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THE STUDY OF MORPHOMETRIC AND DIVERSITY OF TURTLES IN AUR LAKE MUSI RAWAS REGENCY

Kajian Morfometrik dan Keanekaragaman Penyu di Danau Aur Kabupaten Musi Rawas

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Abstract One of Indonesia extinct fauna which is still found in South Sumatra but less explored is reptile. Testudinata or chelonians are examples of turtles. Aur Lake has a lot of potential issues with various species, often finding them on the shores of Aur Lake. However, those turtles do not know yet what types of species. The high intensity of catching and decreasing environmental quality can also be a threat to the existence of turtles. This research is titled "The Study of Morphology and Diversity of the Turtles in Aur Lake Musi Rawas Regency. At the Aur Lake, Musirawas. The design of this study is descriptive qualitative with survey methods: Turtles were identified based on morphology, carapace, plastron, head, tail, feet and were identified there are 4 species and total 11 individuals comprising 5 of species *Siebenrockiella crassicollis* (Geomydidae), 1 *Amyda cartilaginea* (Trionichidae), 4 *Cuora amboinensis* (Geomydidae), and 1 *Trachemys scripta* (Emydidae). The diversity level (H') was obtained 1.162225545, and the evenness level was 0.838368515. The implication of this research was to provide information about the diversity of turtles around the Aur Lake stream in Musirawas Regency then strive to maintain the turtle's natural habitat in order to avoid the exploitation of animals and Aur Lake can be used as learning centers for student to study about biodiversity turtles and turtles conservation *ex-situ* and *in-situ*.

Keywords: *Aur Lake, Diversity, Morphometric, Turtle*

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INTRODUCTION

Turtles are rare animals that are spread throughout the world. The number of turtles is not less than 260 species from 14 families identified. The Union Conservation of Nature (IUCN) reported that large-scale of seawater exploitation in 1987 in Ottawa, Canada. 30,000 spawning turtles were caught and killed in Indonesia every year. All types of turtles in Indonesia are protected based on PP 7 of 1999 concerning Preservation of Plant Types and Animal and PP No. 8 of 1999 concerning Utilization of Types of Plants and Wildlife, which means that all trade in life or death situations (Firliansyah, Kusrini, & Sunkar, 2017). This is because almost all species of turtles in Indonesia have Reducing endangered. This matter caused severe criticism from various world conservation institutions such as Greenpeace which launched an intensive campaign to stop the turtle trade in particular its use for religious activities (History, 2018). The usage of turtles for religious activities has been severely prohibited by the turtle population and reduces sustainability (Firliansyah et al., 2017), loss of the primary habitat such as forest (Henri, Hakim, & Batoro, 2017) then river regulation reducing occupancy and contributing to population decline (Ocock, Bino, Spencer, Thomas, & Kingsford, 2018). Based on the data, there are about 45 species of turtles from 7 families (Agromedia, 2010). The data from the Ministry of Environment and Forestry Directorate General of Natural Resource Conservation and Ecosystems (Ditjen KSDAE, 2016) in South Sumatra which has reached 5,625 animals consisting of 5 species from 3 families. This figure proves that Indonesia is very rich in turtles animal (Kusrini, Mardiastuti, Riyanto, & Ginting, 2014). In Musi Rawas regency, turtles are often found but what type of species does not known yet. From the research teams observation, in Lubuklinggau City near Musirawas Regency, there are people who sell food from turtles, and there are also many baby turtles sellers in the market. This situation is considered as the cause of the turtles extinction. So, this research is needed to conduct in order to be able to identify the types of turtles found in Aur Lake location before they become more threatened. the formulation of the problem in this study is how morphometrics, diversity and environmental conditions of turtles found in the aur lake. This research aims to know the type of tutles in the Aur Lake (level of diversity), morphometric measurements and determine abiotic factors in Lake Aur.

