KNOWLEDGE OF BEACHGOERS TO THE PRESENCE OF AND

THREATS TO SEA TURTLES IN THE GULF OF MEXICO; RESULTS OF

A SURVEY OF VISITORS TO GALVESTON ISLAND, TEXAS

An Undergraduate Research Scholars Thesis

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ABSTRACT

Knowledge of Beachgoers to the Presence of and Threats to Sea Turtles in the Gulf of Mexico;
Results of a Survey of Visitors to Galveston Island, Texas. (May 2013)

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The Gulf of Mexico (GOM) is home to five of seven extant species of sea turtles: *Lepidochelys kempii* (Kemp's ridley), *Chelonia mydas* (green turtle), *Caretta caretta* (loggerhead), *Eretmochelys imbricata* (hawksbill), and *Dermochelys coriacea* (leatherback). Knowledge of Galveston Island residents and visitors regarding these species is relatively unknown. Our objective was to quantify, through surveys, the public's knowledge of sea turtles on Texas beaches and in GOM waters. Specifically, we were interested in: 1) awareness of threats to sea turtles in various life history stages and habitats; 2) peoples understanding of their own role in mitigating threats to sea turtles; and 3) their willingness to support programs whose foci include: protection and conservation of sea turtle habitats, outreach and education, and legislation designed to facilitate the conservation of sea turtles in the GOM. A random survey of visitors to the Midtown Beach and Galveston Island State Park (GISP) on Galveston Island was conducted during Summer and Fall of 2012 (n=132). Participants were asked to provide responses to 17 questions. We found that Texas residents exhibited greater awareness of the sea turtle hotline phone number compared to non-Texas residents. Both resident and non-resident visitors to GISP

also exhibited a greater awareness to the sea turtle hotline phone number compared to all visitors surveyed at Midtown beaches. Though the majority of participants lacked overall awareness of sea turtles and their habitats, 80% of the total number of people surveyed expressed their willingness to support regulations that protect sea turtles and their habitats. Identifying the demographics of visitors is vital as we refine materials used in outreach, and the survey results clarified what visitors and residents are unaware of, thus providing a foundation of topics and concepts for future education and outreach.

ACKNOWLEDGMENTS

CHAPTER I

INTRODUCTION

Five species of sea turtles reside in the Gulf of Mexico (GOM). These include: *Lepidochelys kempii* (Kemp's ridley), *Chelonia mydas* (green turtle), *Caretta caretta* (loggerhead), *Eretmochelys imbricata* (hawksbill), and *Dermochelys coriacea* (leatherback). Each of these GOM populations is listed in the International Union for Conservation of Nature and Natural Resources (IUCN) red book as threatened or endangered (Wright, 1982). Their status as either threatened or endangered is influenced by several factors including a commercial turtle fishery in the early 1900's (Witzell, 1994), poaching of both turtles and eggs, especially during the 1960s-1980s (Spotilla, 2004), commercial and recreational fishing gear (nets, hooks, monofilament, long lines, boats, jet skis), plastic bags and bottles, balloons, and loss and/or degradation of both nesting and foraging habitat through encroachment or catastrophic events such as oil spills or fire. Two of the seven species are found most frequently along the Texas coast. The Kemp's ridley is the only species of the five that is endemic to the GOM. Poaching of eggs as they were deposited on the beach in Rancho Nuevo, Mexico led to their near extinction in the 1980's (Lutz and Musick. 1997, Spotilla 2004). The nesting female population on the coast of Rancho Nuevo, Mexico represents nearly 95% of all Kemp's ridley nesting. As of the early 1980's, nest counts at Rancho Nuevo had dropped from 40,000 in the 1940's to less than 2,000 in the 1960's (Spotilla, 2004). By 1987, the annual number of ridley nests had dropped below 800 (Lutz and Musick, 1997).

