

# -HIGH DENSITY OF ROAD KILLED EMYDID TURTLES IN EASTERN TEXAS-

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## Summary

Investigators have collected data on freshwater turtle vehicular mortality at a site in east Texas during the spring and summer nesting seasons of 2008-2010. A total of 636 Emydid turtles have been detected on a 3.2 km stretch of road crossing Steinhagen Lake on Highway-190. Based on 16 survey occasions spanning 3 field seasons we estimate a density of 66.25 killed turtles/km (106.5 killed turtles/mi) each field season and recommend mitigation tactics. Using a figure published by Aresco in 2004, this rate of mortality would move this site to second place on the highest road mortality spots for freshwater turtles in North America.

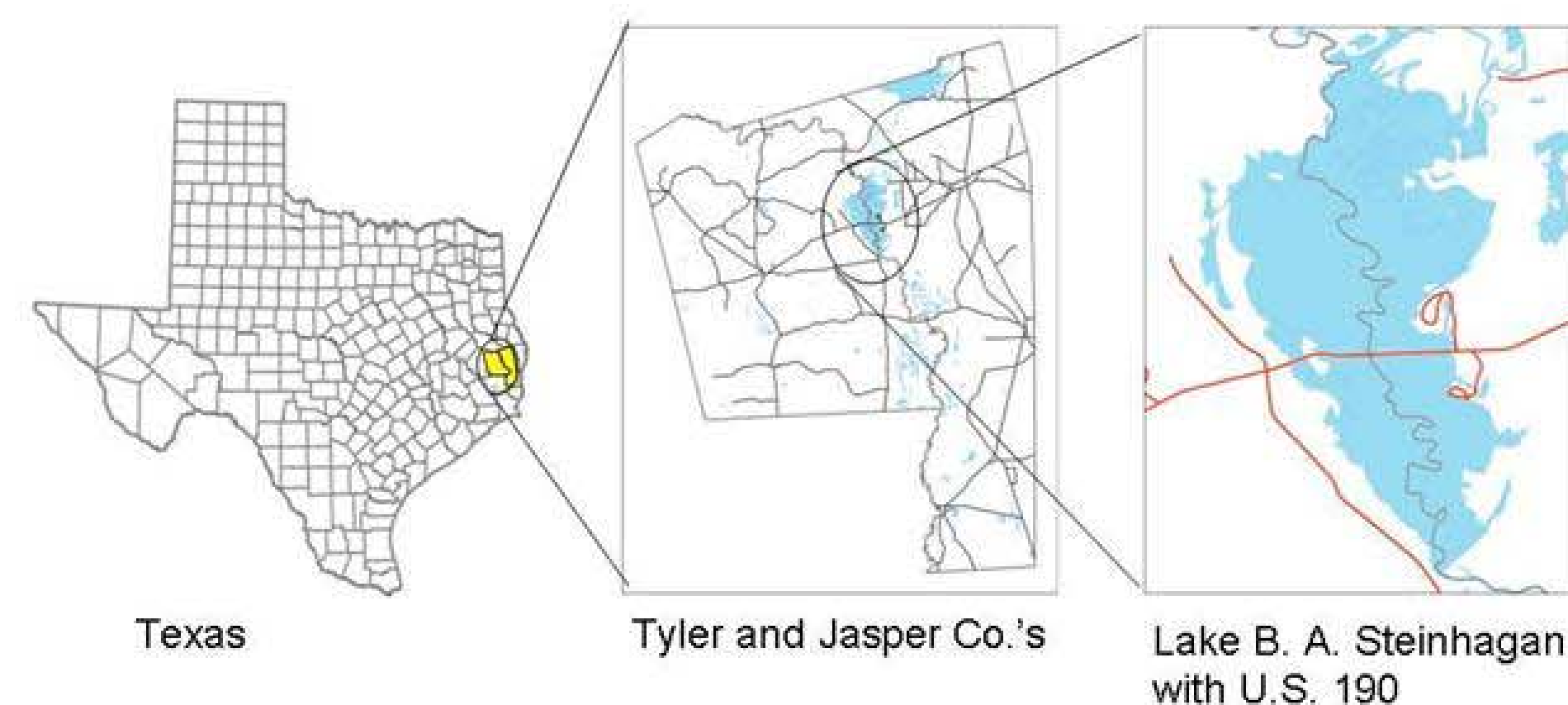
Additionally, we hypothesize from our findings that the road kill animals in question are female turtles actively selecting this stretch of highway as nesting habitat. The percentage of DOR turtles comprised of female mortalities was 40%, less than 1% male, and 59% were of unknown gender. We believe the "unknowns" are also female but were too badly decomposed or fragmented to confirm. Female turtles may prefer the edges of pavement because these areas are regularly disturbed and anthropogenically maintained. It is characterized by short grasses and loose or disturbed soil thereby making it easier for females to access and excavate nests.

