) in Sidorejo Village, Lendah Subdistrict, Kulon Progo Regency, Special Region of Yogyakarta Province

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ABSTRACT

Softshell turtles are freshwater turtles with soft carapaces. Their habitat includes freshwater bodies such as rivers and swamps in tropical and subtropical regions. Data on softshell turtle species and their potential habitats in the freshwater ecosystems of the Special Region of Yogyakarta have not been well documented. Based on information from local residents, a softshell turtle population occurs in Sidorejo Village, Lendah, Kulon Progo, Special Region of Yogyakarta. Accordingly, this study aimed to examine the species and potential habitat of softshell turtles in Sidorejo Village, Lendah, Kulon Progo, Special Region of Yogyakarta. Sampling was conducted from 2 February to 17 April 2020 in Kedung Ingas Stream, Sidorejo Stream, and Andong Stream using the Purposive Sampling method. The results showed that the softshell turtle species found was *Amyda cartilaginea*. The habitat was characterized by shallow streams with depths of 20–70 cm and widths of 150–250 cm, muddy substrates with leaf litter, clear water available throughout the year, calm currents, and riparian vegetation with canopy cover such as water apple, guava, gayam, thorny bamboo, apus bamboo, and lempeni. Softshell turtle nests were characterized by their location under trees, fragments of crab shell in front of the nest cavity, small bubbles in front of the cavity, nest forms resembling cavities in soil or solid rock, and isolated nest sites. These three streams are potential habitats for softshell turtles.

Key words: nest; potential habitat; Sidorejo village; softshell turtle.

INTRODUCTION

Softshell turtles (*Amyda cartilaginea*) are freshwater turtles with soft carapaces covered by soft skin tissue. They belong to the reptile family Trionychidae. Softshell turtles are commonly found in freshwater habitats such as rivers and swamps in tropical and subtropical regions (Arbi *et al*., 2021; Safi *et al*., 2025). In Java, there are three species of soft-shelled freshwater turtles, namely *Amyda cartilaginea* (Asiatic softshell turtle), Chitra chitra (Asian narrow-headed softshell turtle), and *Dogania subplana* (Malayan softshell turtle) (Iskandar, 2000; Das, 2010; Safi *et al*., 2025; Rhodin *et al*., 2025). In Indonesia, the distribution of softshell turtles includes Sumatra, Kalimantan, Java, Bali, and Lombok (Restu & Negara, 2018; Takandjandji *et al*., 2018; Dimenta *et al*., 2020; Arbi *et al*., 2021; Sidit *et al*., 2025).

The existence of softshell turtles in Indonesia and even in Southeast Asia is threatened by human activities for several reasons. They are widely used for consumption, traded alive as pets, their skins are sold as souvenirs, and their oil is used as a cosmetic ingredient (Takandjandji *et al*., 2018; Sihombing *et al*., 2021; Savitri & Emeralda,

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2023; Safi *et al*., 2025). Meanwhile, studies on their populations and reproduction remain limited (Sidit *et al*., 2025). Research on local community perceptions of freshwater turtle conservation, including softshell turtles, has only recently been conducted by a number of researchers (Tiara *et al*., 2025). Tiara *et al*. (2025) reported positive findings, showing that communities living near rivers generally had a good attitude and supported freshwater turtle conservation, including that of softshell turtles, although some residents were less concerned because they were not aware of the freshwater turtle species present in their waters. Therefore, to support softshell turtle conservation efforts in the Special Region of Yogyakarta, data on freshwater turtle diversity, especially softshell turtles, are needed.

Data on the diversity, potential habitat, and distribution of softshell turtles in the Special Region of Yogyakarta have not been well documented. Scientific information on the presence or encounters of softshell turtles in this region is still very limited. Research on softshell turtles in Yogyakarta is also still scarce.

