Reviewed: 7/27/2021

Injury Rates of Diamondback Terrapin (*Malaclemys terrapin)* in Galveston Bay, Texas

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Introduction

Diamondback terrapin (*Malaclemys terrapin*) inhabit brackish water salt marshes along the Eastern and Gulf Coast of the United States (Coker 1906). Terrapin are often found in dense populations exhibiting high site fidelity. Unfortunately these unique characteristics have lead to their decline (Gibbons et al. 2001; Seigal 1984). Human industry and development have had a detrimental impact terrapin populations throughout history and continues to contribute to their decline (Szerlag & McRobert 2007). Mitro (2003) suggests that survival is more influential on population growth than reproductive success. It has been shown the highest injury rates in terrapin occur in larger individuals (Cecala et al. 2008). Natural predation by sharks, fish, and crabs have been documented as another stress to terrapin populations (Cecala 2008).

As documented in the current Texas State Wildlife Plan, data is urgently needed to insure wise conservation and management of terrapin by the Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service. The objective of our study was to analyze the types and affects of injuries on diamondback terrapin in Galveston Bay, Texas. We analyzed the types and rate of terrapin injuries at two different locations and habitats.

Figure 1. Map of Study area in A) West Galveston Bay, TX and B) Deer Island complex with locations of captured injured terrapin.

Materials & Methods

- •Diamondback terrapin were caught using land searches and marine trapping throughout West Galveston Bay in Texas (Figure 1).
- •Terrapin were observed at two different habitat types;
  - •1) large barrier island and mainland areas (Sportsman's Road on Galveston Island and Green's Lake in Hitchcock, TX)
  - • 2) isolated island sites (North and South Deer Islands in West Bay, Galveston Bay, TX).
- •Carapace length and weight were measured and injury type, severity, and location of injury were noted and photographed when applicable.
- •Injuries were divided into four categories (Figure 2):
  - • death (death of turtle) • shell (any injury to any part of shell)
  - •limb (any injury to any of four legs including missing legs, toes, etc)
  - •head (injury to any part of head including eye, nose, mouth, neck, etc)
- •Differences in injury rates were evaluated using Fisher's exact test with a 95% confidence interval to determine if there was a significant difference between the injury rate in different sexes on island versus mainland locations.
- •We used the Mann-Whitney test with a 95% confidence interval to determine if there was a significant difference in the weight or the carapace length of terrapins injured versus not injured.

Figure 2. Examples of dead terrapin and sources of mortality A) Female terrapin hit by a boat with cracked carapace; B) male turtles damage to both eyes, nose, and mouth; most likely from predator.

Male						
Injuries		**% M**	**Island**	**% M**	**Mainland**	**% M**
Death	2	11%	1	10%	1	11%
Shell	6	32%	4	40%	2	22%
Limb	8	42%	3	30%	5	56%
Head	3	16%	2	20%	1	11%
total	19		10	52.63%	9	47.37%
Female						
Injuries			**Island**	**% F**	**Mainland**	**% F**
Death	8	18%	8	21%	0	0%
Shell	18	42%	15	39%	3	50%
Limb	10	22%	9	24%	1	17%
Head	8	18%	6	16%	2	33%
total	44		38	86.36%	6	13.64%

Table 1. **Summary of Data.** Total number of injuries and the percentages of each type of injury at each site by sex.

