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Neonate survival en handled broods of the Olive Ridley Turtle *Lepidochelys olivacea* (Testudines: Cheloniidae) in “El Verde”, Sinaloa, Mexico

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ABSTRACT

We worked in the protective and conservation area of the Olive Ridley Turtle *Lepidochelys olivacea* in the beaches of Estero Verde, Sinaloa, Mexico (2004 season). The position in the beach does not affect survival. We found nests until the preferential nesting site located at the beginning of the second sandy berm in a zone free of vegetation; and the latter presented a slight increase in survival. Specimens handled for 2-5 hours survived less ($R^2=0,82$).

KEY WORDS

Incidence of turtles, management, survival, protected area, conservation.

RESUMEN

Trabajamos en la zona de protección y conservación de la tortuga golfinia *Lepidochelys olivacea* en las playas del Estero el Verde, Sinaloa, México, en la temporada 2004. La posición en la playa no afecta la supervivencia. Hallamos nidadas hasta el sitio preferencial de anidación ubicado al inicio de la segunda berma arenosa en zona libre de vegetación; estas últimas representaron un ligero incremento en la supervivencia. Un manejo de 2 a 5 horas reduce la supervivencia ($R^2=0,82$).

PALABRAS CLAVE

Incidencia de tortugas, manejo, sobrevivencia, zona de protección, conservación.

The olive ridley turtle *Lepidochelys olivacea* (Eschscholtz, 1829), is one of the most abundant sea turtles (Limpus, 1995). The atmosphere of the nesting beaches and the environment in the halls of incubation, it is very important to study the biology of reproduction and nesting (Richardson, 2000); therefore, a continuous nesting beaches, monitoring as well as also an effective monitoring, will provide important information for the effectiveness of hatching in the nests is greater.

The site on the beach each gender choose to nest, seems to be related to the size and the average weight of the animal, turtles of the genus *Lepidochelys* arrive at Sandy barrier beaches and usually go up until the first berm or terrace, where it is common that they nest beaches and usually go up until the first berm or terrace, where it is common that they nest together at the first attempt in clearances of vegetation, unless they find an obstacle as roots, stones or sticks buried, because then seek a new

site close to the first, where will try again to dig the nest (Marquez, 1996).

In agreement with Limpus, Baker & Milar (1979) and Parmenter (1980) all handling (excavation, transportation and re-seeding) should be within two hours of the oviposition of the eggs or eggs should be left in place at least 25 days to reduce the impact of the movement which leads to mortality.

It is important to determine limits of protection, the areas of highest incidence of nesting turtles, so implement monitoring plans to improve handling of broods techniques and also that these areas are somewhat better sheltered, without removing the importance and time zones with lower quantities, since the entire area represents an important potential in the conservation of this body. On the other hand would in better shape clutches exposed to predators or looting.

METHODOLOGY

"El Verde" Camacho beach (Fig. 1) is located 10km approximately to the North of the city of Mazatlán, Sinaloa on the Mexican Pacific coast. Corresponds to a protected natural area in the form of reservation and site of refuge area for the protection, conservation, reforestation, development and Control of the different species of turtle marine "El Verde" beach, 23°26'31,85" N 106°34'57,92"W and 23°20'30,48" N 106°29'31,15"W.

Patrols were conducted for the monitoring the area and collection of nests recorded number of eggs, time of collection and time of reseeded clutch. Clutch data is labeled and the percentage of hatching or survival of eggs, established position, which corresponds to the preferential nesting site of the turtle, olive ridley on the beach, according to Marquez (1996).

The nesting area was marked by stakes every 150m to have 100 stakes within the coverage area. Clutches were moved to the Protection Center located near the area of protection, re-seeding in polyurethane boxes, and arrangement in an incubation room.

Development of the processing of the data

We used Excel and Statistical version 5.1 (StatSoft Inc., Tulsa, OK). ANOVA was performed to see if there were differences in survival between by handling time. The Kruskal-Wallis test was used to determine whether there are differences in the average of turtles that come to spawn along the areas of the protection of "El Verde". Later the Student-Newman-Keuls multiple comparison test was used (Montgomery, 1991), an ANOVA was applied to determine differences in the percentage of survival by area.