Based on information from local residents, a softshell turtle population was found in several streams located in Sidorejo Village, Lendah Subdistrict, Kulon Progo Regency, Special Region of Yogyakarta. Sidorejo Village has a natural environment with many springs, many small streams with dense riparian vegetation, and a location far from the city. Residents of Sidorejo Village often encounter softshell turtles directly and in high numbers around springs and streams, especially in Kedung Ingas Stream and Sidorejo Stream. In addition, cases of illegal softshell turtle hunting are common in Sidorejo Village, where nests on riverbanks are dug deeply. Until now, it is unknown who the poachers are or where the turtles are taken. This illegal hunting occurs because there is no village regulation governing the hunting of aquatic fauna, especially softshell turtles, and no effort has yet been made to cultivate softshell turtles in the village. These data may serve as a reference for drafting such village regulations. The poaching situation and the lack of information on softshell turtle habitat made this study important to conduct.

This study aimed to examine: (1) the occurrence of softshell turtles; and (2) their potential habitat in Sidorejo Village. The results of this study are useful for: (1) providing complete information and a database for future research; (2) serving as a reference for softshell turtle conservation and sustainable use; and (3) providing a reference for drafting village regulations prohibiting softshell turtle hunting in Sidorejo Village.

MATERIALS AND METHODS

Research period and location

The study was conducted in Kedung Ingas Stream, Sidorejo Stream, and Andong Stream in Sidorejo Village, Lendah Subdistrict, Kulon Progo Regency, Special Region of Yogyakarta (Figure 1). Kedung Ingas Stream is divided into two parts, the northern and southern sections, by the Kedung Ingas Reservoir. Accordingly, the study sites were divided in detail into the northern side of Kedung Ingas Stream, the southern side of Kedung Ingas Stream, Sidorejo Stream, and Andong Stream. The study was carried out from 1 February 2020 to 17 April 2020 with 26 sampling occasions.

Study method

The method used in this study was Purposive Sampling. At each sampling location, water sections likely to contain nests or softshell turtle individuals were selected, namely stagnant or calm water bodies, edges, and cavities. Sampling was conducted twice a day, in the morning and at night. All captured softshell turtles belonging to the family Trionychidae were documented and brought to basecamp for identification. Softshell turtles that were not captured but whose distinctive features could be observed were counted as one individual.

The distinctive morphological features of softshell turtles, especially *Amyda cartilaginea*, that could be observed included: (1) a black-and-yellow carapace pattern that is closely arranged,

usually consisting of six spots forming slight rounded protuberances; when the turtle is in water, this pattern appears more clearly than when it is on land; and (2) a head pattern with yellow spots in the head region, which is clearly visible when the turtle raises its head above the water surface or while it is in the water during night or morning sampling. If a softshell turtle was not captured during sampling but these special morphological features for species identification were observed, it was used for identification (hereafter, softshell turtles that were not captured but were identified through these special features are referred to as Special Marker = SM).

All softshell turtles encountered were captured, identified, documented, and then released back into their habitat. Identification of captured softshell turtle species followed Ernst & Barbour (1987), Iskandar (2000), Das (2010), and Stuart *et al*. (2001).

Data Analysis

The data obtained were then analyzed using the distribution pattern formula and the density formula.

Distribution pattern formula:

$$\bar{X} = \frac{\sum X}{N}$$

$$S^2 = \frac{\sum (x^2) - (\sum x)^2 / N}{N - 1}$$

Based on the mean density value ∑x and variance s2 from a total of N sampling occasions.

Notes

$s^2/\bar{x}$ = Density or species variation

$\sum x$ = Number of species

N = Number of samples

Ratio $s^2/\bar{x} = 1$ indicates a random distribution

Ratio $s^2/\bar{x} > 1$ indicates a clustered distribution

Ratio $s^2/\bar{x} < 1$ indicates a uniform distribution

In addition, a quantitative parameter, namely density, was used. Density formula (Indriyanto, 2006):

$$\text{Density of softshell turtles without special marker} = \frac{\text{Number of softshell turtle individuals}}{\text{Length of stream sampled (km)}}$$

$$\text{Density of softshell turtles with special marker} = \frac{\text{Number of softshell turtle individuals} + \textit{Special Marker}}{\text{Length of stream sampled (km)}}$$