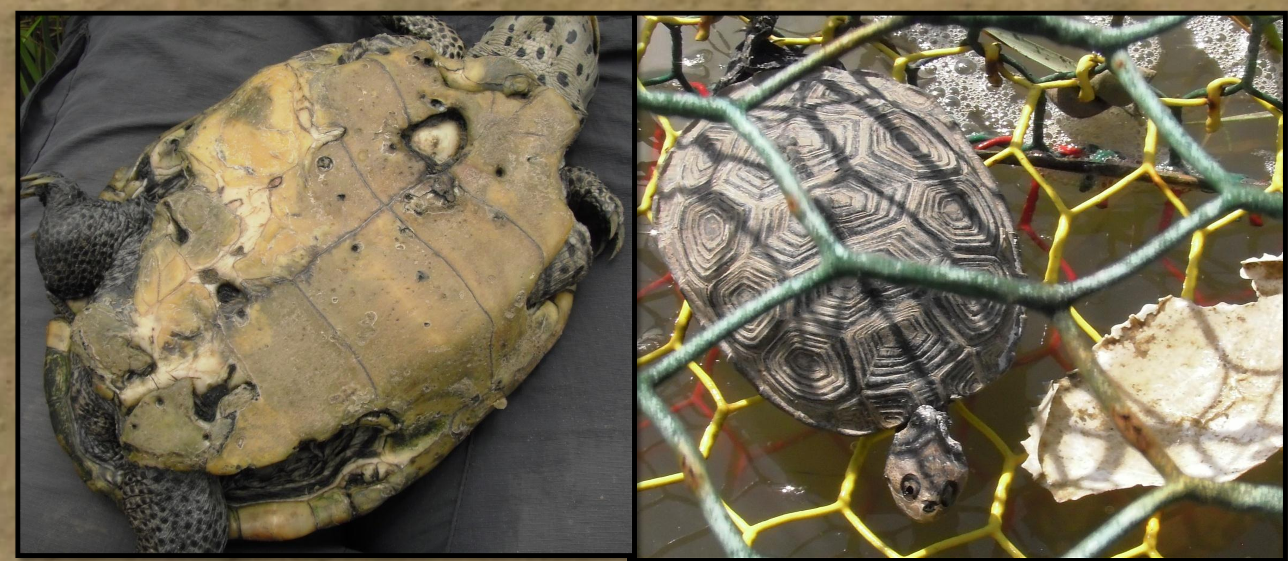

Figure 3. Examples of terrapin injuries. A) Plastron of female terrapin most likely damaged by boat propeller; B) dead male terrapin in crab trap.

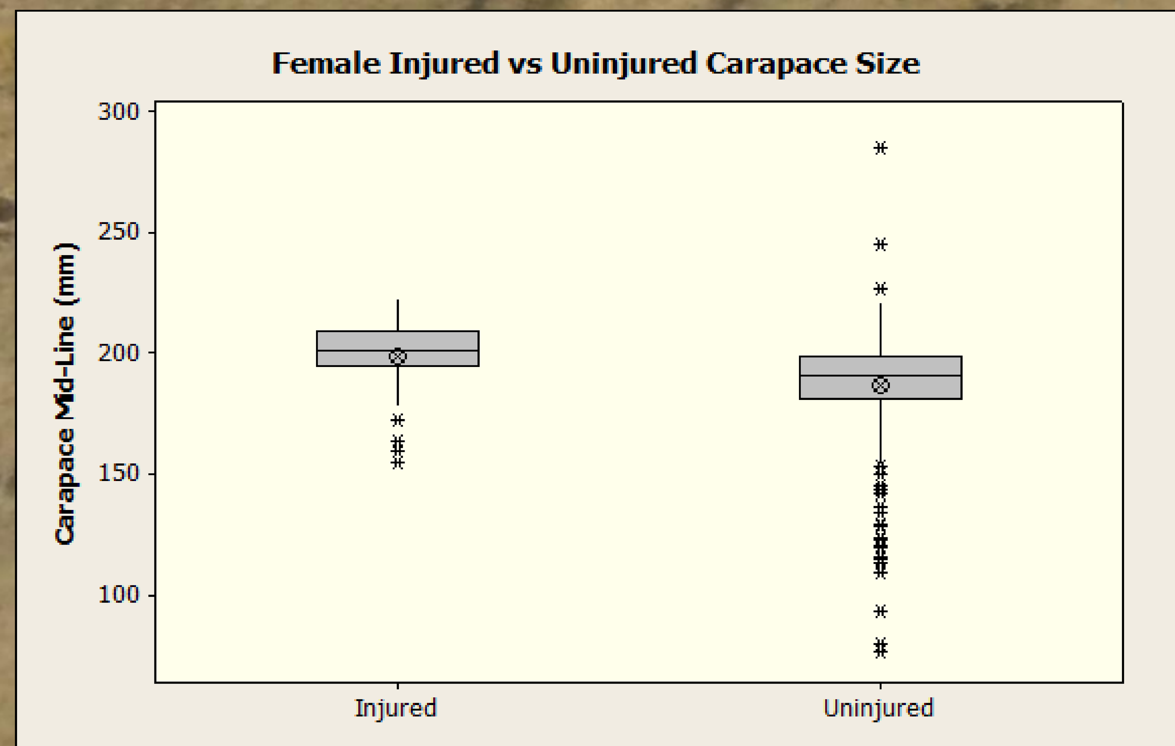

Figure 4. Relationship of female terrapin size and terrapin injuries (p value of <0.001 Mann Whitney Test).