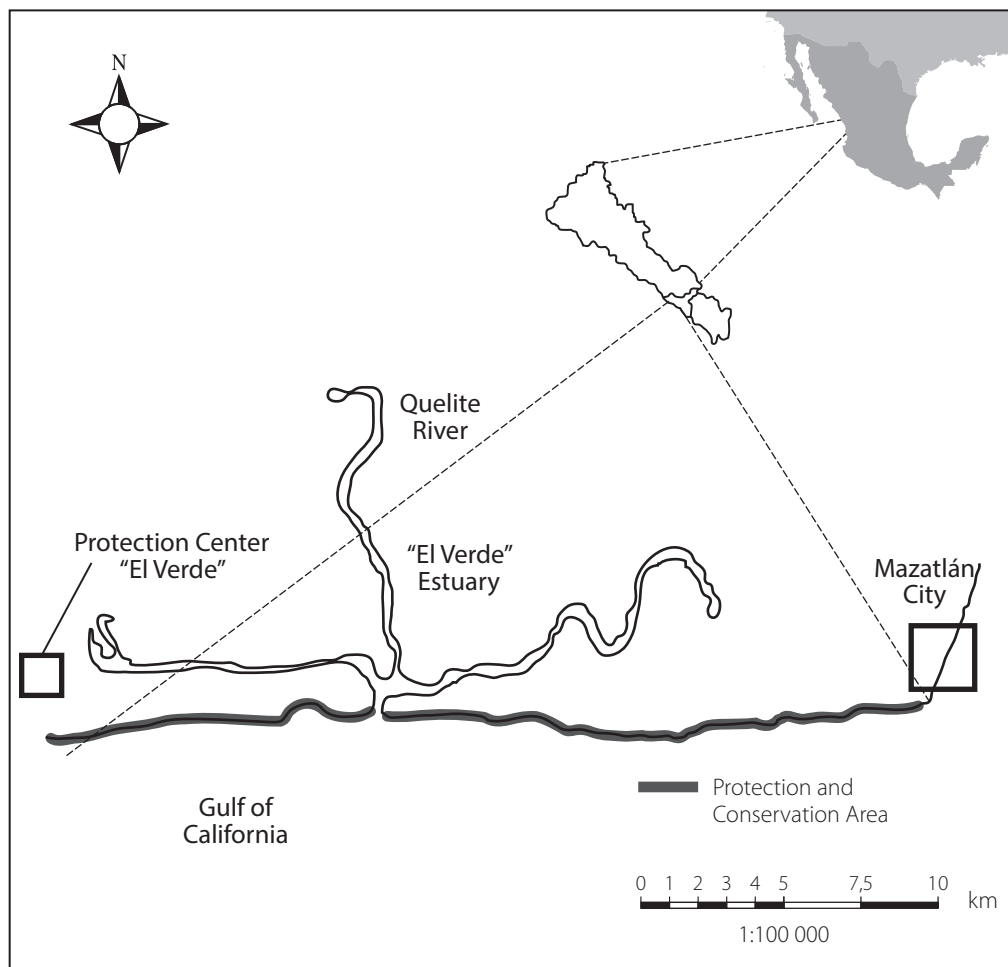


FIG. 1. Zone of the sea turtle protection *L. olivacea*, "El Verde".

The data processing was done in the "Instituto de Ciencias del Mar y Limnología de la UNAM".

RESULTS

A subsample of the collected broods comprising from May 28 to 13 of September 2004, which is the time of greatest abundance of clutches (Fig. 2) was used for this study.

The preferred nesting site of the turtle, olive Ridley on the beach (Fig. 3) was established and its effect on survival in neonates was analyzed; Table 1 shows the number of eggs, neonates living and survival percentage results.

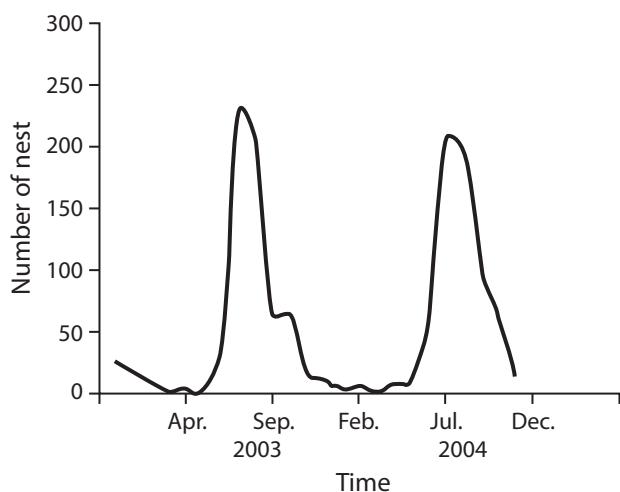


FIG. 2. Number of nests in the time series representative of the site.

Survival was not affected by position (ANOVA $p=0,1624$, Fig. 4). The number of broods found by position indicates that there is a preference in nesting in positions 3 and 4, while position 6 seemed to be avoided (Fig. 5). The number of eggs remains constant, but the percentage of survival had a slight increase in position 6.

