Cey. J. Sci. (Bio. Sci) Vol. 30, 2002, 99-104

IMPACT OF LUNAR CYCLE ON NESTING BEHAVIOUR OF MARINE TURTLES

E.M. Lalith Ekanayake*, K.B. Ranawana[1], T. Kapurusinghe, M.G.C. Premakumara and M.M. Saman

Turtle Conservation Project (TCP), 73, Hambantota Road, Tangalle, Sri Lanka.
[1]Department of Zoology, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka.

ABSTRACT

Coastal inhabitants in Sri Lanka believe that the number of nesting turtles increases during the full moon days. Also the tidal rhythm of the sea is directly correlated with the lunar cycle. This study was carried out to find the correlation of lunar cycle and the daily tidal rhythm with the number of nesting turtles. The lunar cycle and the daily tidal rhythm were plotted against the number of nesting turtles. It was found that there was no correlation of number of nesting turtles with the lunar cycle or tidal rhythm.

Keywords

Nesting turtle, Tidal rhythm, Lunar cycle

INTRODUCTION

According to the Newton's theory of gravity every particle in the universe attracts every other particle with a force that depends on their masses and the distance between them (stated in Watson, 1973). The earth attracts the moon strongly and keeps the same orbit and the moon is large enough and close enough to tug it in insistently at the earth's mantle. The water on the earth's surface behaves like loose garments that can be pulled out from the body and fall back again. The moon circles the earth every 27.3 days keeping the same face to the earth. But the earth shows its all sides to the moon once every 24.8 hours. Because of this system the water on the earth flows out towards the moon and therefore brings the high tide forty-eight minutes later each day. The rhythm continues and twice a day there is a high tide and a low tide. It takes 29.5 days from one full moon to next full moon day. The sun and the moon are directly in line with the earth twice in this cycle. At that time the pull of their bodies is added together to produce higher tides than usual. These spring tides occur when the moon is full and again during the time of the new moon. Much more moderate movements of water called the neap tides occur twice each month at the quarters of the moon, when the sun and the moon are positioned opposite to each other. According to the above facts the tidal amplitude changes with the lunar cycle. The water in the ocean and all the living marine animals and plants

* Corresponding Author's E-mail: lalith100@hotmail.com

respond to this rhythm. Also the same gravitational force of the moon that acts on the ocean can act on very small water bodies.

Coastal inhabitants in Sri Lanka who collect turtle eggs believe that there is a relationship with nesting turtles and lunar cycles. Because, they have seen that more turtles nest during the full moon. Also in French Guiana leatherbacks inter nesting return dates are closer to the full moon or the new moon (Girondot and Fretey, 1996). Reina (Pers. comm.) observed in Pacific Costa Rica there is no correlation with turtle nesting and the lunar cycle. The local people in the East Philippines claim that marine turtles will only nest during the new moon, the full moon and in the first and last quarter (Christopher, Pers. Comm.). Bresette (2000, Pers. Comm) analyzed three-year data record of an 18-kilometer loggerhead-nesting beach in Hutchinson Island, Florida. He found that there is no discernible correlation between the lunar cycle and nesting. Dobbs *et al.* (1999) found that the nesting activity of hawksbill turtles at Milman Island, northern Great Barrier Reef, Australia was significantly correlated with tidal height. Here, more turtles attempted to nest when the high tide occurred before midnight than after midnight. Bustard (1979) has suggested that the nesting cycles of marine turtles may be associated with tides where the tidal cycles are pronounced. Loggerheads normally nest above the high tide line and the turtles emerging at the high tide have to crawl shorter distance than the turtles emerging at low tide. When a turtle crawl a short distance it can save energy and the exposed time to the predators such as racoons, pigs and humans will be shortened. When the distance is increased across the beach between the high and low tide levels, there is greater advantage to emerge at high tide time. For this the tidal height and also the beach slope are very important factors. Frazer (1983) found that more loggerhead turtles nest at high tide than low tide in the Cape Canaveral beach in Florida and Cape Lookout beach in North Carolina, USA. But, Davis and Whiting (1977) found that there was no correlation with the tidal level and turtle emergence at Cape Sable beach, Florida, USA.

Main objective of this study was to find out whether there is a correlation between the lunar cycle and the number of nesting turtles. The other objective was to find the correlation of the tide level with the number of nesting turtles.

MATERIALS AND METHODS

Lunar cycle

In general full moon and new moon are qualitative measurements which cannot be used for mathematical work. Therefore, we formulated a method to give a quantitative value for the lunar cycle. In Sri Lanka we use the word '*pasaloswaka*' (fifteen circles) for full moon and '*amawaka*' (zero circles) for new moon. According to astrologers in Sri Lanka in the *amawaka* day we cannot see the moon and from the next day moon appears circle by circle and in the full moon day there are fifteen circles. We gave the value zero for the new moon and value fifteen for the full moon. The value could be quantitative value for the light

intensity or it could be the gravitation of the moon. The number of turtle nests and false crawls were plotted against the lunar value. Also the correlation of nests *vs.* lunar cycle and false crawls *vs.* lunar cycle was calculated using correlation function and scatter plots.

