

***Cuora amboinensis* Roaming Patterns in Artificial Habitats in The Ex-Situ Turtle Conservation Area, Bengkulu University**

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ABSTRACT

This research was carried out in September-October 2023 at the Bengkulu University ex-situ turtle conservation area, aiming to provide comprehensive knowledge about roaming patterns, active times, and movement areas in artificial habitats so that they can be used to develop effective conservation strategies for maintaining the preservation of *C. amboinensis* in the ex-situ turtle conservation area, Bengkulu University. This study observed 11 individual turtles (4 females and 7 males). This research uses literature study methods and direct observations in the field. The results obtained showed that *C. amboinensis* had: high mobility because all artificial areas were explored. The active time of *C. amboinensis* is in the morning and evening. The range of movement of males is greater than that of females. Mounting activity occurs spontaneously or directly when male *C. amboinensis* and female *C. amboinensis* meet in a certain area. The roaming pattern of *C. amboinensis* occurs randomly and the range of movement between male and female *C. amboinensis* is very different.

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1. INTRODUCTION [Times New Roman 10 bold]

Shell Turtle (*Cuora amboinensis*) is a reptile that is very easy to recognize because it has a distinctive body shape. Its characteristic is a black carapace (Apriani et al., 2016). The feet have quite long claws; between the toes there are membranes; and the female's body size is greater than the body mass of the male *C. amboinensis*. Several distinctive characteristics differentiate it from other types of turtles. Apart from having a distinctive body shape, *C. amboinensis* also plays an important role in maintaining natural balance (Marianingsi et al., 2023). As a predator of small animals, *C. amboinensis* is able to help control the population of living creatures in its habitat. This animal has the ability to survive in various habitats, such as ponds, brackish water swamps, fresh water swamps, rivers, and rice fields (Hermawan & Candra, 2023). In general, *C. amboinensis* inhabits land and water. So, this species is called a semi-aquatic animal species. Semi-aquatic is a habitat for animals that live in two habitats (Asad et al., 2021); (Taran et al., 2022) Its habitat is land and water. Land and water allow these turtles to have a wide range of roaming patterns and are free to carry out various activities such as sunbathing, foraging, mating, swimming, perching, and laying eggs (Marianingsi et al., 2023). Natural habitat *C. amboinensis* experiences disturbance from other creatures, so damage to its natural habitat can occur due to human hands or other creatures. So, a safe house is needed for turtles to continue their lives. The artificial habitat is designed like its natural habitat to support all the activities of *C. amboinensis*. Artificial is an artificial area created outside its natural habitat, and the management of the area is fully regulated by humans (Purwantono et al., 2016). Good area planning is very necessary so that *C. amboinensis* has a wide range of coverage.

Movement *C. amboinensis* is influenced by good habitat quality (Hagani et al., 2021). Good quality habitat for *C. amboinensis* should include water and land areas. High quality habitat also allows *C. amboinensis* to have a wide home range. Eksplorasi is a daily activity of turtles which is commonly carried out by each individual to carry out various activities such as looking for food, a place to rest, looking for a mate, looking for a place to lay eggs and swimming (Marida et al., 2022). *C. amboinensis* also walks in its habitat to find a quiet place to rest. However, there has been no research on the roaming patterns of *C. amboinensis*, but movement

behavior has been described in research (Marida et al., 2022), which examines the behavior of reptile class wild animals.

The research focuses on creating maps of *C. amboinensis* ' home range patterns that are specific, accurate and easy to understand in an artificial ex-situ turtle conservation area at Bengkulu University. The contents of the map show the roaming pattern towards mating, active time, range of movement and differences in roaming patterns between male *C. amboinensis* and female *C. amboinensis*. Literature study methods and direct field observations were used to collect data about movement patterns and behavior of *C. amboinensis* within a week. The research results are expected to provide comprehensive knowledge about roaming patterns, active times, movement areas, and differences in roaming patterns between male *C. amboinensis* and female *C. amboinensis*. So, it can be used to develop effective conservation strategies to preserve *C. amboinensis* both in the Bengkulu University ex-situ turtle conservation area and in other area.

2. RESEARCH METHOD

Types of research

This type of exploratory research uses direct observation methods on the subject of observation, namely the roaming patterns of *C. amboinensis* in the ex-situ turtle conservation area at Bengkulu University.

Time and place

This research was carried out in an artificial conservation area at Bengkulu University. The research period was one month, starting from September 11 to October 11, 2023. The time span used was 3 weeks for preparing the artificial pond and 1 week for data collection.