METHODS

This research was conducted by survey and exploration. It was conducted from February to November 2018 with 5 stations. The technique of data collection in this study is observation and interview. The procedures in this research are as follows: (1) Determination of 5 stations to catch turtles, (2) Measurement of abdominal factors in each station found by turtles. Includes: temperature, humidity, brightness, dissolved oxygen and acidity (pH), (3) The sample temperature is then moved into a box and labeled, (4) Perform analysis and identification.The sample was identified in the Biology Education Laboratory STKIP PGRI Lubuklinggau. Each sample be measured carapace length, carapace width, plastron length, plastron width, head, tail, feet turtles refer to (Nijman, Shepherd, Mumpuni, & Sanders, 2012; Protiva et al., 2016; Sasaki et al., 2006; Seidel & Ernst, 2017). The data analysis used the Shannon-Wienner diversity index.

RESULT AND DISCUSSION

The results of the research on the diversity of turtles in Aur Lake, Musi Rawas Regency, South Sumatra Province are as follows:

Table1. Types of Turtles in 5 Station at Aur Lake

No	Species	The number of individual turtles					Quantity
		St-1	St-2	St-3	St-4	St-5	
1	*Trachemys scripta*	-	1	-			1turtle
2	*Amyda cartilaginea*	-	-	-	-	1	1turtle
3	*Cuora amboinensis*	-	-	-	4	-	4 turtles
4	*Siebenrockiella crassicollis*	1	1	-	3	-	5 turtles
Quantity							*9Turtles*

Description: St-1 :Station 1, St-2 :Station 2, St-3 :Station 3, St-4 :Station 4, St-5 :Station 5

Diversity data for turtle animals at Aur Lake is obtained index 1,162225545 and evenness 0,838368515. This can be interpreted that the diversity of turtles is classified as moderate. And

for evenness levels for the level of community stability and support between 0-1, the value of H' > 3.0 shows level diversity very high, H' > 1,5 - 3.0 shows level high diversity. H' > 1,0 - 1.5 shows level diversity being. H' < 1 shows level diversity low (Mustafa, 2014). the data obtained showed that the environmental community of turtles is unstable. (Krebs,1999) Evenness value (E) is smaller indicating the more uneven distribution of an organism in a community, this is because there are certain types that dominate a community. Conversely, if the value of E approaches number 1, the organism in the community spreads evenly.

Table 2. Data on Diversity, Dominance and Eveness

No	Family	Species	Q	KJ	pi	ln p1	∑ pi ln pi	Dominance
1	Emydidae	*Trachemys scripta*	1	9,0909091	0,090909091	2,3978953	0,217990479	0,008264
2	Trionichidae	*Amyda cartilaginea*	1	9,0909091	0,090909091	2,3978953	0,217990479	0,008264
3	Geomydidae	*Cuora amboinensis*	4	36,363636	0,363636364	1,0116009	0,367854877	0,132231
4	Geomydidae	*Siebenrockiella crassicollis*	5	45,454545	0,454545455	0,7884574	0,358389709	0,206612
N	S	4	11			H'	1,162225545	

Q = Quantity, KJ = Composition of types
Eveness = 0,838368515

Cuora amboinensis classification
Kingdom : Animalia
Phylum : Chordata
Class : Reptilia
Ordo : Testudines
Familia : Geoemydidae
Genus : Cuora
Species : *Cuora amboinensis*

Figure 1. *Cuora amboinensis* (Personal documentation, 2018)

Ambon tortoise is a semi-aquatic animal which means living in water but it will appear occasionally to land for sunbathing. It has black head color with three distinctive yellow lines: around the edges of the head above the eyes, on the cheeks, and on the lips. Carapace tends to be high rounded with a blackish and brownish color (Badaruddin E, 2015). Plastron which can be bent based on the transverse line, so that the head and legs can be hidden. It is cream (dirty white) with black spots. In the carapace there are three keel pieces (longitudinal protrusions), which are in the middle of the vertebral shielding pieces and to the right of the vertebrae near the border with the vertebral chip (Figure 2). For the concave plastron male turtle, the Ambon turtle plastron is not flat. Along the edge of the leg is a yellow line.