We categorized four groups of handling time: 0 to 0,5, 0,5 to 1, 1 to 2 and 2 to 5 hours, that specifies timeout handling of clutches. With longer handling of the clutch (collection, transport and reseeded clutch), there is a decrease in the percentage hatching; $F(3,301)=4,3289$, $p=0,0052$. The 2 to 5 hour period was the worst (Tuckey).

The mean number of turtles varied with sections of the beach (Kruskall-Wallis ANOVA, Fig. 6).

Zone 1 (0,025) is different from zones 3 and 4; zone 2 (0,0707) is different from zone 4. Test of multiple comparisons (SNK) The zone 1 and 2 are the most similar. There were also differences in the percentage of survival between the four areas (ANOVA $p=0,0022$; zone 3 differed from others (Tuckey).

Summary regression: Total mortality = $-0,2865 * (\text{management time in minutes}) + 95,369$; with a $R^2=0,8218$ (Fig. 7); survival = 75% and mortality = 25%.

DISCUSSION

The olive ridley turtle spawned all of 2004, the highest proportion of turtles nesting occurred in August. The months with the highest number of brood covers the period between June and November.

According to Flores (1985) the incubation of the parrot turtle nest (*Lepidochelys kempii*) in "Rancho Nuevo" beaches, Tamaulipas naturally presents a slightly higher number

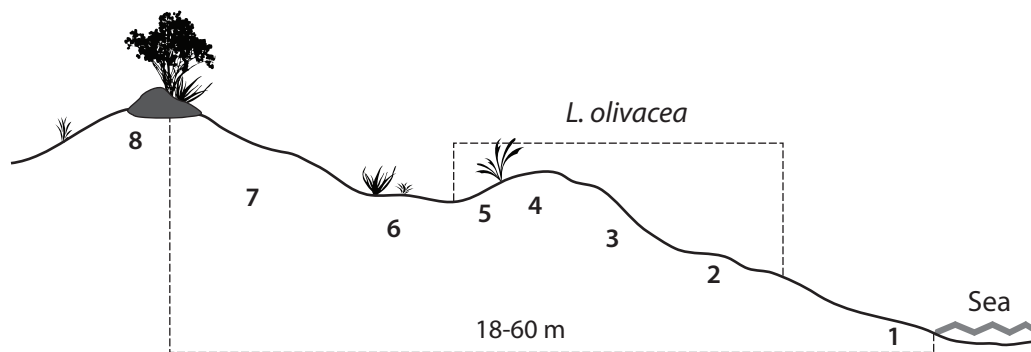


FIG. 3. Position of the turtle nesting on the beach olive ridley *L. olivacea*. Adapted from Marquez (1996).

TABLE 1
Results of average number of eggs, neonates living
and percentage of survival by nest position.

Position	Number of eggs	Neonates living	% Survival
2	90,5±19,19	48±27,5	52±28,5
3	94,2±20,08	48±29,8	49,9±30,1
4	95±18,86	48,2±24,8	52±27,01
5	95,5±21,62	55±25,9	58±26,7
6	94,2±15,01	63±31,9	69±32,2

The results are described in media and standard deviation.

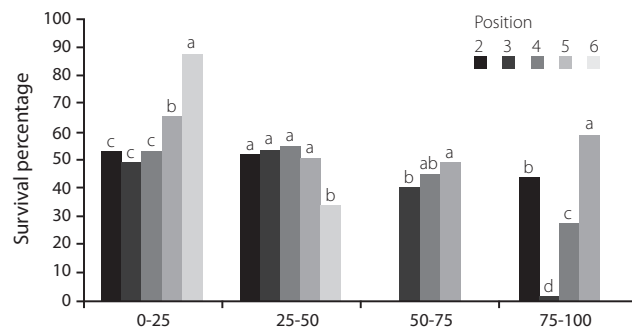


FIG. 6. Number of broods per area and position.

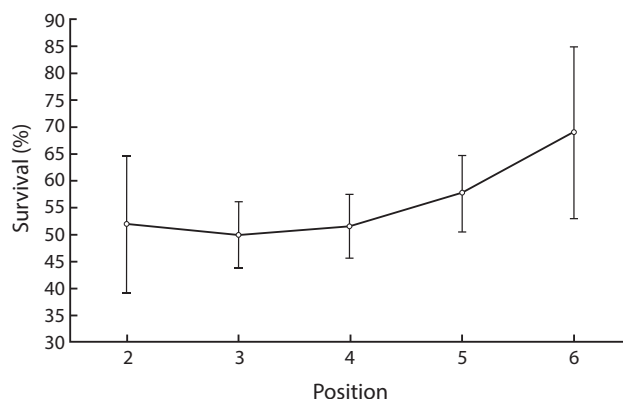


FIG. 4. Graphical ANOVA between the preferential nesting on the beach site and the hatching. Percentage bars denote a 0,95% confidence interval.