In 1977, a bi-national recovery plan between Mexico and the United States was developed for the purpose of creating laws to facilitate the conservation of the Kemp's ridley. This recovery plan consists of 3 steps: 1) protecting the surviving females, their eggs, and hatchlings at Rancho Nuevo; 2) reducing the mortality of juvenile and adult turtles in shrimp trawls; and 3) an experimental imprinting and head start program aimed at establishing a nesting population at Padre Island National Seashore in Texas (Spotilla, 2004). As a result of the bi-national recovery plan, and other efforts the number of ridley nests in the United States and Mexico has experienced an 11.3% annual increase (Turtle Expert Working Group, 2000). Reduced mortality of juvenile and adult sea turtles by shrimp trawls occurred with the implementation of the Turtle Excluder Device (TED). A TED is a grid of metal bars fitted to the front of a shrimp-trawl net. Shrimp can still swim through the bars and get caught in the back of the net, while larger animals, like sea turtles, will hit the bars and are released through an opening at the bottom of the net (Lewison, Crowder, and Shaver, 2003). After its implementation in 1991, there was a decline in the number of strandings for the following 2-3 years. Reasons TEDs could be unsuccessful in preventing turtle entanglement include improper use or operational errors, or incidental capture in nets not required to use TEDs, like skimmer nets (Lewison et. al, 2003).

The second most common sea turtle in the GOM is the green turtle. Implementations of TEDs, as well as protection of seagrass beds, have been influential in ongoing recovery of the green turtle as well. The herbivorous green turtle is highly dependent upon seagrass beds in Texas coastal waters. At one time, Texas had a booming green turtle population large enough to support a commercial fishery. Unfortunately, due to poor or absence of catch limits, sustainable harvest were non-existent and this species was fished out in Texas waters by 1896, forcing the

closure of the commercial cannery in Fulton and its relocation at Tampico, Mexico (Witzell, 1994). Today, the green turtle population continues its slow recovery in Texas. Loss of habitat and/or habitat degradation is the greatest threat facing this species. The main factors influencing this trend are nutrient enrichment, sewage disposal, pollution, and the expansion of the human population i.e. coastal development, the latter of which is believed to be the most severe impact on seagrass habitat loss (Short and Wyllie-Echeverria, 1996). Efforts made to conserve these habitats include increased legislation for their protection and an overall increase in the protection of coastal ecosystems (Duarte, 2002). It is also important to know the potential future status of seagrass ecosystems in order to guide effective conservation policies (Duarte, 2002). By preparing for on-going conservation of seagrass beds, it will yield positive results for the green turtles that utilize them.

All five species of sea turtles found in the GOM, experience or are subject to complications and mortality due to the ingestion of marine debris and trash. In a study done by Dr. Pamela Plotkin and Dr. Anthony Amos, all five species of sea turtles found in the GOM, both male and female, posthatchling through adult, had eaten or were tangled in debris. Discarded plastics and fishing nets were involved in the majority of the instances (1990). Ingestion of debris in small amounts is not always the direct cause death, however. The nutrient dilution that occurs when these non-nutritive items replace food items affect sea turtles overall growth and reproductive output (McCauley and Bjorndal, 1999). As well, entanglement can prevent a turtles from diving to eat or surfacing to breath, or can amputate limbs, leaving open wounds susceptible to infection (NMFS, 1998). There are currently no large-scale efforts aimed at the reduction and prevention of ingestion of trash and human debris by sea turtles. However, at the local level, some efforts

include the placement of trashcans at heavily populated beaches, monofilament disposal receptacles on fishing piers, and outreach material designed to educate beach goers as to the dangers littering poses to sea turtles.

Though several steps are being taken to help protect and conserve all of these threatened and endangered sea turtle populations, the public's knowledge of their presence, as well as anthropogenic factors impacting them, is relatively unknown. Determining the public's knowledge of sea turtles and threats facing them will create a baseline of knowledge from which further education and outreach materials can be developed and future conservation efforts can be implemented.

My hypotheses are: 1) Galvestonians will exhibit a more extensive knowledge of the threats facing sea turtles in the GOM; 2) Visitors staying in beach rental homes will share a similar knowledge base; 3) Regardless of where participants are from, the majority of people will be aware of sea turtle presence on Texas beaches, but will not be aware of the habitats turtle's use as hatchlings, juveniles, or adult; and 4) Overall, I do not expect to find a difference in willingness of beachgoers to support programs designed to conserve these turtles and their habitats.