A collaborative effort between the Houston Zoo, the Texas Department of Transportation, Texas Parks and Wildlife, and the United States Fish and Wildlife Service has resulted in a mitigation strategy to reduce future turtle mortality on this causeway.

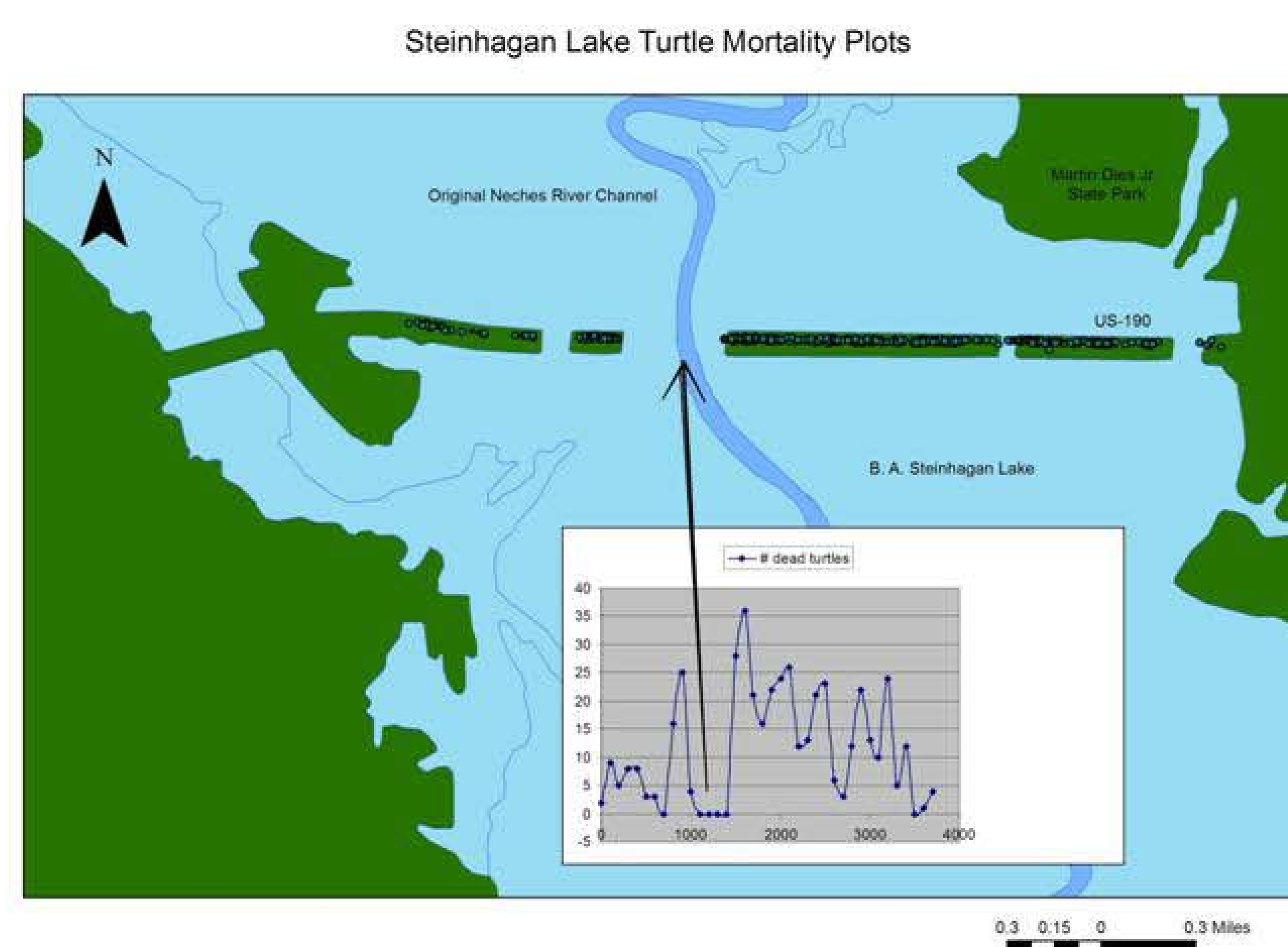
## Introduction

Roads are known to have effects on wildlife (Forman and Alexander, 1996) and the significance of these effects varies based on the life history characteristics of the species (Jaeger et al., 2005). Studies of the effects of road mortality on freshwater turtle populations have appeared in literature and it has become clear that females suffer preferential mortality, resulting in male-biased populations because of nesting migration (Steen and Gibbs, 2004; Aresco, 2005; Steen et al., 2006). Aquatic turtle populations across the United States have evidently become male-biased over the last century, coincident with the expansion of the nation's transportation network (Gibbs & Steen, 2005) because of the life-history traits of turtles, specifically low recruitment and delayed sexual maturity (Congdon et al., 1993; Steen et al., 2006), populations cannot effectively compensate for the loss of sexually mature individuals (Heppel, 1998; Steen et al., 2006).

## Location



A 3.2 kilometer section of Highway US-190 in Jasper and Tyler counties in east Texas as it crosses B.A. Steinhagen Lake. The lake was formed by the Town Bluff Dam on the Neches River in 1951 and the current bridges were built