Mathematical Modelling Approach in Predicting New Mother Sea Turtle Nesting Patterns at Chagar Hutang Turtle Sanctuary, Redang Island, Malaysia

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Samperisam, Wan Siti Noor Sofea Wan [a] ; Roslan, Ummu Atiqah Mohd [b, c] ;
Zakaria, Siti Fatimah [d] ; Harun, Fatimah Noor [b] ; Rusli, Mohd Uzair [e] ; +1 author

[a] Biological Security and Sustainability Research Interest Group, Faculty of Science and Marine Environment, Universiti Malaysia Terengganu, Terengganu, Kuala Nerus, 21030, Malaysia

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Abstract

Sea turtles, ancient marine reptiles that have survived for over 210 million years, now face unprecedented threats from human activities and climate change. This study employs mathematical modeling to predict and understand sea turtle nesting patterns at Chagar Hutang Turtle Sanctuary,

Redang Island, Malaysia. We analyzed historical nesting data from 1993 to 2022 using three continuous time models: exponential growth, logistic growth, and Gompertz growth. These models were fitted to the data using Maple Software, followed by rigorous error analysis. The Gompertz model emerged as the best fit, with sum of error of 20.7, significantly outperforming the logistic (28.5) and exponential (1227.2) models. This suggests that sea turtle population growth in the area follows a sigmoidal pattern with asymmetric growth rates. The model predicts a continued increase in new mother sea turtles up to 2030, but with a decreasing growth rate, indicating the population may be approaching carrying capacity. These findings provide valuable insights for conservation planning, highlighting the need for adaptive management strategies and expanded protection efforts. Our study underscores the efficacy of mathematical modeling in predicting sea turtle population dynamics and informs evidence-based conservation strategies for these iconic marine species. ©Copyright Wan Samperisam.

Author keywords

exponential; Gompertz model; logistic; mathematical modelling; Mother sea turtle

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