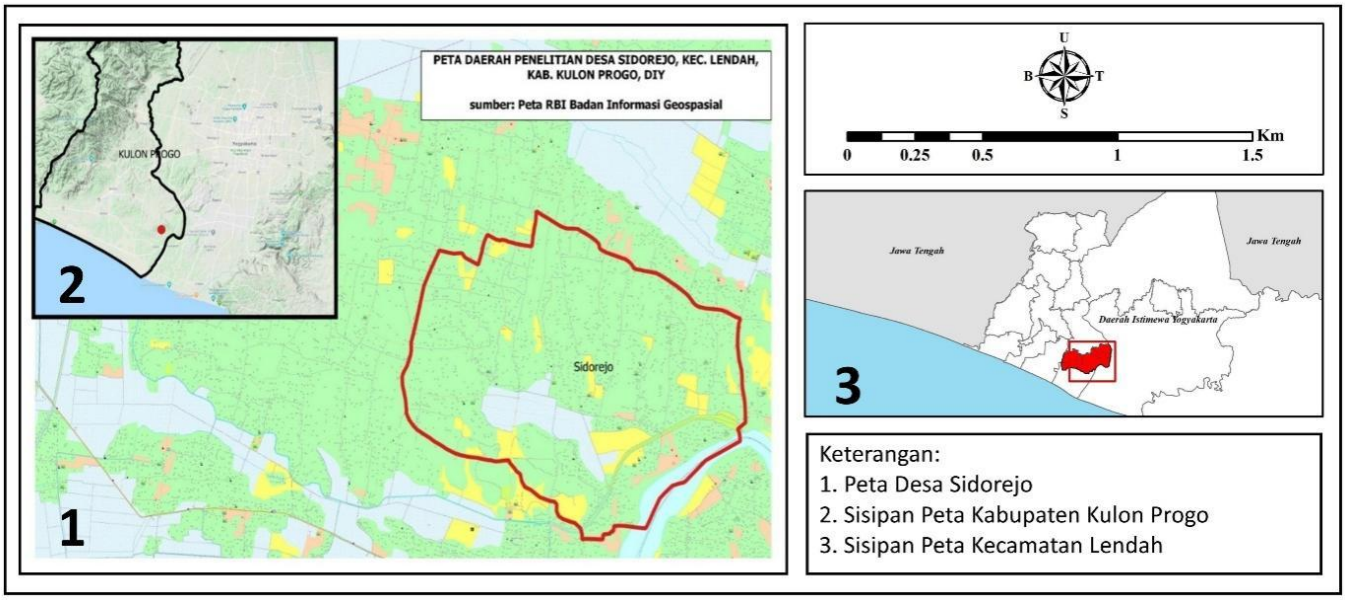

Figure 1. Map of the study location.

RESULTS AND DISCUSSION

The results of 26 sampling occasions in Sidorejo Village, particularly in Kedung Ingas Stream, Sidorejo Stream, and Andong Stream, showed only one softshell turtle species, Amyda cartilaginea. The Amyda cartilaginea data obtained in this study were divided into two groups, namely captured and uncaptured individuals. Uncaptured softshell turtles could be identified by their special features (Special Marker). In adult softshell turtles, in addition to their large body size, namely Curved Carapace Length (CCL) greater than 25 cm, another characteristic is the dorsal part of the head without patterning (Oktaviani & Samedi, 2008). Meanwhile, turtles categorized as "juvenile", besides having Curved Carapace Length (CCL) less than 25 cm, also showed: (a) a black and yellow carapace pattern that is closely arranged, usually consisting of six spots forming slight rounded protuberances, and appearing more clearly when the turtle is in water (Figure 2); (b) a very rough carapace surface; (c) yellow spots on the head that vary in size and shape (Figure 2); (d) five yellow spots on the plastron; (e) a very pointed snout; and (f) male individuals having longer claws and tails and a brighter carapace color than females.

During daytime sampling, a softshell turtle was observed and identified but not captured in Kedung Ingas Stream while hiding beneath fallen leaf litter (Figure 3A). At night, a softshell turtle

Figure 2. Carapace and head patterns of hatchling and juvenile *Amyda cartilaginea* individuals (Photograph: personal documentation).