My objectives are to quantify, through surveys, the public's knowledge of sea turtles on Texas beaches and in the GOM including: 1) their awareness of threats to sea turtles in various life history stages and habitats; 2) peoples understanding of their own role in mitigating threats to sea turtles; and 3) their willingness of the public to support programs whose foci include: protection

and conservation of sea turtle habitats, outreach, and education, and legislation designed to

facilitate the conservation of sea turtles in the GOM.

CHAPTER II

METHODS

Survey Procedure

Surveys involving public perceptions of GOM sea turtle conservation were conducted with adult participants (>18 years of age) on midtown beaches and GISP on Galveston Island, TX (Figure 1) from 11 July 2012 to 20 October 2012.

Figure 1: Map depicting the two sample sites at which surveys were conducted (Midtown n= 88; GISP n= 44).

Individuals were randomly selected and those willing to participate provided their consent (in accordance with the Institutional Review Board of Texas A&M University, Permit # 2012-0277),

accepted a handout containing research project details, and then verbally provided answers to 17 survey questions. These questions included participant age, education level, and residence location (local resident, non-coastal visitor, or coastal resident from a different state). Non-residents also provided information about their type of accommodations (e.g., hotel or rental unit) while visiting the island. Other questions included those listed in Table A-1 of the Appendix A. After completing the survey all participants were given a packet of information regarding sea turtles and the importance of Galveston beaches as critical nesting habitat.

Data Analysis

All statistical tests were conducted using IBM SPSS 19 statistical software (IBM Corp.; Armonk, NY USA). Prior to conducting statistical tests, normality of all data was tested using a Shapiro-Wilk test. When normality was not met, data was transformed. A Kruskal Wallis test was used to test for statistically significant differences ($P<0.05$) between mean values of categorical data (i.e., age). A Mann-Whitney U test was used to test for statistically significant differences between mean values of nominal data (i.e., local versus non-local residence). Chi-squared tests were also performed to test for statistically significant differences between observed and expected count values.

CHAPTER III

RESULTS

Only the most significant findings are reported here. A summary of all results is presented in Table A-2 of Appendix A.

State of Residency

Between in-state and out of state participants, there was a statistically significant difference in awareness of the turtle hotline ($P= 0.016$). In-state participants had a higher mean rank value than those out of state. Texas residents showed no statistically significant difference in overall knowledge of sea turtles and their habitats regardless of their city of residence ($P= 0.413$). Figure 2 and Table 1 show the distribution of survey participants from Texas, and include the distance from their residence to Galveston Island.

Location Encountered at the Beach

Between survey participants encountered at midtown beaches and GISP, there was a significant difference in people's awareness of the sea turtle hotline ($P= 0.029$). People surveyed at GISP had a higher mean rank value than those encountered at midtown.

