PART II. POSTER PRESENTATIONS

TEMPORARY SEQUENCES AND DESCRIPTION OF THE EMERGENCY OF NEWBORNS OF LOGGERHEAD IN THE CAPE VERDE ARCHIPELAGO

Elena Abella and Luisfelipe López-Jurado

Departamento de Biología, Facultad de Ciencias del Mar Universidad de Las Palmas de Gran Canaria, 35017 Las Palmas, Canary Islands, Spain

INTRODUCTION

Sea turtles bury their eggs in the sand of the beach, where they incubate. After a period of approximately two months, hatchlings break the eggshell and remain inside the chamber for three to seven days (Hays & Speakman, 1993). Then they leave the nest and emerge to the surface of the beach, going quickly towards the surf, to begin their pelagic and developmental stage (e. g., López-Jurado & Andreu, 1998).

Hatchlings usually do not emerge from the nest as a single group. They emerge in groups at different moments, resulting in more than one emergence per nest during some days (Whitherington et al., 1990; Hays et al., 1992; Peters et al., 1994).

Nesting population of *Caretta caretta* in Boavista (Cabo Verde, Western Africa, FIGURE 1) has recently been discovered and it has been the object of management and conservation effort since 1998 to do research on the most significant aspects of their reproductive biology. Below we present the pattern of emergence of hatchlings from the nests in Boavista, in natural nests and in artificially incubated ones.

MATERIAL AND METHODS

During the 2000 nesting season, a total of 234 nests of *Caretta caretta* were marked and monitored in three beaches of the southeastern coast of the island between 7th July and 27th August. One hundred of these nests were relocated from the original beach to a hatchery to safeguard the survival of the hatchlings, because the fate of the hatchlings in the places where they were laid by the female (flooded sand or compressed substrate) could be uncertain (see Material and Methods in "Hatching success between natural and relocated nests from loggerhead in the island of Boavista (Cape Verde, Western Africa)" in this Symposium).

The eggs from these nests were incubated in similar conditions to those in situ on the beaches, and hatchlings were released in different closer beaches to avoid predators feeding stations in the incubation beach (Mortimer, 1999).

From the 45th day of incubation, a plastic net was placed around the nest to retain hatchlings during their emergence to the surf. After each emergence event, hatchlings were counted and measured (straight carapace length), and released immediately, leaving untouched the nest waiting for subsequent emergences. When the number of hatchlings emerged matched (or was similar to) the total number of eggs lay by the female, or after 70 days of incubation, the nest was excavated with caution checking for new hatchlings (Miller, 1999).

RESULTS

A total of 234 nests were marked and 139 of them were included in the analysis (84 from hatchery and 55 natural ones), excluding nests with doubtful results and those in which the marks were lost due to tides and rain.

Incubation period for *C. caretta* in Boavista averages 59.0 days (N=178), without significant differences between nests incubated in the hatchery and those on the beaches (t=-0.636, p=0.52).

Number of emergence events per nest

In the hatchery, the number of emergences (Mean=2.54 emergences/nest, Range=1-8, N=84) was significantly higher than on the beaches (Mean=1.36 emergences/nest, Range=1-4, N=55; U'=1079.0, $p<0.0001$).

Interval between the first and last emergence

An average of 3.68 days passed between the first and the last emergence (Range=1-20, N=139). Also, this was significantly higher (U'=1155.0, $p<0.0001$) in the hatchery (Mean=4.77 days, Range=1-20, N=84); than in the beaches (Mean=2.01 days, Range=1-12, N=55).

Percentage of hatchlings per emergence

The great majority of hatchlings emerge in the first event, this value diminishing in subsequent emergences. Thus, in the first event, the percentage of hatchlings that emerged from the nest was 88.1%. If we compare this result between nests incubated in the hatchery and those let in the beaches, we observe how the percentage is significantly higher in situ, averaging 90.7% (U'=3390.0, $p<0.0001$) in front of those incubated in the hatchery (86.3%). This difference changes in subsequent emergences, being the percentage lower in the nests incubated in situ (TABLE I).

Size of hatchlings

Mean body size of hatchlings in the first emergence event was 42.0 mm of straight carapace length (Range=39.0-45.0, N=126). If we compare between different emergence events (from 1st to 5th, due to small sample size from 6th to 8th), there are no significant differences ($F_{4, 258}=2.36$, p=0.053, FIGURE 2).

DISCUSSION

Incubation period for sea turtles is influenced by factors such as temperature (Mrosovsky & Yntema, 1980) and O_2 levels (Ackerman, 1980). Therefore, eggs from the same nest may have different incubation periods, resulting in more than one emergence per nest. On the other hand, emerging in groups is better from the energetic point of view to climb to the surface (Carr & Hirth, 1961), although there exist limiting factors in the time they wait for their siblings (energy expenditure or predatory detection, Hays et al., 1992).