in 1943 in anticipation of the dam's construction (Floyd Boyet and Keith Horn, pers. Comm.). The surveyed section of road is comprised of two bridges and a small island in the center of the lake. We survey both the North and South sides of US-190 on this stretch of road. Our findings to date do not show mortality has been heavily weighted on one side of the highway compared to the other. 50% of mortalities have been documented on the north side of the road and 50% have been documented on the south side of the road.



## Methodology

Biologists from the Houston Zoo conduct monthly surveys on this 3.2 kilometer stretch of road during the months ambient temperatures elevate and reproduction and Emydid movement is most likely to occur, primarily between the months of March through August. In 2009 and 2010 we have continued monthly surveys through October.

When Chelonian remains are detected, a GPS waypoint is taken, the species, gender, side of road, and description of the remains are noted. The remains and/or fragments are then removed from the side of the road and discarded. Subsequent surveys yield new dead on road turtles (DOR's) for each survey because we have removed all evidence of mortality from the previous month.

Additionally, other reptile species, as well as amphibian mortalities are recorded. Nesting events, egg casings and live turtle sightings are also noted.



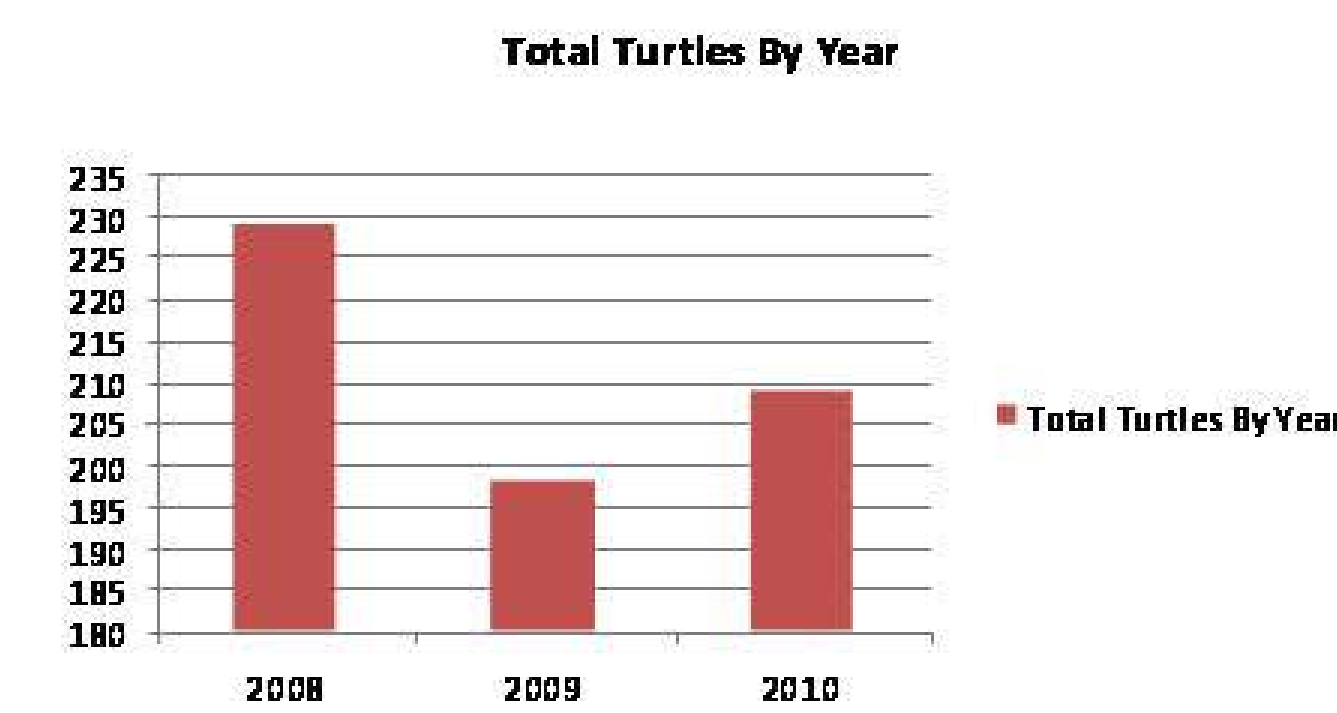
Biologists from the Houston Zoo survey HWY US-190 for turtle remains