Tools and materials

The tools used in this research are: Avenza Maps application, marker, and neat rope. The object of the research is the Batok Turtle (*C. amboinensis*) which is located in the Bengkulu University Conservation *Artipisia Pond*. The number of turtles observed was 11 individuals (4 females and 7 males) from 20 individuals found in the artificial conservation pond at Bengkulu University with the consideration that the data for 11 individuals was complete and accurate.

Research Procedure

The work steps carried out in this research are as follows: Each individual is marked with a livestock makers (whiteboard marker) to make it easier to observe the turtle's movement patterns and behaviour. The pond where the turtles moved during observation was made into four plots, namely by naming them (open land area, closed land area, open pond area, and closed pond area) with the size of the pool namely: 14 meters long and 11 meters wide. Next, install the coordinate rope using ropes on both sides of the pool, namely the X-axis coordinates and the Y-axis coordinates. Where the X-axis coordinate rope consists of X1 to X14 while the Y-axis coordinate rope consists of Y1 to Y11 as in figure1 below.

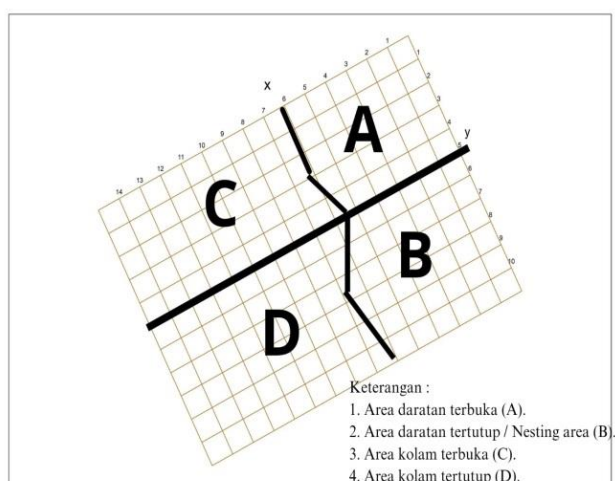


Figure1. Coordinate map of turtle areas *C. amboinensis* in Bengkulu University Conservation

The movement of *C. amboinensis* is observed three times a day for a week, namely in the morning 07:00-10:00, midday 11:00-14:00 and in the afternoon 14:00-16:00. Pinning on the Avenza Mapp application is carried out when the turtle is found, either in the morning, midday, afternoon, on or evening. The movement point of the turtle using the Avenza Mapp application on an Android cellphone based on the location or position of the turtle is found by referring to the X and Y axis coordinate rope. A map of the range of *C. amboinensis* in the ex-situ turtle conservation area, Bengkulu University.

3. RESULT AND DISCUSSION

Observations of the roaming patterns of *C. amboinensis* in this study were divided into random roaming patterns in one area and roaming patterns looking for a mate. The details are presented in the image of the home range pattern on the map of *C. amboinensis* in the ex-situ turtle conservation area at Bengkulu University.

1. Random roaming patterns in male and female *C. amboinensis*

C. amboinensis has high mobility with the aim of looking for food, resting, swimming, mating, perching and sunbathing as depicted in the map in Figure 2.