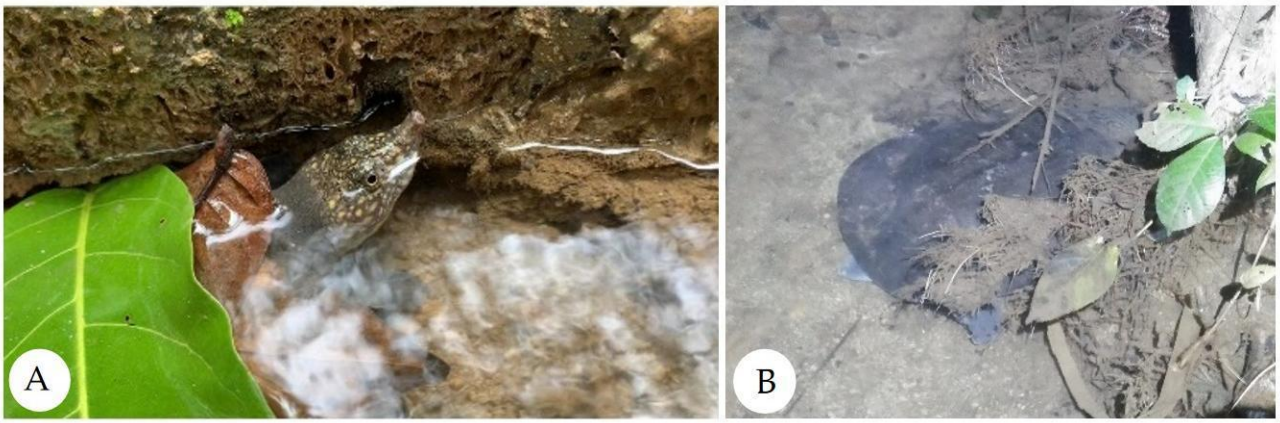

Figure 3. Softshell turtles observed and identified but not captured (Special Marker): (A) in Kedung Ingas Stream during the day; (B) in Sidorejo Stream at night.

was observed and identified but not captured in Sidorejo Stream while foraging (Figure 3B). In Andong Stream, all softshell turtles were captured.

The number of captured softshell turtles was 16 individuals in Kedung Ingas Stream, 10 individuals in Sidorejo Stream, and 1 individual in Andong Stream. The total number of captured softshell turtles was 27 individuals. Most of the captured individuals were in the young age group, especially newly hatched ones (Table 1). Age determination was based on CCL, where softshell turtles with CCL < 25 cm were classified as juveniles and those with CCL ≥ 25 cm were classified as adults (Oktaviani & Samedi, 2008). Meanwhile, the number of softshell turtles observed and identified but not captured (Special Marker) was 12 individuals in Kedung Ingas Stream and 6 individuals in Sidorejo Stream, whereas in Andong Stream all turtles could be captured and identified, so the total number of observed and identified individuals was 18 (Table 1).

The total number of captured adult softshell turtles was 8 individuals. Four individuals were encountered at night and the other four at dusk. Before being captured, all four individuals that