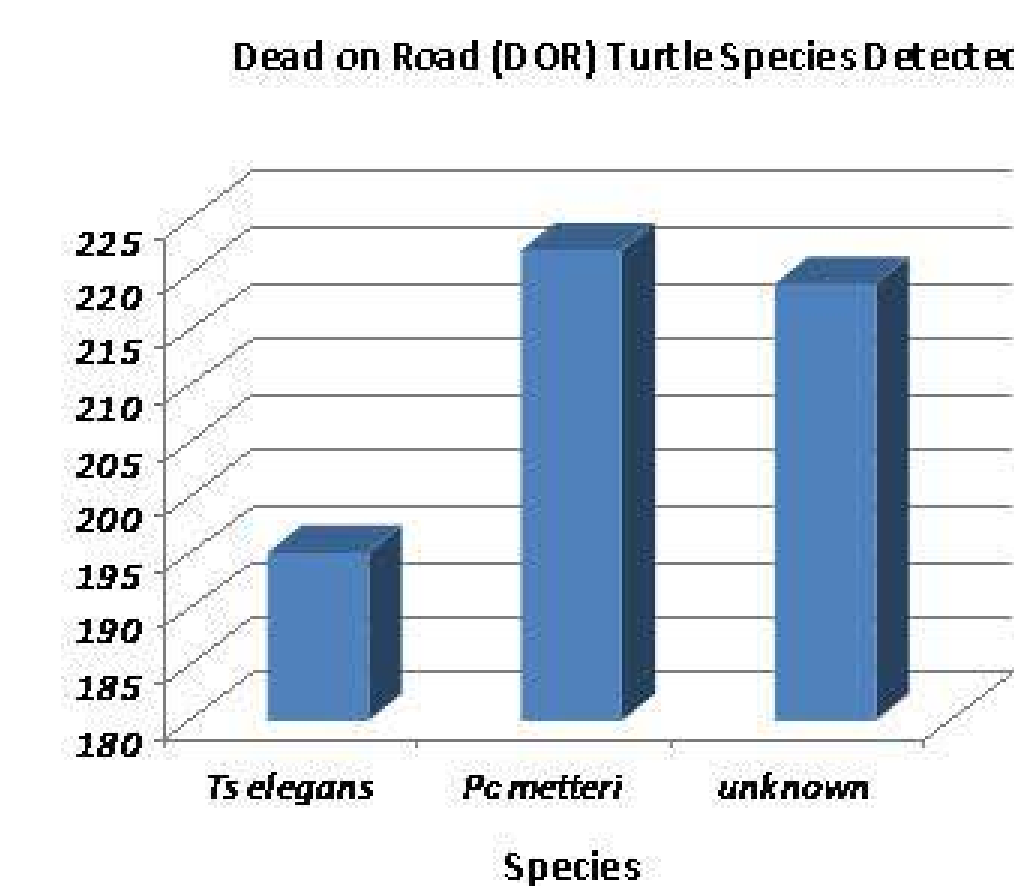
DOR gravid *P.c. metteri*

## Results and Analysis

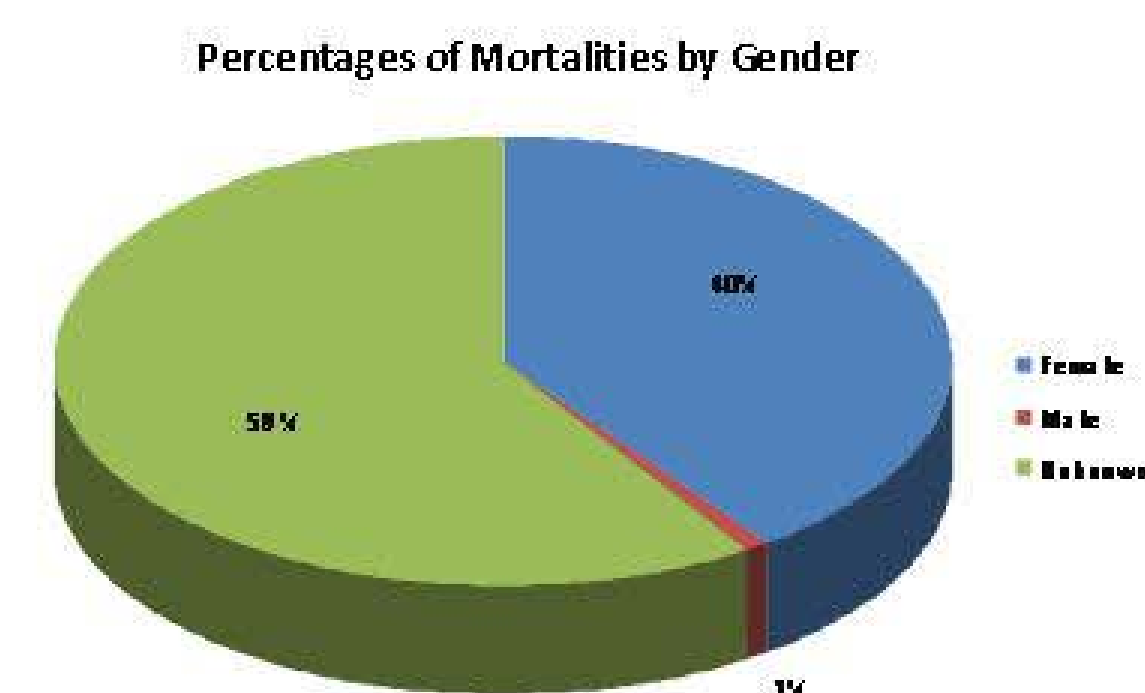
A grand total of 636 dead on road turtles have been detected between the 2008-2010 field surveys. While the total number of DOR turtles found during the 3 seasons appears to fluctuate in the graph below, 2008 may be skewed due to the presence of deceased turtles prior to the commencement of the study.



DOR individuals detected comprised of red-eared sliders (*Trachemys scripta elegans*) at 31% and Missouri river coolers (*Pseudemys concinna metteri*) at 35%. The remaining 34% were Emydid turtles too decomposed or fragmented to identify past the family level.



The percentage of female mortalities was 40%, less than 1% were male, and 59% gender could not be determined. We hypothesize that remaining unknown DOR's are primarily female turtles but are too badly decomposed or fragmented to confirm.



## Results and Analysis (Continued)

All confirmed male mortalities were of a sub-adult life stage (less than 2 years old) and were detected later in the summer. We hypothesize based on findings from 2008-2010 that road killed turtles are nesting females actively selecting this stretch of highway over more natural areas as a nesting site based on roadside verge conditions such as well drained soils, vegetation cover, thermal properties and proximity to water.