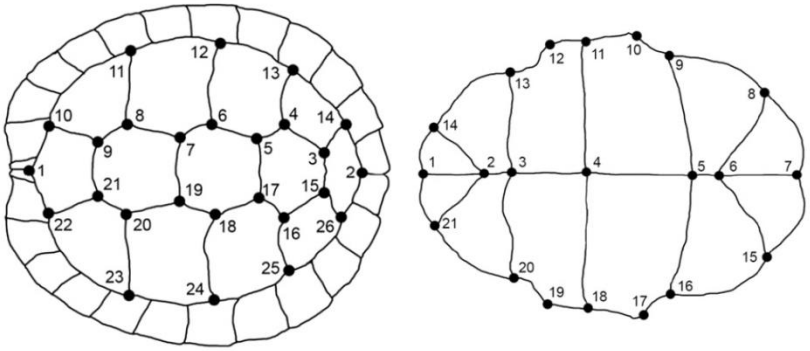


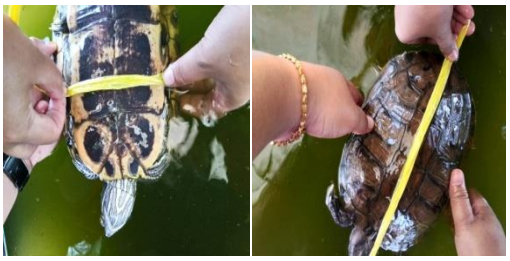
Figure 2. Carapace and plastron of *Cuora amboinensis* showing the landmarks used in this study (Protiva et al., 2016)

Siebenrockiella crassicollis classification
Kingdom : Animalia
Phylum : Chordata
Class : Reptilia
Ordo : Testudines
Familia : Geoemydidae
Genus : Siebenrockiella
Species : *Siebenrockiella crassicollis*

Figure 3. *Siebenrockiella crassicollis* (Personal documentation, 2018)

The black marsh turtle (*Siebenrockiella crassicollis*) is a kind of freshwater turtle belonging to the family of Geoemydidae. This tortoise has the shape of the curved upper lip (lip). The body is relatively small, its shell length reaches 200 mm. The nucleus (neck) is narrow and narrows towards the front. The vertebral pieces are also narrow, about 40% of the width of the cranium in the middle of the body. The vertebral chip is almost the same length; the no. 1 extends to the front, no. 2 to 4 widens in the middle, and no-5 widens behind. The first biggest, and the fourth smallest fragment. Marginal pieces form a flat shell edge on the front, but are jagged on the back (Sasaki et al., 2006).

The long sequence of relationships (form the midline) between the pieces of the abdominal shield are: abdominal, pectoral, femoral, anal, gular, humeral. Turtles are black on the back carapace, over the head and stomach (plastron). There are white or pale spots on the cheeks and above his eyes. Yellowish white stripes or patterns are found around the connection between the stomach pieces, or sometimes completely black (Sasaki et al., 2006).



Trachemys scripta elegans Classification
Kingdom : Animalia
Phylum : Chordata
Class : Reptilia
Ordo : Testudines
Familia : Emydidae
Genus : Trachemys
Species : *Trachemys scripta elegans*

Figure 4. *Trachemys scripta elegans* (Personal documentation, 2018)

The Brazilian turtle is a freshwater turtle, whose morphological features are webbed hind legs which are of course only used in water. In addition, in general, turtles that live in water do not have too convex shells that do not burden their bodies when swimming.

(Seidel & Ernst, 2017) described the family of emydidae as *trachemys scripta* having a flatter body, the contacted part between the plastron and the carapace was wider and remained flat. Usually the front leg members are stronger than the back.