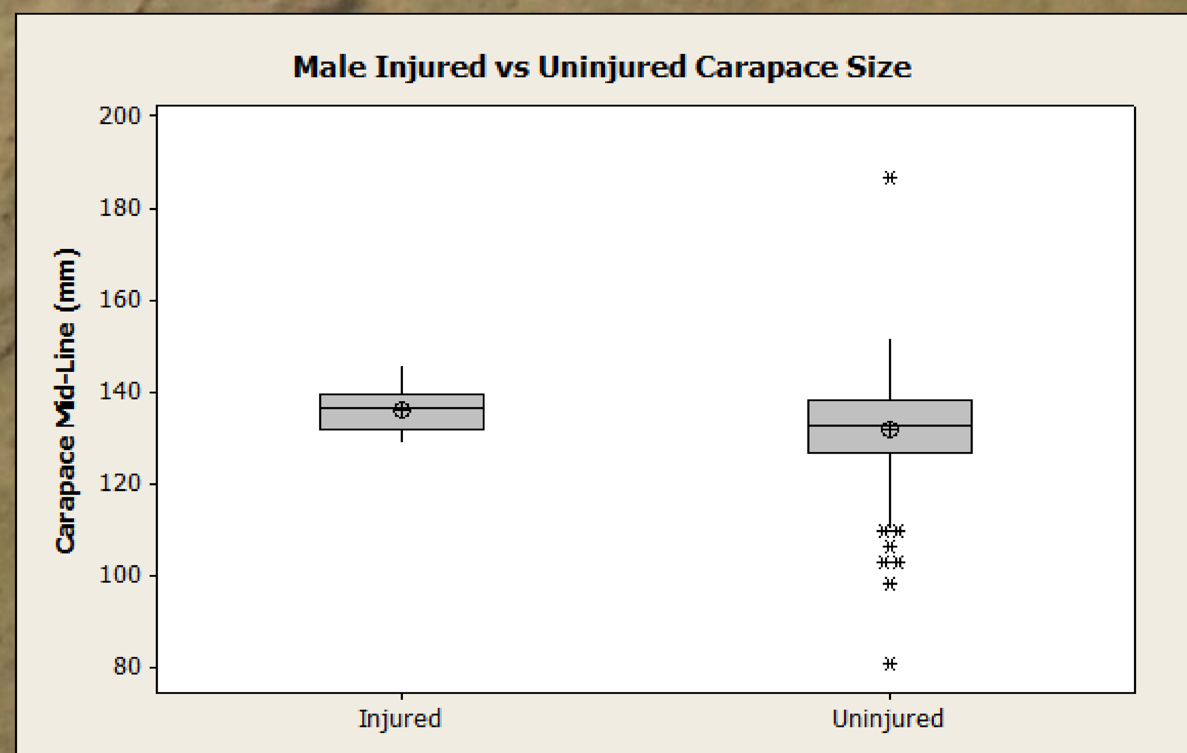

Figure 5. Relationship of male terrapin size and terrapin injuries (p = 0.0535 Mann Whitney Test).

Results

A total of 56 dead or injured terrapin were observed during the study, several had more than one injury (table 1). A variety of injuries with associated causes were observed (Figure 3). We found that female carapace length was significantly larger (p = <0.001) in injured versus uninjured individuals (Figure 4). Although not statistically significant (p=0.0535) injured male carapace length was slightly larger than uninjured (Figure 5).

The injury rate of males was significantly lower (p=0.001) from the injury rate of females at isolated islands (Figure 6). However, the injury rate of males was not found to be significantly different (0.775) than females in the mainland habitat. The injury rate of males and females on the mainland were not found to be significantly different (p=0.176 and 0.092) from males and females collected at the islands respectively.