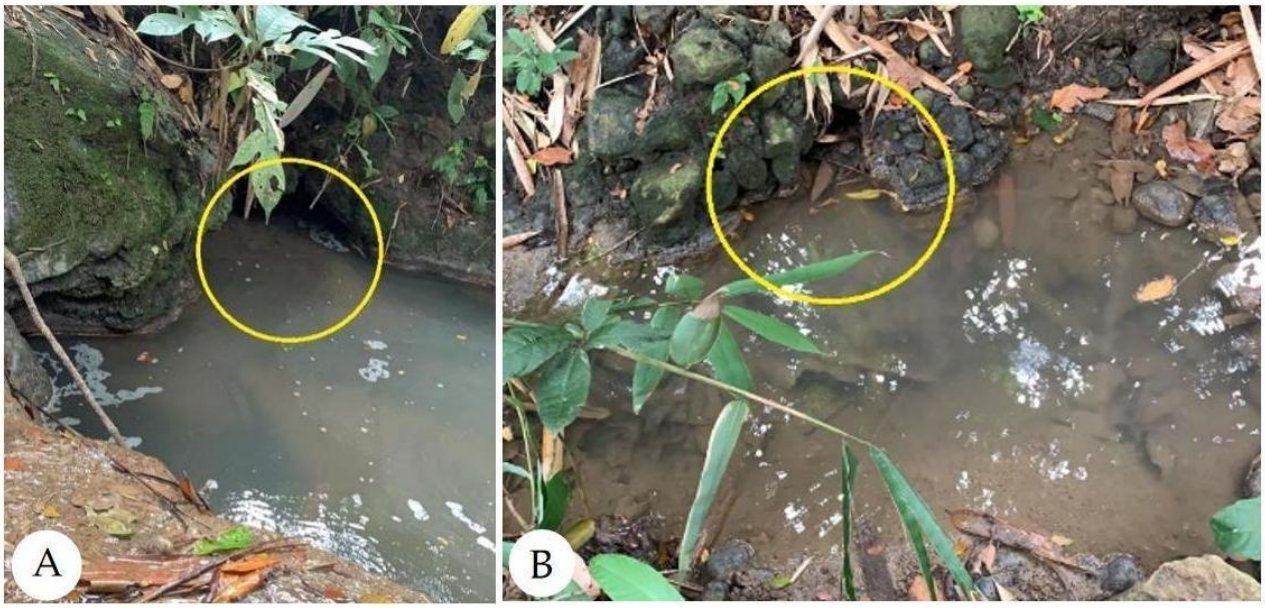

Figure 4. Nest characteristics: (A) small bubbles appearing in a cavity on the riverbank and standing water that is fairly clear and deep; (B) a cavity on the riverbank.

Figure 5. Softshell turtle eggs near Sidorejo Stream (Photo: personal documentation).

appeared at dusk had been caught by installed fishing hooks. These four turtles were captured on riverbanks consisting of soil with riparian vegetation such as nutgrass (*Cyperus rotundus*), cogon grass (*Imperata cylindrica*), and sembung herb (*Blumea balsamifera*). The time when these turtles were caught on fishing hooks coincided with their preparation to forage, namely dusk approaching night. Meanwhile, the other four adult individuals that appeared at night were observed carrying out the following activities: (1) foraging near riparian vegetation of water apple (*Syzygium aqueum*) and guava (*Psidium guajava*); (2) digging mud on riverbanks beneath gayam trees (*Inocarpus fagifer*); (3) being hooked in stream water near riparian vegetation of nutgrass, cogon grass, and sembung herb; and (4) foraging on riverbanks near riparian vegetation of nutgrass, cogon grass, and sembung herb.

The sampling results also showed 17 young softshell turtle individuals classified as newly hatched. Some of these newly hatched turtles were found during the day and others in the afternoon. Before being captured, the three individuals that appeared during the day originated from the same nest clutch and were found dispersing in puddles in garden areas or household yards not far from the stream. Around the hatching nest location there were nutgrass, cogon grass, and sembung herb. At another nest site, other small individuals also appeared in the afternoon and were observed: (1) hiding under leaf litter, (2) remaining still after just hatching, and (3) being in the stream water. The hatching site was located near a gayam tree.

Sampling was conducted during the softshell turtle reproductive cycle because eggs and hatchlings were encountered during the study. Based on the experience of Mr. Hermanto, a local resident who has observed softshell turtle behavior, the egg hatching season occurs from January to March. This statement is fairly consistent with references indicating that the hatching season occurs in January, May, and June (Kopstein, 1938 in Auliya *et al*., 2016). This study was conducted from February to April. Thus, part of the study period corresponded to the post-hatching season. During the period from post-hatching until the pre-mating season (the mating season occurs from September to November), softshell turtles tend to remain inactive and usually emerge only to forage. In contrast, they appear most frequently during the hatching and mating seasons.

Potential habitat of softshell turtles

Softshell turtle habitat has several characteristic features, namely: (1) calm lowland waters such as swamps, ponds, and tributaries; (2) calm waters with muddy substrates; and (3) waters with recessed or rocky banks that create holes along the river edge (Oktaviani *et al*., 2008; Auliya *et al*., 2016). These habitat characteristics were found in several streams in Sidorejo Village used as sampling sites, so several streams in Sidorejo Village can be considered potential habitats for softshell turtles.