Trachemys scripta elegans and *Amyda cartilaginea* are one member of Subordo Cryptodira on the movement of the head and length. Female *Trachemys scripta* has 7 cervical vertebrae, 9 thorachal vertebrae, 1 sacral vertebrae and 27 caudal vertebrae. Centrum vertebrae *Trachemys scripta* is large with anterior and posterior zygaphophysis in the cervical dilated and elongated, which influences the limited lateral movement. The higher structure of the centrum of the thoracic vertebrae follows the shape of the carapace. The sacral vertebrae have 1 segment of the centrum widening on the lateral side attached to the carapace called pars lateral, the centrum vertebare caudalis is short and there is a shortened anterior zygapophysis structure. In contrast to *Amyda cartilaginea* females have a number of 7 segment vertebrae, 10 thorachal vertebrae, 2 vertebra sacs and 11 caudal vertebrae. Centrum vertebrae *Amyda cartilaginea* are small with anterior and posterior zygaphophysis in the thin and pendent cervical, allowing the turtle to carry out more lateral movements. The centrum structure of the flat thorachal vertebrae adjusts the shape of the carapace. The sacral vertebrae have 2 centrums and 2 lateral pars elongate and meet each other, forming a pelvina sacral hole, the centrum of the caudal vertebrae extends and a neural spinal structure.

Amyda cartilaginea Classification
Kingdom : Animalia
Phylum : Chordata
Class : Reptilia
Ordo : Testudinata
Familia : Trionychidae
Genus : Amyda
Species : *Amyda cartilaginea*

Figure 5. *Amyda cartilaginea* (Personal documentation, 2018)

Bulus (*Amyda cartilaginea*) is a kind of soft back turtle that is a member of the Trionychidae family. This turtle is called the soft back because some of its shields are made of cartilage and its back is covered with thick and slippery skin (Nijman et al., 2012). *Amyda cartilaginea* is a semi-aquatic animal that lives in swamps, rivers and lakes with a temperature of 25-30 ° C and solitary life that is not in groups, which are nocturnal and diurnal animals associated with eating at 6 am to 10:00 am. and the afternoon at 4:00 a.m. to 11:00 a.m (Muslim, 2016). These animals usually have a rear diameter reaching 100 cm, although generally only reaches 60 cm. The head is rounded up, with a small proboscis located at the tip of a short trunk. This shield is relatively round, covered with thick, soft and slippery skin, with long, smooth, intermittent pimples and low folds. His neck is long, so that his head can reach at least half of his shield. Front and back legs with a full membrane, especially in the front limbs. The color varies from black, gray to brown. Young animals have yellowish spots, bright or opaque. Sometimes there are 6-10 round dark spots with white edges, arranged in curved rows on the back. The lower side of the body is smooth, whitish (Hamadryad, 2008).

BIOECOLOGY ASPECTS

Turtles conservation is very closely related to bioecological conditions of turtle habitat. if the bioecological conditions do not meet, it is difficult to maintain turtles. And also the results of breeding these turtles are not able to compensate for the exploitation and destruction of turtle's environmental habitat (Kusrini et al., 2014). Ideal temperature (Puspitasari, 2007) for turtle environments is 24.4 ^{o}C-27 ^{o}C. Air humidity is around 45% -72%, water pH ranges from 7-8 and soil pH 4.9-6.2. From the findings obtained, it is known that the humidity obtained is 69%, pH 6.7 - 7.1, temperature 25-33 ^{o}C, dissolved solid particles 0.13 ppm, brightness of 115 cm and dissolved oxygen which is 38 mg /

L. It can be seen in Table 3.

Table 3. Measurement of abiotic factors in Aur lake

Moisture	pH	Temperature	The solid particles dissolved	Brightness	Dissolved oxygen
69%	6.7 – 7.1	25-33	0,13 ppm	115 cm	38 mg/L

According to Agromedia (2010) the temperature for turtles starting from 26-30 ℃ and pH 6-7 serves to increase the turtle's body temperature so that it is an effective eradication disease. According to (Sentosa, Wijaya, & Suryandari, 2013) and Agromedia (2010) states that temperature and pH can affect turtles to live. It shows that the temperature and pH conditions at Lake Aur are very suitable for turtle dwellings.