Here 'Nests' is defined as the successful nesting attempts in which eggs were laid whereas 'False crawls' are unsuccessful nesting attempts, which did not involved in laying eggs. We have conducted an in-situ nest protection programme for the sea turtles on Rekawa turtle rookery in Southern Sri Lanka from September 1996 to December1999. Number of nesting for the most frequent green turtle (*Chelonia mydas*) on this beach was taken for the analysis.

Tidal levels

The National Aquatic Resource Agency (NARA) maintains a tide gauge to measure the tide levels (tide amplitude) of the sea in the Tangalle area. We have used their tidal records for the years 1997 and 1998 for this study. The tidal levels were changing within one day and also throughout the year. Hence, we have plotted the tidal levels *vs.* the number of nesting turtles and the tidal levels vs. the number of false crawls on a scatter plot to find out the correlation with the tide. Also it was plotted as linear graphs. However in this study we have considered only the high tide dates and low tide dates of the month and, the high tide and low tide time of the each day was not considered for this analysis.

RESULTS

The correlation of the number of nesting and false crawls of the turtles (from September 1996 to December 1999) with the lunar cycle is shown in Figure 1. 2740 green turtle nests and 2541 green turtle false crawls were considered for this analysis. The correlation value for the lunar cycle with the number of nesting was 0.014 and the correlation value for the lunar cycle with the number of false crawls was 0.03. The correlation of the number of nests and false crawls with the high tide and low tide amplitude (from January 1997 to December 1998) is shown in Figure 2. 1714 green turtle nests and 1856 green turtle false crawls were considered for this analysis. The correlation value for the high tide height with the number of nests was 0.088 and the high tide height with the number of false crawls was 0.067. The correlation value for the low tide height with the number of nests was 0.040 and the low tide height with the number of false crawls was 0.041.

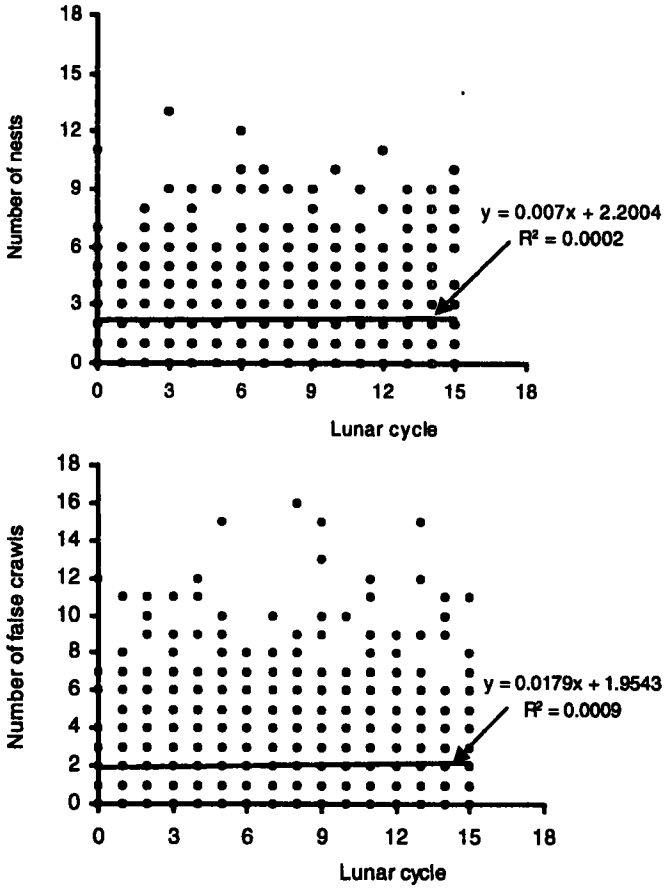

Figure 1. The correlation of the number of nesting and false crawls of the turtles (from September 1996 to December 1999) with the lunar cycle.