Housing on Galveston Island

Across all types of housing, there was significant difference in participant awareness of the sea turtle hotline (P= 0.026) and where to find the hotline (P= 0.000). Participants who elected to camp in GISP had the highest mean rank value for both these questions.
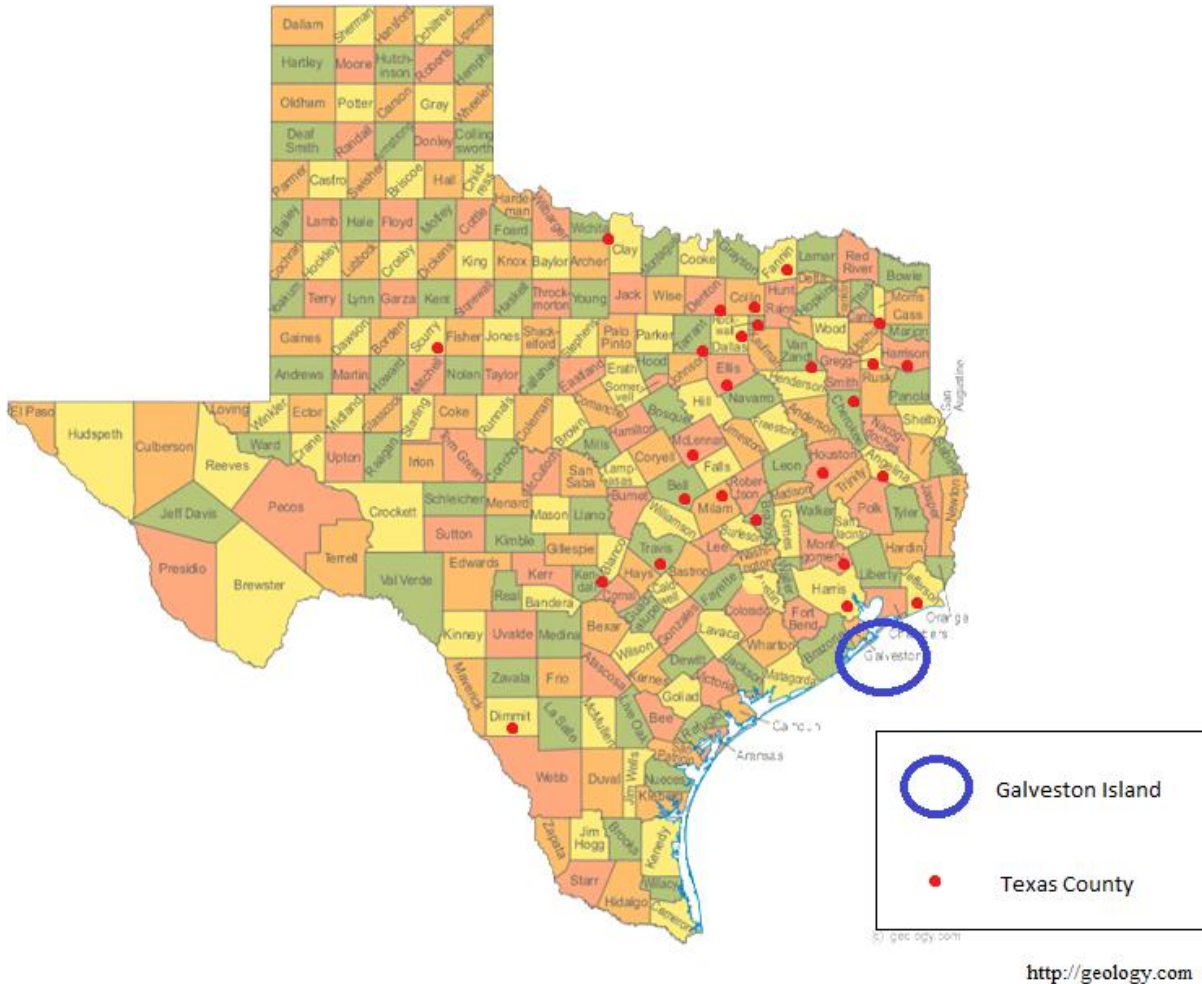

Figure 2: Distribution of home counties of Texas resident as revealed by survey results.

Table 1: Distances of Texas cities from Galveston Island. The cities denoted are those reported as the residence of survey participants.

City	County	Distance From Galveston Island (km)
Alto	Cherokee	325.1
Austin	Travis	346.0
Beaumont	Jefferson	136.5
Bergheim	Kendall	416.8
Big Wells	Dimmit	553.6
Boerne	Kendall	445.8
Bonham	Fannin	26.9
Brazoria	Brazoria	97.4
Burleson	Johnson and Tarrant	490.8
Cameron	Milam	304.2
Canton	Van Zandt	444.2
Collin	Collin	535.9
Crosby	Harris	105.9
Cypress	Harris	29.2
Dallas	Dallas	469.9
Friendswood	Harris	61.5
Frisco	Collin and Denton	515.0
Fort Hood	Killeen	410.0
Harris	Harris	88.0
Houston	Houston	85.9
Keller	Tarrant	527.9
Kemah	Houston	45.7
Kilgore	Gregg and Rusk	403.9
League City	Galveston	48.0
Longview	Gregg	423.3
Lufkin	Angelina	276.8
Magnolia	Montgomery	155.3
Midlothian	Ellis	457.1
Pasadena	Houston	71.9
Pearland	Brazoria	72.6
Pittsburg	Camp	478.0
Rockwall	Rockwall	500.5
Round Rock	Travis and Williamson	500.5
Seabrook	Harris	47.8
Snyder	Scurry	806.3
Spring	Harris	123.3
Sugarland	Houston	106.5
Temple	Bell	355.7
Humble	Harris	18.3
Waco	McLennan	383.0
Webster	Harris	52.6
Wichita Falls	Wichita	688.8
Woodlands	Houston	133.6