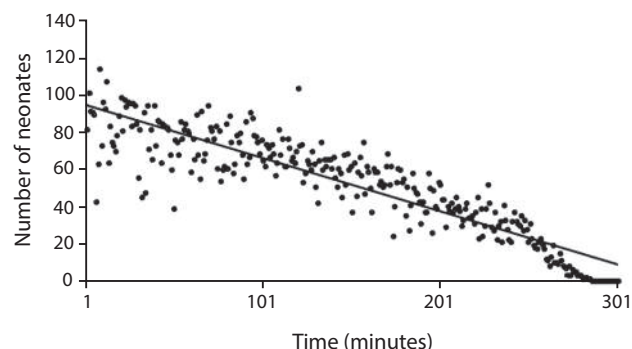


FIG. 7. Regression analysis of linear type with negative slope between (Y) the number of live neonates (total mortality) and (X) time management ($Y = -0,29X + 95,38$ $R^2 = 0,82$).

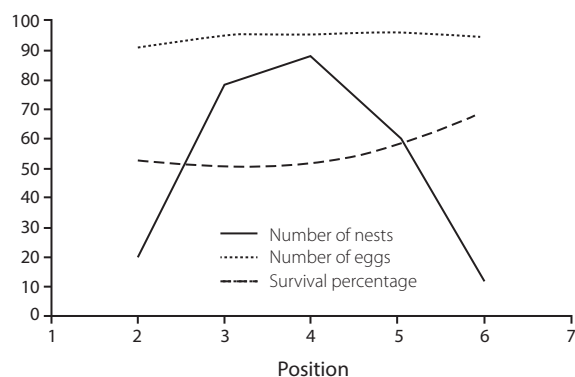


FIG. 5. Number of broods, survival percentage and number of eggs by preferential site of nesting (position).

of neonates live compared with the nests transplanted to pens or polyurethane boxes. Boulon (2000) says that the first and best option for handling is always eggs in situ protection. In situ protection in this area is very difficult due to the looting and predation of clutches and turtles for this that the management (excavation, transportation and reseeded), is the best option.

According to Marquez (1996), the position of the clutch on the beach or the site on the beach each gender choose to nest is characteristic of each species and appears to be related to the size and the weight average of the animal. So the tortoises of the genus *Lepidochelys* arrive at Sandy barrier beaches and usually go up until the first berm or terrace, where it is common that nesting at the first attempt in clearances of vegetation, unless they are

an obstacle as roots, rocks or buried sticks, because they will then seek a new site close to the first, where will try again to dig the nest. In this case refers to the location of the broods of *L. olivacea* in position 2 to 5, for this the position of the clutches work included 2 through 6 is a position above described by Marquez (1996), although only occurred in the first two areas probably since these beach areas are more gentle slope on the other hand by comparing the percentage of survival between positions we can see an increase in the number of infants live in position 6, which is not listed as typical of the genus *Lepidochelys*, although the comparison of analysis of variance test indicates that there are no significant differences, we can speculate otherwise with a 10 increase in the percentage of survival.

Harry & Limpus (1989) recommended that the eggs should not be moved at all in a span of 3 hours to 21 days after the oviposition. Garduño & Cervantes (1996), determine that survival in natural nests to the transplant is larger, in this case the decisive variable is time management, because the nests that are left *in situ*, not subjected to a disturbance by management is greater survival, also explained that the revival of nests may be affected by the manipulation of eggs, since after polarized the germinal disc in the embryo tilt or any slight change in the, will increase mortality. Naranjo (1989) explains that in the transplanted nests, the management does not affect if done with the greatest of care. Boulon (2000) explains that after one period of more than 12 hours of being nest, eggs should not collect, since the embryo adheres to the inside of the shell and the movement is fatal. This study found that after two hours of management time survival percentage decreases by 40, there is a linear trend that explains that mortality increases with the increase of management time and decreases the survival of infants born. This allows information to implement monitoring plans to reduce the time between and reduce clutch handling times. Manipulation time represents a point of great relevance for the development of the fieldwork.

The areas of highest incidence of turtles allowed us to establish monitoring systems focusing on the areas where the highest proportion of nesting females come.

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