In several streams in Sidorejo used as sampling sites, suspected softshell turtle nests were also found. These nests were distinguished into two types: (1) adult nests used as shelter by adult individuals, and (2) egg nests for incubation and hatching. Our observations showed that one adult nest was occupied by only one softshell turtle individual. The nests were located under large trees because of their high moisture content, which likely allows softshell turtles to survive during the dry season. Stream locations that serve as softshell turtle habitat are characterized by upstream sections with natural conditions, clear and clean water available throughout the year, and the presence of springs.

The characteristics of adult nests found at the sampling sites were identified based on several indicators, including fragments of freshwater crab shells (*Parathelphusa* sp.) and mollusk shells around and in front of the nest. These signs are relevant because freshwater crabs and mollusks are among the foods consumed by softshell turtles (Auliya *et al*., 2016; Triponia *et al*., 2025). In Sidorejo Village, freshwater crabs are the main food source of softshell turtles besides mollusks and fish because they are easy to catch. The hard crab shells cannot be completely crushed and therefore leave fragments behind. These shell

fragments were found in front of suspected nest cavities, suggesting that a softshell turtle might be present inside the cavity. Another characteristic is water with substrates containing mud. Muddy substrates are ideal nesting sites for Amyda cartilaginea (Auliya *et al*., 2016; Arbi *et al*., 2021), and such conditions were also found at the sampling locations. Mud allows the turtles to bury their bodies effectively for self-protection and escape from predators more easily. Another characteristic of adult softshell turtle nests is that half of the cavity is above the water surface while the other half is submerged. On the exposed nest surface there was rarely a mixture of sand and gravel; instead, only solid rock was present (Figure 4A; Figure 4B). The nest took the form of a cavity or hollow in soil beneath solid rock (Figure 4B). In addition, small bubbles were found in front of the nest and were presumed to result from turtle respiration (Figure 4A). The nest cavity extended inward into the riverbank with fairly clear and deep standing water (Figure 4A).

During the study, a total of 8 adult softshell turtle nests were found, all of which occurred in Kedung Ingas Stream and Sidorejo Stream, with 4 nests in each stream. Measurements of adult nests in Kedung Ingas Stream and Sidorejo Stream were almost the same, with heights of 10–40 cm, widths of 30–95 cm, and depths of 20–70 cm. In the Kedung Ingas Reservoir, which is part of the same watercourse as Kedung Ingas Stream, softshell turtle nests are likely absent. The reservoir is unlikely to function as a nest site because the water is too deep and the reservoir is human-made, with strong and hard reinforced concrete banks. At the Andong Stream sampling site, nest measurements were not taken for safety reasons because the site was difficult to access and the water depth exceeded 1.5 m.

During the study, no observation of egg nest characteristics was carried out because only one suspected egg nest was found and it had already

Table 1. Number of softshell turtle individuals found in each stream.

Location	Number of Individuals				Total Individuals (Captured and SM)
	Captured			Not captured, identified (Special Marker = SM)	
	Adult	Juvenile	Total		
Kedung Ingas Stream	4	12	16	12	28
Sidorejo Stream	4	6	10	6	16
Andong Stream	0	1	1	0	1
Total Individuals	8	19	27	18	45

Note: Special Marker (SM) = softshell turtles that were not captured but could be identified by their distinctive morphological characteristics.

Table 2. Density of *A. cartilaginea* in Sidorejo Village, 2 February 2020 – 17 April 2020.

Location	Sampling area (km)	Softshell Turtle Individuals			Density (individuals/km)	
		Captured & identified		Not captured, identified (Special Marker = SM)		
		CCL < 25 cm (juvenile)	CCL ≥ 25 cm (adult)		With SM	Without SM
Kedung Ingas Stream	1	15	1	12	28	16
Sidorejo Stream	1	8	2	6	16	10
Andong Stream	0.5	1	0	0	1	1
Total	2.5	24	3	18	45	27

Note: CCL = Curved Carapace Length; Special Marker (SM) = softshell turtles that were not captured but could be identified by their distinctive morphological characteristics.

been dug up. No hatchlings remained in the suspected nest because they had already emerged, leaving three eggs outside the nest (Figure 5). These three softshell turtle eggs were located in a household garden near Sidorejo Stream. The three eggs were found lying on the soil surface and may have been excavated by predators such as monitor lizards or dogs.