Table 4. Turtle morphometric data

No	Turtle species	K (cm)		P' (cm)		T	H	LG
		L	W	L	W			
1	*Trachemys scripta*	16,3	13,5	15,1	13,3	CF	GR	NSL
2	*Amyda cartilaginea*	29	28,8	27,8	29	S	BK	FCN
3	*Cuora amboinensis* (1)	7,3	6	5,5	3,4	CF	BSY	NSL
4	*Cuora amboinensis* (2)	34	29	27	29	CF	BSY	NSL
5	*Cuora amboinensis* (3)	23	19	17	19	CF	BSY	NSL
6	*Cuora amboinensis* (4)	25,2	20	12,5	20	CF	BSY	NSL
7	*Siebenrockiella crassicollis* (1)	31,5	26	24	26	CF	WC	NSL
8	*Siebenrockiella crassicollis* (2)	15	13	11	13	CF	WC	NSL
9	*Siebenrockiella crassicollis* (3)	27,5	22	19,5	22	CF	WC	NSL
10	*Siebenrockiella crassicollis* (4)	19	15	13	15	CF	WC	NSL
11	*Siebenrockiella crassicollis* (5)	25	27	27	27	CF	WC	NSL

Gloss : K : *Karapas;* P': *Plastron;* T : Tail; H : Head; LG : Leg;
L : Long; W : Width; CF: Can fold; WC: White Color; GR : Combination Green and Edge red; NSL : Nail Scaly Long; S: Short; BSY: Black Stripe Yellow; SY : Speckled Yellow; FCN: Fin Cover Nail.

From Table 4, we know that *Cuora amboinensis* and *Siebenrockiella crassicollis* have similarities in the tail and feet, except that in the head there are differences in white *Siebenrockiella crassicollis* and *Cuora amboinensis* clack stripe yellow with varying morphometrics. *Trachemys scripta* which is found to have a green body with yellow and light green lines containing a shape, a greenish shell and a red tinge right behind the eyes.

Amyda cartilaginea in the findings big enough has a carapace width of 28,8 cm and a length of 27,8 cm. This larger carapace is due to *Amyda cartilaginea* consisting of fragments wrapped in cartilage (Mustafa, 2014) for plastron widths of 29 cm and 27.8 shorter than the carapace part because there is a pair of bone *epiplastron*, one *entoplastron* bone, a pair of *hyosplastraon* bones, *hypoplastron* and *xiphiplastron*. *Amyda cartilaginea* which is rarely found in lakes, *Amyda cartilaginea* species usually like the flow of the river, as found in Ogan Komering Ilir Sumatra South (Oktaviani 2007; Kusrini et al., 2014).

The implication of this study is to provide information about the diversity of turtles (Testudinata) around the Lake Aur stream in Musirawas Regency and strive to maintain the turtle's natural habitat to avoid exploitation of animals. If the turtle population in the aur lake continues to be maintained, the aur lake can be used as one of the learning centers for turtle animal conservation for school children or the community. As has been done by the postgraduate (S2) Science Education University of Bengkulu which has developed the conservation of turtles *ex-situ* and *in-situ* (Anggraini, Karyadi, & Enersy, 2018).

Figure 6. Biology education student stkip pgri lubuklinggau learned about turtle morphometrics in aur lake recreation area.

Research team introduce to college student about types turtles found in lake Aur, then college student do measurement from long and wide carapace, long and plastron width, determine type sex turtles, as well team researcher too deliver that the need keep population turtles in the Aur lake so its natural habitat not lost.

CONCLUSION

The results showed that number of turtles identification were 11 individuals consisting of 5 species of *Siebenrockiella crassicollis* (Geomydidae), 1 species of *Amyda cartilaginea* (Trionichidae), 4 species of *Cuora amboinensis* (Geomydidae), and 1 *Trachemys scripta* (Emydidae). 11 individual turtles have varied morphometrics. The condition of abiotic factors in Aur Lake, South Sumatra Province is quite good and suitable as a turtle residence. Brightness level is 115 cm, dissolved oxygen is 38 mg / L, humidity is 69%, temperature is 25-33, pH is 6.7 - 7.1 and dissolved solid particles is 0.13 ppm. The turtles in Aur Lake diversity level (H') obtained is 1,162225545, and the evenness level is 0.8383. It shows the temperature and pH conditions at Lake Aur are very suitable for turtle dwellings and can be conservation area.

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