Age

Across all age groups, there was a significant difference in knowledge of: a) Where to find the sea turtle hotline; b) Whether calling this hotline applies to both live and dead turtles; and c) the habitats utilized by both juvenile and adult Kemp's ridley turtles. Survey participants in the 18-28 category had the highest mean rank value for knowledge pertaining to where to find the turtle hotline (P= 0.013). The highest mean rank value pertaining to whether the hotline applies to both live and dead turtles was the age group 39-48 (P= 0.010). Survey age 29-38 had the highest mean rank value for important juvenile and adult Kemp's ridley habitats (P= 0.019 and P= 0.004 respectively).

Level of Education

Across all levels of education, there was a significant difference in: a) Knowledge of common man made dangers facing turtles; b) The population status of the Green turtle in the GOM; and c) and in their willingness to support conservation measures such as the elimination of vehicular traffic on beaches and beach raking during the nesting season. Participants with a Ph.D. and those with an 8th grade level of education had the highest mean rank values for knowledge of common man made dangers (P= 0.020). Those with a Master's degree had the highest mean rank value for knowledge of the population status of the green turtle in the GOM (P= 0.032). Participants who obtained a Master's degree and those with an 8th grade level of education had the highest mean rank values for willingness to support the elimination of vehicular traffic on beaches and beach raking during the nesting season (P= 0.048 and P= 0.048 respectively).
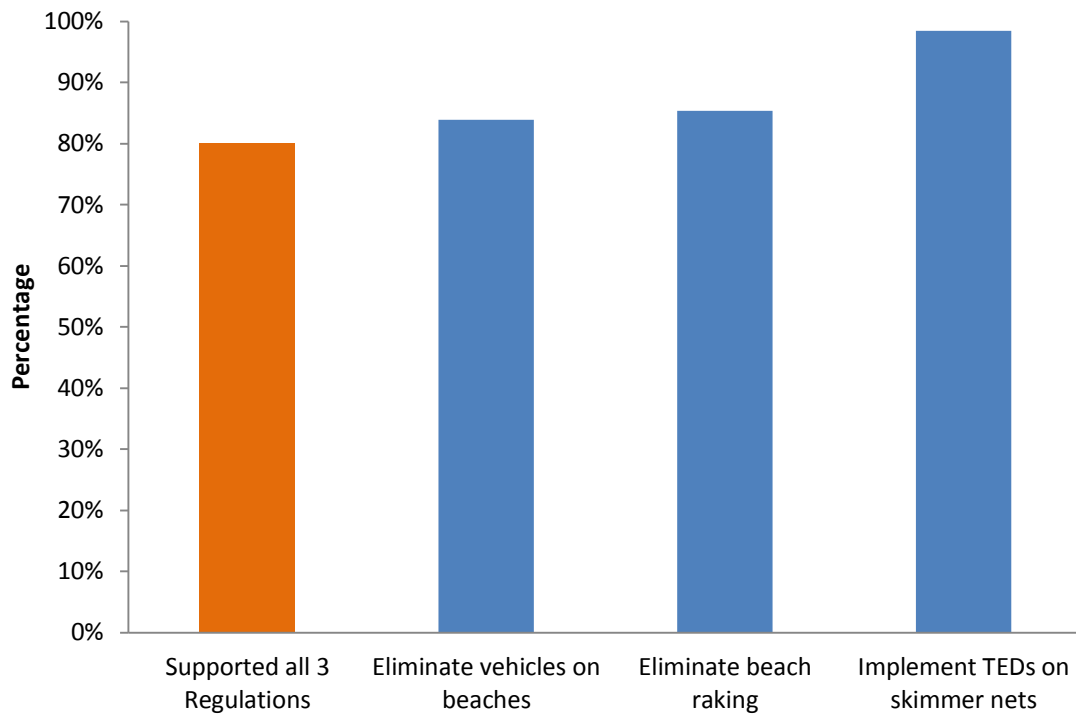
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Figure 3: Percentage of all participants willing to support regulations that work to protect sea turtles and their habitats, including eliminating vehicles on beaches, beach raking during the nesting season, and implementing TEDs on skimmer nets.