Population distribution of softshell turtles

The analysis of the softshell turtle distribution pattern in Kedung Ingas Stream north of the Kedung Ingas Reservoir and in Sidorejo Stream yielded a value of 0.04. Because 0.04 < 1, the distribution pattern of softshell turtles in these two streams is uniform. Meanwhile, no distribution pattern result was obtained for Kedung Ingas Stream south of the reservoir or for Andong Stream because only one individual was encountered in each of these streams.

The highest density was recorded in Kedung Ingas Stream at 28 individuals/km, whereas the lowest density was recorded in Andong Stream at 1 individual/km (Table 2). The site with the highest softshell turtle density was Kedung Ingas Stream, located from Kwarakan Hamlet to Jurug Hamlet. Sixteen individuals were captured at this site: ten hatchlings, two juveniles, and four adults. Among the ten hatchlings, one individual was found during the day while foraging near the nest; its food was freshwater crab, and around the nest there were water apple and guava trees.

The site with the second-highest softshell turtle density was Sidorejo Stream, located in Kwarakan Hamlet. Ten individuals were captured at this site. No juvenile-category individuals were captured here. Six individuals were classified as hatchlings and four as adults. These six hatchlings were observed during the day and afternoon. Before sampling, these six individuals that appeared during the day had hatched from the same nest and then dispersed into puddles in garden yards. The nest had the following characteristics: it was located on the riverbank with riparian vegetation of gayam and lempeni trees. One adult softshell turtle at dusk was observed emerging from the nest in preparation for foraging after dusk because the species is nocturnal. Meanwhile, three other large individuals were observed at night: (1) digging mud near the nest under gayam and lempeni trees, (2) being hooked near wild grass, and (3) foraging around the nest near wild grass.

CONCLUSION

Sampling of softshell turtles in Kedung Ingas Stream, Sidorejo Stream, and Andong Stream in Sidorejo Village, Lendah Subdistrict, Kulon Progo Regency, Special Region of Yogyakarta found only one softshell turtle species, namely *Amyda cartilaginea*, with a total of 45 individuals. These 45 individuals consisted of 27 captured and identified turtles and 18 uncaptured turtles that displayed clear distinctive morphological features allowing species identification (softshell turtle Special Markers). The number of turtles in Kedung Ingas Stream was 16 individuals with 12 Special Marker individuals, in Sidorejo Stream 10 individuals with 6 Special Marker individuals, and in Andong Stream 1 individual without any Special Marker.

The habitat characteristics of softshell turtles in several streams of Sidorejo Village are as follows: shallow streams with depths of 20–70 cm and widths of 150–250 cm; muddy stream substrates with litter or fallen leaves; clear water available throughout the year; calm currents; and riparian vegetation with canopy cover such as water apple, guava, gayam, thorny bamboo, apus bamboo, lempeni, nutgrass, cogon grass, and sembung herb. Adult nest characteristics include being located under trees, fragments of crab shell in front of the nest cavity, the presence of small bubbles, nest forms resembling cavities in soil or solid rock, half of the nest above the water surface while the other half is submerged, and isolated nest locations, usually in sacred places. In addition, stream altitude ranged from 47 to 60 m above sea level, pH from 7.1 to 7.8, air and water temperature from 28 to 34°C, nest height from 10 to 40 cm, nest width from 30 to 95 cm, and nest depth from 20 to 70 cm. Total density was 28

individuals/km in Kedung Ingas Stream, 16 individuals/km in Sidorejo Stream, and 2 individuals/km in Andong Stream.

The distribution pattern of softshell turtles in two streams in Sidorejo Village was uniform, especially in the northern part of Kedung Ingas Reservoir and in Sidorejo Stream. The three study streams constitute suitable habitat for *Amyda cartilaginea* because many individuals, nests, and hatchlings were encountered.

Based on the study that has been conducted, recommendations for future research are to carry out continuous population monitoring in both the rainy and dry seasons and to conduct studies related to the daily behavior of softshell turtles.

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