In general, our results suggest that the pattern of emergence of hatchlings of *C. caretta* in Boavista is similar to the ones already described, which shows once more that there is not just one emergence event in each nest, and that this occurs in a variable interval of days (Hays et al., 1992; Peters et al., 1994). Comparing the total number of days of emergences with the data on the bibliography, there are no outstanding differences. For example, in Turkey, emergences cover a time of 2.3 days (Peters et al., 1994), while this value is 8.3 days in Greece (Hays et al., 1992), and in Florida it ranges between 1 and 3 days (en Whitherington et al., 1990).

The higher number of emergence events as well as the total duration in the hatchery could be due to the different incubation temperatures inside a single nest unlike those incubated on the beaches. Even though the chambers made by us in the hatchery tried to be similar to those made by the loggerhead females, it is possible that the shape of the chambers was more variable, resulting in the differences mentioned before. Nevertheless, the characteristics of the beach chosen for the hatchery compared with the features of the beaches with the nests in situ may also cause the differences.

On the other hand, the percentage of hatchlings emerging from the nest in the first emergence event is lesser in the nests incubated in the hatchery, possibly because, in these nests, hatchlings emerge in a higher number of days (TABLE I).

However, the emergence success from hatchlings incubated in the hatchery was higher than the same result in the beaches (see results in "Hatching success between natural and relocated nests from loggerhead in the island of Boavista (Cape Verde, Western Africa)" in this Symposium).

If we observe now the size of the hatchlings, there is no significant relationship between subsequent emergences (FIGURE 2), as it is noted in other known populations, e. g., in Greece (Hays et al., 1992). Although we have no data on this subject, the hypothesis relating to the smaller size of hatchlings that remain in the nest after all emergences results feasible, as it occurs in Turkey (Peters et al., 1994).

Acknowledgements:

We thank the David and Lucile Packard Foundation and Sea Turtle Symposium for travel support.

LITERATURE CITED

Ackerman, R. A. (1980). Physiological and ecological aspects of gas exchange by sea turtle eggs. Amer. Zool., 20:575-583.

Carr, A. & Hirth, H. (1961). Social facilitation in green turtle siblings. Animal Behavior, 9:68-70.

Hays, G. C. & Speakman, J. R. (1993). Nest placement by loggerhead turtles, *Caretta caretta*. Animal Behaviour, 45:47-53.

Hays, G. C., Speakman, J. R. & Hayes, J. P. (1992). The pattern of emergence by loggerhead turtle (*Caretta caretta*) hatchlings on Cephalonia, Greece. Herpetologica, 48(4):396-401.

López-Jurado, L. F. & Andreu, A. C. (1998). *Caretta caretta* (Linnaeus, 1758), pp. 44-56. In A. Salvador (eds.), Reptiles. Fauna Iberica, vol. 10. Museo Nacional de Ciencias Naturales, CSIC, Madrid.

Miller, J. D. (1999). Determining clutch size and hatching success, pp. 124-129. In K. L. Eckert, K. A. Bjorndal, F. A. Abreu-Grobois and M. Donnelly (eds.), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group.

Mortimer, J. A. (1999). Reducing threats to eggs and hatchlings: hatcheries, pp. 175-178. In K. L. Eckert, K. A. Bjorndal, F. A. Abreu-Grobois and M. Donnelly (eds.), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group.

Mrosovsky, N. & Yntema, C. L. (1980). Temperature dependence of sexual differentiation in sea turtles: Implications for conservation practices. Biological Conservation, 18:271-280.

Peters, A., Verhoeven, K. J. F. & Strijsbosch, H. (1994). Hatching and emergence in the Turkish Mediterranean loggerhead turtle, *Caretta caretta*: natural causes for egg and hatchling failure. Herpetologica, 50(3):369-373.

Whitherington, B. E., Bjorndal, K. A. & McCabe, C. M. (1990). Temporal pattern of nocturnal emergence of loggerhead turtle hatchlings from natural nests. Copeia, 4:1165-1168.

Figure 1. Map showing Cape Verde Islands, and the position of Boavista.

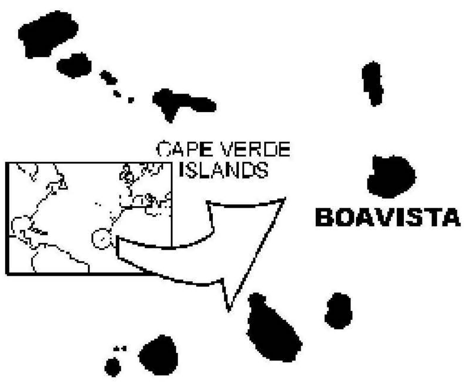

Figure 2. Mean body size (SCL of hatchlings of *caretta caretta* from Boavista (bars show Standard Deviation).