Results presented in Figure 3, though not statistically significant, the percentage of responses justify a summary of their own. Eighty percent of those surveyed were willing to support all three regulations that work to protect sea turtles. The implementation of TEDs on skimmer nets was the most highly supported of the three regulations.

CHAPTER IV

CONCLUSIONS

Greater awareness of the turtle hotline by Texas residents and those encountered at GISP, including campers, is most likely due to their familiarity with Galveston Island. A Texas resident is more likely to be a frequent visitor to Galveston Island, thus having more exposure to the beaches and outreach material compared to non-Texas residents. Participants in the age group 18-29 also have a greater awareness of where to find the hotline. Participants encountered at GISP possibly exhibited greater knowledge of the sea turtle hotline because the majority of them were campers, spending more time in the state park, while those encountered at midtown beaches were mostly likely day visitors.

Though none of the age groups exhibited a strong awareness of the hotline in general, those participants 39-48 years of age had the highest mean rank value for knowing when to call the turtle hotline. This particular age group exhibited a greater understanding of the importance of collecting both live and dead stranded turtles. Though this age group (39-48) may not be aware of research opportunities represented by the collection of stranded turtles, they understood it was important to call for aid. My results showed that the age group 29-38 demonstrated the greatest knowledge relating to juvenile and adult Kemp's ridley habitats. It is possible that as a result of unequal sample size, this data may be skewed. Data for the same age group did not yield statistically significant results for questions regarding the Kemp's nesting on Texas beaches, the nesting season, the population status, or common man made dangers. If this age group had a greater awareness of juvenile and adult Kemp's ridley habitats, one could expect them to be

more aware of man-made dangers facing these habitats, including habitat degradation, as well have other knowledge pertaining to the species, no of which were significant.

Data indicating greater knowledge of common man made dangers by those with an 8th grade level education and those with a Ph.D. may also have been affected as a result of 8th grade level of education [(n= 1) of 132]. For those with a PhD however, the high mean rank value is still meaningful. Those with a PhD could be expected to have a greater awareness of these dangers because they have a broader academic background. Through their education they would likely have greater exposure to human dimensions in the environment. Though both the midtown beach and GISP have trashcans and signs advertising clean beaches, perhaps more prominent outreach material depicting multiple sources of anthropogenic threats to sea turtles would increase awareness. Since the majority of participants are willing to support programs and regulations with a mission of protecting coastal habitats, a greater understanding of what they are protecting the turtles from would likely be beneficial. Data demonstrating that those with a Master's degree exhibited greater knowledge of the status of the GOM population of green turtles may also be somewhat questionable [(n= 11) of 132]. Those with a Master's did not show statistically significant knowledge pertaining to any of the questions regarding the Kemp's ridley. Since the Kemp's has a larger nesting population on Texas than the green turtle, participants' lack of knowledge of the Kemp's and greater knowledge of the green is difficult to explain.

Though there were no statistically significant results regarding awareness of participants (n= 132) to the presence of sea turtles on Texas beaches, 80% of people surveyed supported all three

regulations aimed at the protection of sea turtles and their habitats. Extending outreach material, like that found at GISP, to midtown beaches would help raise awareness of sea turtles on Texas beaches, in turn potentially creating support for species conservation. Though there was no significant difference in awareness of turtles on Texas beaches between subjects encountered at GISP and Midtown, with a larger sample size, I hypothesize visitors at GISP would exhibit greater awareness due to the park's extensive outreach program.

