Species determination based on head scutes, carapace, and plastron of turtle hatchlings at Boom Beach, Banyuwangi

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Abstract. A comprehensive study on the determination of species is important for the turtle conservation program. The external characteristics of turtles were identified based on the pattern of the head scutes, carapace and plastron. This study aimed to investigate the dead hatchling species at Boom Beach, Banyuwangi. Boom Beach is a 3 km stretch of beach in northeast Banyuwangi. We investigated 15 dead hatchlings from 4 different nests. Patrols were carried out all night and morning on the surface of the nest and excavated to collect dead hatchlings. All hatchlings were cleaned of epibion and dried to avoid reflection. The hatchlings were placed on a white table and photographed with a digital camera (Nikon D3100) from above. Figures were taken at a distance of 1 m to reduce the effects of visual distortion. As a result, the pattern of head scutes consisted of more than one pair of prefrontal scales; carapace consisted of six lateral scutes and six vertebral scutes; and plastron consisted of four intramarginal scutes with pores, respectively. It can be concluded that all the dead hatchlings were species of olive ridley turtle (Lepidochelys olivacea).

1. Introduction
Turtle conservation is crucial to protect turtle populations from extinction. Semi-natural nests as media for hatching turtle eggs decreased hatching of olive ridley turtle eggs (Lepidochelys olivacea). The hatchability of eggs in semi-natural nests shows an average of 75% of hatchlings [1]. Data on the reduction in hatchability or mortality of hatchlings before being released into the sea are not followed by the gender of the dead hatchlings, so it is necessary to study the sex ratio of the hatchlings that died or failed to hatch. This is important to predict the survival of the turtle and its conservation in the future. The long-term survival of sea turtles depends on the gender of the hatched turtle eggs [2].

Many studies have been carried out to determine the species of hatchlings using various techniques. Techniques that have been used include gonad histology [3], hatching quality [4], radioimmunioassay (RIA) to measure testosterone levels in blood or chorioallantois fluid [5], post-hatching laparoscopy of surviving hatchlings, observation of carapace and plastron structures [6]. Identification based on several characteristics such as shell, plastron, and tail has been used in several studies to determine gender differences, including Chysemys picta and Podocnemis expansa [7], Chelydra serpentina [8], Chelonia mydas [9], and geomydidae species [10]. Morphological measurements followed by the use of appropriate statistics can be used to identify hatchlings. Several further studies have been conducted to
find differences in hatchling species using a morphological approach [11]. This study was conducted to investigate the dead hatchlings at Boom beach, Banyuwangi.

2. Material and methods
2.1. Ethical approval
Ethical approval was done by Animal Ethics and Use Committee Universitas Airlangga No. 368/HRECC.FODM/VIII/2020. This ethical action aimed to prevent animal abuse and distress.

2.2. Collecting samples
A total of 15 dead hatchlings were found and collected as samples. All samples were cleaned of epibion and sand using absolute alcohol. The sample was placed on a white table and dried to prevent reflection. The figure was taken with a digital camera (Nikon D3100) at a distance of 1 m from above to prevent visual distortion. The head scutes, carapace and plastron were captured perpendicularly. Furthermore, the figure was converted to a monochrome version to determine landmark points on the head scutes, carapace and plastron.

2.3. Interpretation
The identified landmark points contain biological coordinate information data to be adjusted using a handbook [6].

3. Results and discussion
Based on the results of landmark determinations, a similar structure was found with L. olivacea. Specific characters appear more than a pair of prefrontal scales, more than 6 lateral scales and 6 vertebral scales on the carapace, and 4 porous inframarginal scales on the plastron (Figure 1 and 2). On the other hand, Eretmochelys imbricata has 2 pairs of prefrontal scales, 4 lateral scales on the carapace, and 4 inframarginal scales without pores on the plastron. The C. mydas species has a pair of prefrontal scales, 4 lateral scales on the carapace, and 4 inframarginal scales without pores on the plastron. Structural differences were found in 5 lateral scales on the L. kempii carapace.

Figure 1. Landmark structures of carapace (left) and plastron (right)

Figure 2. Landmark structures of the head scutes
Morphometric geometry is an analysis of the shape of body morphology to determine the variation of species. This method involves a multivariate procedure in distance, angle, and distance ratio [12]. Morphometry is a comparative analysis of biological forms and mathematical changes to measure variability and analyze differences in biological forms. The shape of the organism will be transformed into a geometric form. Geometry cannot be separated from the dimensions of space and size metrics. Coordinate points representing spatial dimensions are used as a method of measuring distances between points in a space called landmarks [13].

*L. olivacea* has a relatively small body size compared to other species. The average body weight of *L. olivacea* is 35 kg and the maximum is 75 kg, with a body length of 150 cm, meanwhile the hatchlings weigh 16 grams to 19 grams with a length of 44 mm [14]. *L. olivacea* has a dark green carapace with a yellow underside. The body of a turtle consists of a carapace or dorsal part, a plastron or covering of the chest and abdomen, and intermarginal which is the connecting part between the edges of the carapace and the plastron. Outward features that can be observed are six pairs of costal scutes on the carapace, four pairs of intermarginal scutes on the plastron, two pairs of prefrontal scales and three pairs of postocular scales [6,15].

*L. olivacea* are globally distributed in tropical waters. The population of *L. olivacea* detected was mostly dominated by female turtles [16]. *L. olivacea* have the largest population distribution in the Indian Ocean and Pacific Ocean [14]. The distribution of *L. olivacea* in Indonesia is scattered in the Java Sea. *L. olivacea* in Banyuwangi can be found in Alas Purwo National Park and the surrounding coasts, as well as Banyuwangi Boom Beach [1,17].

4. Conclusion
It can be concluded from the head scale pattern consisting of more than one pair of prefrontal scales; carapace consists of six lateral scales and six vertebral scales; and a plastron consisting of four intramarginal scales with pores on all the dead hatchlings referred to the olive ridley turtle species (*Lepidochelys olivacea*).

5. References

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6. Acknowledgments
Authors acknowledged the Banyuwangi Turtle Foundations and the Faculty of Veterinary Medicine, Universitas Airlangga for their support and facilities in this study.