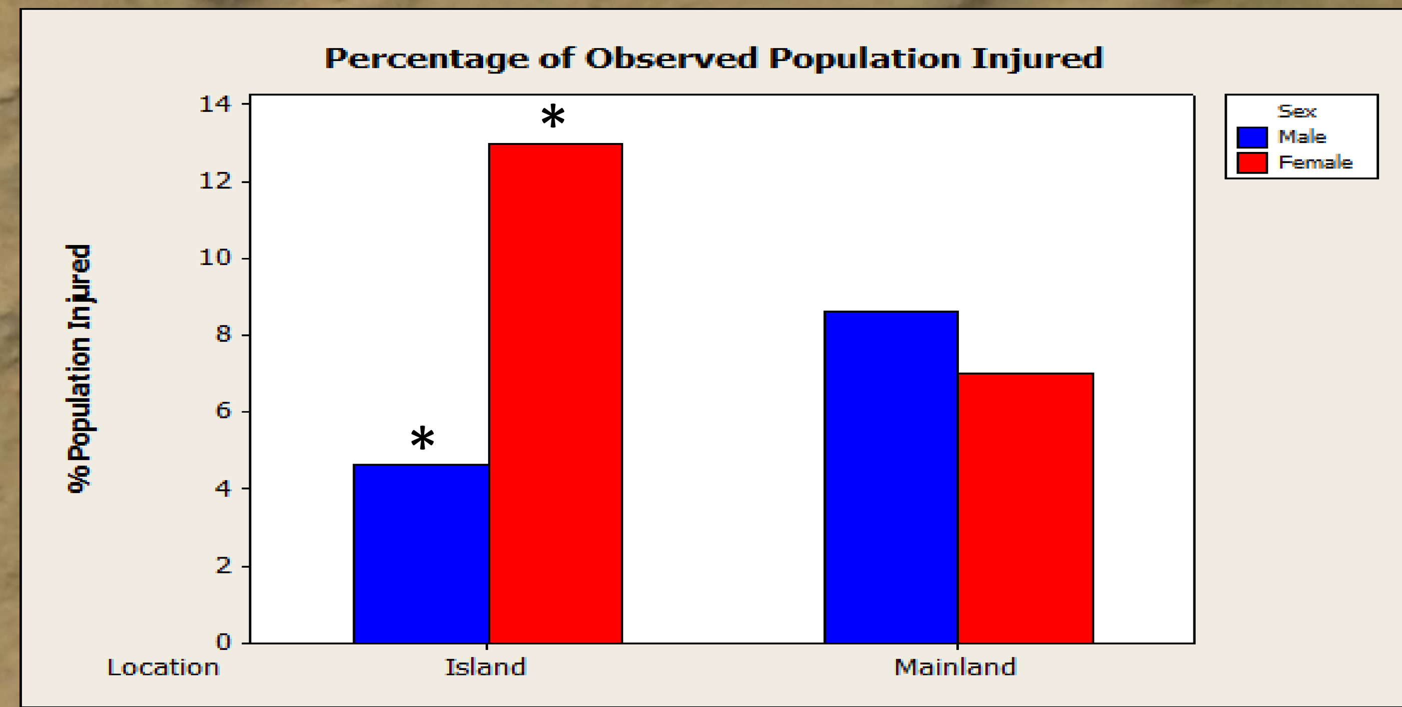

Figure 6. Percentage of male and female terrapin at both island and mainland habitats. Significant differences (p <0.05 Fishers Exact Test) in the proportion of injured terrapin was between male and female isolated island terrapin.

Discussion & Future Work

Our data suggests that larger females sustain more injuries than smaller females. Several mechanisms may be responsible for this. For example older terrapin would accumulate more injuries over time. In addition, larger females may be subject to a higher proportion of unsuccessful predation attempts that result in injury versus mortality. We also found that females at isolated islands have a higher injury rate than the males in the same area. One possible reason for this observed difference is that females have to travel to nest, putting them at greater risk of injury or death by motor boats and aquatic predation (Roosenburg 1991). On the isolated islands there is not a large area for nesting thus females terrapins may travel off the island to nest thereby increasing their risk of injury. We plan to continue monitoring these populations to determine how these injuries may affect the physiological condition of terrapin and survival. This critical information is needed to determine possible approaches to minimize terrapin injury and conserve terrapin populations.

Literature Cited

Cecala, K.K., J.W. Gibbons, and M.E. Dorcas. 2008. Ecological effects of major injuries in diamondback terrapins: implications for conservation and management. Aquatic Conservation: Marine and Freshwater Ecosystems DOI: 10.1002/aqc.

Coker, R.E. 1906. The natural history and cultivation of the diamond-back terrapin with notes of other forms of turtles. North Carolina Geological Survey Bulletin. 14:1-67.

Gibbons, J.W., J.E. Lovich, A.D. Tucker, N.N. Fitzsimmons, and J.L. Greene. 2001. Demographic and ecological factors affecting conservation and management of diamondback terrapins (*Malaclemys terrapin*) in South Carolina. Chelonian Conservation and Biology 4:66-74.

Mitro, M.G. 2003. Demography and viability analysis of a diamondback terrapin population. Canadian Journal of Zoology 81:716-726.

Seigal, R.A. 1984. Parameter of two populations of the diamondback terrapin (Malaclemys terrapin) on the Atlantic coast of Florida. Pages 77-87. in R. A. Seigel, L. E. Hunt, J. L. Knight, L. Malaret, and N. L. Zushlag (eds.) Vertebrate Ecology and Systematics - A Tribute to Henry S. Fitch. Museum of Natural History, University of Kansas, Lawrence, Kansas.

Szerlag, S. and S.P. McRobert. 2007. Northern diamondback terrapin occurrence, movement, and nesting activity along a salt marsh access road. Chelonian Conservation and Biology. 6:295-301.

Acknowledgments

We thank USFWS, Texas Parks and Wildlife, Sea Grant, and the Houston Zoo for funding terrapin research in Galveston Bay. We also thank the dedicated staff of EIH and all of the countless graduate students and volunteers that have spent long hot days in the marsh capturing and releasing Texas Diamondback Terrapin. **For more information please visit www.EIH.UHCL.edu or email marlowa@uhcl.edu or guillen@uhcl.edu**