Identifying the demographics of visitors is vital as we refine the distribution and design of materials used in outreach efforts. Knowing where participants elect to stay while visiting Galveston Island, or which beaches are most frequented allowed us to determine how and where to reach the largest number of people. The answer to this question will help us assess where to target our efforts to educate our visitors about sea turtles in the GOM. By providing location-specific outreach materials (beach signs, hotel door hangers, rental house table tents) to specific lodging destinations we can maximize our outreach "footprint." More importantly, the survey results clarified what visitors and residents are unaware of i.e. the presence of sea turtles on Texas beaches and common man made dangers facing them, thus providing a foundation of topics and concepts for future education and outreach.

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Table A-1: Questions asked of participants during the survey process.

1. Do you know if sea turtles nest on Texas beaches?	10. Is the Kemp's ridley (Lk) considered threatened or endangered?
2. Do you know when the Lk nests?	11. Is the green turtle in the GOM considered threatened or endangered?
3. What species are most common on Texas beaches?	12. Knowing that all species of sea turtles are either threatened or endangered, would you be willing, in the future, to support with your time or resources, programs that promote conservation efforts?
4. Are you aware that there is a turtle hotline to call if you see a sea turtle on the beach?	13. Can you tell me what the most important habitat is for hatchling Lk turtles?
5. Do you know where on the beach to find the hotline?	14. Can you tell me what the most important habitat is for juvenile Lk turtles?
6. Do you know if calling the hotline applies to both live and dead sea turtles?	15. Can you tell me what the most important habitat is for adult Lk turtles?
7. Do you know some of the common man made dangers facing sea turtles?	16. What role do sea turtles play in the ecosystem?
8. Knowing the danger that trash on the beach/water poses to sea turtles, are you willing to make sure your trash as well as other trash you may encounter while visiting the beach gets put in the proper receptacles?	17. Would you support regulations that help to protect sea turtles, for instance slowing the speed of vehicles on beaches from 25 mph to 15 mph or eliminating vehicular traffic altogether, eliminating beach raking during nesting season, or implementing Turtle Excluder Devices (TEDs) on skimmer nets?
9. Of the seven species of sea turtles, are you aware of how many of them are listed as either endangered or threatened?	

Table A-2: All P-values calculated. (* denotes a significant value).

	Age	State of residency	Location encountered at the beach	Level of education	Housing on Galveston Island	Distance from Galveston Island
Do sea turtles nest on TX beaches?	0.972	0.095	0.061	0.856	0.195	
Do you know Kemp's nesting season?	0.991	0.706	0.797	0.344	0.868	
Are you aware of the stranding hotline?	0.050	*0.016	*0.029	0.423	*0.026	
Do you know where on the beach to find the hotline?	0.013	0.511	0.067	0.884	*0.000	
Does calling the hotline apply to both live/dead turtles?	0.010	0.565	0.763	0.335	*0.036	
Common man made dangers	0.936	0.366	0.290	*0.020	0.082	
Will you pick up your trash?	0.620	0.646	0.480	0.878	0.920	
How many species are listed as endangered/threatened?	0.941	0.448	0.120	0.746	0.182	
Kemp's status?	0.940	0.245	0.562	0.807	0.634	
Green in the GOM status?	0.535	0.353	0.721	*0.032	0.793	
Would you support programs that promote conservation efforts?	0.296	0.338	0.527	0.216	0.565	
Hatchling habitat?	0.690	0.124	0.797	0.257	0.172	
Juvenile habitat?	*0.019	0.960	0.077	0.859	0.111	
Adult habitat?	*0.004	0.626	0.198	0.896	0.077	
What role do sea turtles play in the ecosystem?	1.000	1.000	1.000	1.000	1.000	
Will you support regulations to help protect sea turtles?	0.831	0.700	0.927	0.256	0.934	
A. Support eliminating vehicular traffic during the nesting season?	0.878	0.859	0.654	*0.048	0.977	
B. Support eliminating beach raking during the nesting season?	0.767	0.288	0.766	*0.048	0.554	
C. Support implementing TEDS on skimmer nets?	0.165	0.639	0.724	0.713	0.878	
Total points on survey						0.413