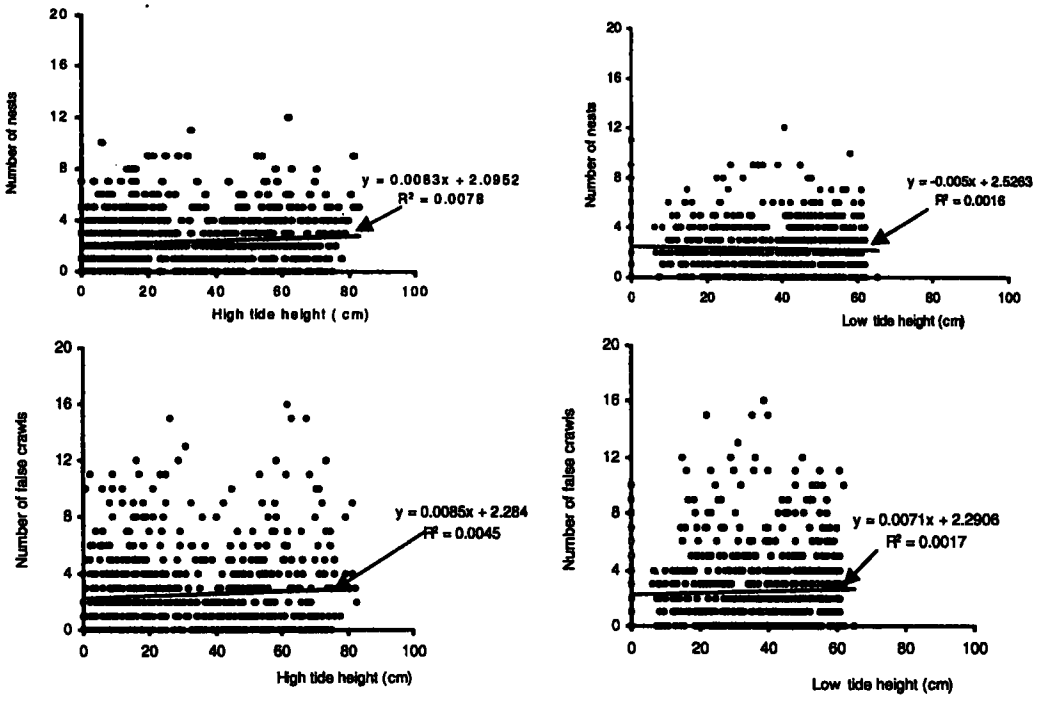

Figure 2. The scatter plots to show the correlation of the number of nests and false crawls with the High and low tide.

DISCUSSION

According to the observations gathered during this study there was no significant correlation between the lunar cycle *vs.* number of nesting green turtles or number of false crawls. Because of the few nests recorded for the other four turtle species during this study we have taken data only from green turtles for this analysis. Girondot and Fretey (1996) observed peak nesting of leatherbacks in French Guiana during the spring tides (full and new moon). One objective of our study was to find out whether there were more nesting turtles at full moon days, as the local people believe. But, we observed that there was no significant increase of number of green turtle nesting during the full moon days. According to this result we can conclude that the comments made by the local villagers were wrong. During the full moon days people could see the beach clearly during the night than on the other days. Rekawa villagers have developed a habit of staying whole night on the beach looking for nesting turtles. Therefore, they could observe more turtles, crawling on the beach from a distance when they stay on the beach on a full moon day. This could be the reason for them to believe that more turtles were nesting during the full moon days.

We have also calculated the correlation value between the tidal levels vs. number of nesting and false crawls of the green turtles. According to the observations made during the study there was no significant correlation between the tidal level and green turtle nesting or false crawls. Loggerhead turtles have shown some correlation with the high tide in the Cape Canaveral beach in Florida and Cape Lookout beach in North Carolina, USA (Frazer, 1983). In those beaches the distance to the beach became shorter at the high tide and that could be the reason for the turtles emerging at high tide. No such observations were made in Rekawa where the tidal range is very short. There was no correlation between the tidal level and turtle emergence (nesting or false crawls) at Cape Sable beach, Florida, USA (Davis and Whiting, 1977). There are two high tides and two low tides per day. But, turtle nesting occurs only at night time in the study area. Therefore, the high tide and low tide were considered only during the night for this study. This study clearly showed that lunar cycle or tidal level did not cause significant changes to the nesting behaviour of green turtles on Rekawa turtle rookery in southern coast of Sri Lanka.

REFERENCES

Bustard, H.R. (1979). Population dynamics of marine turtles. In: Harless, M. and Morlock, H. (Eds.). *Turtles: perspectives and research.* John Wiley and Sons, New York. Pp. 525-540.

Davis, C.E. and Whiting, M.C. (1977). Loggerhead marine turtles nesting in Everglades National Park, Florida, U.S.A. *Herpetologica*, **33:** 18-28.

Dobbs, K.A., Miller, J.D., Limpus, C.J. and Landry Jr, A.M. (1999). Hawksbill Turtle, *Eretmochelys imbricata*, Nesting at Milman Island, Northern Great Barrier Reef, Australia. *Chelonian Conservation and Biology* 3(2): 344-361.

Frazer, N.B. (1983). Effect of tidal cycles on loggerhead marine turtles (*Caretta caretta*) emerging from the sea. *Copeia* **2:** 516-519.

Girondot, M and Fretey, J. (1996). Leatherback turtles, *Dermochelys coriacea*, Nesting in French Guiana, 1978-1995. *Chelonian Conservation Biology* **2**(2): 204-208.

Watson, L. (1973). *The natural history of the supernatural.* Coronet Books, Hodder and Stoughton, Pp. 21-31.