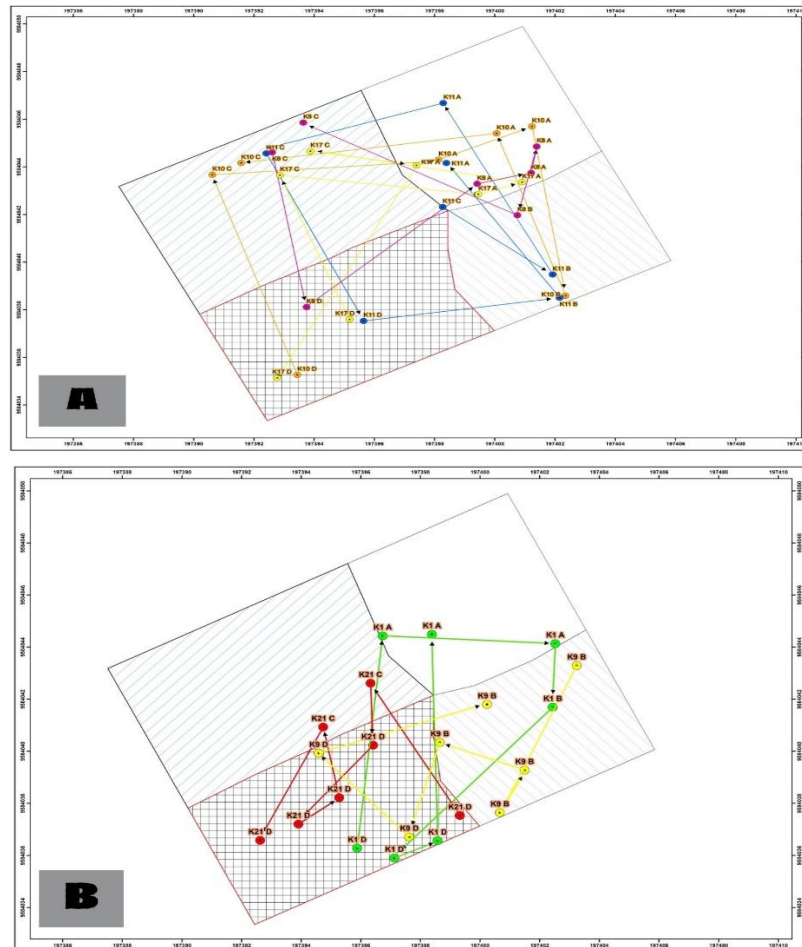


Figure 2. Map of home range patterns of *C. amboinensis* in artificial habitats for (A) males and (B) females.

Information:

- ▶ Movement path of female *C. amboinensis* (K8)
- ▶ Movement path of female *C. amboinensis* (K10)
- ▶ Movement path of male *C. amboinensis* (K17)
- ▶ Movement path of male *C. amboinensis* (K11)
- ▶ Movement path of male *C. amboinensis* (K1)
- ▶ Movement path of male *C. amboinensis* (K21)
- ▶ Movement path of male *C. amboinensis* (K9)



Figure 3. Artificial Habitats

With a total area of 191 square meters, divided into 4 areas, namely: open land area (A), closed land area (B), open pool land area (C), and closed pool area (D). All of these areas were explored by *C. amboinensis*, which shows that the movement (*mobility*) of this animal is very high. *Mobility* in reptiles is carried out with the following objectives: looking for food (*foraging*), sunbathing (*basking*), taking shelter (*cooling*), adjusting body temperature (*shuttling*), changing places (*moving*), not being included in activities (*foraging* and *shuttling*), activities fighting each other or with other predators (*aggression*), and finding a partner (Dewi et al., 2020).

The range of *C. amboinensis* in the two maps that have been depicted has several significant differences. The first map contains 2 female *C. amboinensis* individuals more dominantly exploring the open pool area part (C) with activities that occur in bathing and swimming, as well as open and closed land areas because in the area there are taro and papaya food sources. Meanwhile, in the second map, it appears that the dominant area is exploring closed land and closed ponds because in the closed land area there is a food source, and in the closed pond area it is a place for *C. amboinensis* to protect itself from direct sunlight during the day. The starting point of movement of each *C. amboinensis* individual starts from a different area, and it is not visible from the start of the movement that *C. amboinensis* starts movement from the same area. The artificial area is quite large, and the adaptation occurs so quickly that the turtles initial movements area not in the same position (Silahooy & Huwae, 2020).

Roaming pattern: In the morning and evening, *C. amboinensis* will move to the closed land area in section (B), where the activity they carry out is looking for food. The time for this type of turtle to search for food is in the morning and evening because the environmental temperature *fluctuations* are quite low. This is in line with research (Fu'jjiyat et al., 2023), which studied temperature fluctuations and light intensity in its habitat during the morning and evening, which were lower than during the day. These temperature fluctuations and low light intensity are used by reptiles to carry out various activities, such as looking for food and so on.

This type of turtle also dominates the roaming area in the open pool section (C), with swimming and foraging activities in the water area. When in water, the environmental temperature is low enough so that turtles can moisten their bodies with water directly. This can stabilize its body temperature, and because it is classified as a reptile, this type of turtle also needs a water area to carry out activities (*foraging*, *shuttling*, *moving*, and *mounting*). Turtles, as reptiles live in two types of nature, namely land and water, to support their survival (Apriani et al., 2016). The water area is used for swimming, foraging, and bathing, while the land area is used for foraging, sunbathing, shelter, and so on (Karyadi et al., 2023).

C. amboinensis is also dominant in the closed pool area (D) during the day to protect itself and stabilize its body temperature from direct exposure to sunlight. As *poikilothermal animals*, their body temperature follows or is the same as the environmental temperature (Ario et al., 2016). This type of turtle really needs to adjust its body temperature to its surrounding environment to maintain a stable body temperature. From the exploration carried out by *C. amboinensis*, it can be seen from the two maps that have been depicted that environmental conditions greatly influence the roaming patterns carried out to carry out various daily activities. The movements that occur in male and female turtles are seen moving randomly through all areas in the artificial habitat *area*. It was also observed that the movement range of male *C. amobinensis* was longer than the movement range of female *C. amboinensis*.

2. Roaming patterns looking for mates in *C. amboinensis*

The roaming pattern of *C. amboinensis* is also often carried out with the aim of finding a partner, as depicted in the map in Figure 4.

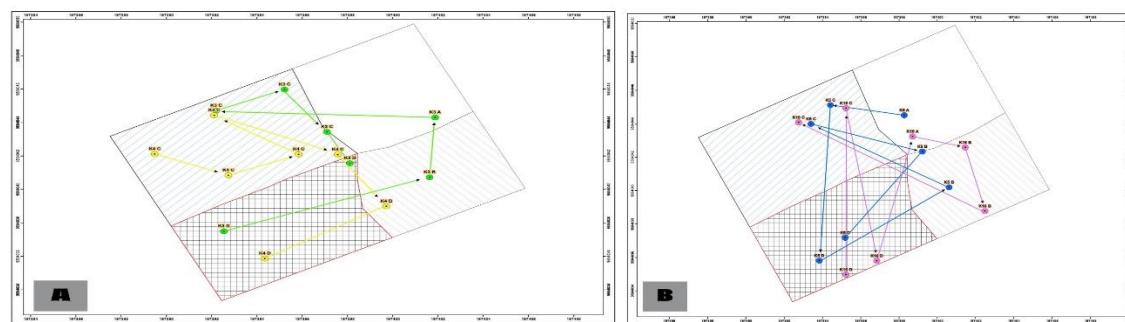


Figure 4. Map of home range patterns for *C. amboinensis* mates artificial habitat areas (A) and (B)

Information:

- Movement path of male *C. amboinensis* (K5)
- Movement path of female *C. amboinensis* (K16)
- Movement path of male *C. amboinensis* (K3)
- Movement path of female *C. amboinensis* (K4)

In the maps depicted above, the two maps show that during *C. amboinensis* roaming, there was also mating activity between male *C. amboinensis* (K5) and female *C. amboinensis* (K16). This activity occurred on the second day and in the open pool area (C). Meanwhile, the male *C. amboinensis* (K3) mated with the female *C. amboinensis* (K4). The mating activity of the *C. amboinensis* pair occurred on the fourth day in the open pool area (C) in the afternoon. This shows that *C. amboinensis* mates directly or spontaneously when male *C. amboinensis* and female *C. amboinensis* meet in the same area. Behavior that shows the mating of male *C. amboinensis* and female *C. amboinensis* is climbing behavior or male *C. amboinensis* mounting female *C. amboinensis* as in Figure 5 below.



Figure 5. Mating behavior of *C. amboinensis*

According to (Putranto et al., 2019), there are 5 natural mating behaviors in animals, namely stages: courtship, the stage of climbing on the back and adjusting the position (*mounting and positioning*), female stimulation, erection and ejaculation, and movements after mating (*postcoital display*). These five behaviors are all visible when this turtle has sexual intercourse, one of which is shown in Figure 5.

In *copulation*, the female turtle will move towards the nesting area (covered land area) with the aim of looking for a dry and sandy place to stay. Silent activities are carried out to dry the body and survey the most comfortable place to lay eggs (Mochamad, 2021). This activity is followed by the male turtle from behind, with the main aim of protecting the female turtle. It is very necessary to differentiate between male and female turtles, because it is the first step to finding out which turtle lays eggs and which protects the female turtle when it lays eggs. According to (Muhammad, 2016), female turtles will follow the movements of male turtles after *copulation*. In connection with this explanation, it can also be seen in the activity that occurs in *C. amboinensis*.

4. CONCLUSION

The roaming pattern of *C. amboinensis* occurs randomly, and the range of movement between male and female turtles is very different. In *C. amboinensis* mating behavior occurs directly (spontaneously) in the same area, which is often called mounting. The dominant browsing activities are carried out in the morning and evening based on fluctuations in environmental temperature with, Foraging (searching for food), basking (sunbathing) activities.

5. ACKNOWLEDGEMENT

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