In a 2006 evaluation of published and unpublished population surveys of turtles conducted on- versus offroads and among 38,166 turtles from 157 studies reporting sex ratios, Steen et al. (2006) found a consistently larger female fraction in samples from on-roads (61%) than off-roads (41%). They concluded that female turtles are indeed more likely to cross roadways than are males, which may explain recently reported skewed sex ratios near roadways and signify eventual population declines as females are differentially eliminated.

In addition to the obvious risks of sexually mature female turtles being stuck by vehicles leading to a male biased turtle population in the lake, there are other factors that could lead to population declines. Eggs could become contaminated from polluted storm water runoff leading to decreased survivorship. Another consideration is that roads act as heat islands and the proximity of a roadway to a nest may result in unnatural heat regimes. This is an important consideration for species with temperature dependent sex determination.

Throughout the course of our surveys we have confirmed that 10% of female turtles were gravid (holding eggs) at the time of death. We can only confirm gravidity in those mortalities in which the reproductive body cavity was visible and relatively fresh. We have observed 12 live turtles digging nests while on field surveys and have found evidence of 99 nests off the side of highway equally distributed on both the north and south sides of the road that had either successfully hatched, were deserted, or predated. We have confirmed 13 DOR hatching turtles. Four disturbed nests were detected on the south side of the road, two of which had live *Trachemys scripta elegans* that had yet to leave the nest. In July 2009, 8 newly hatched *Trachemys scripta elegans* were brought back to the Houston Zoo for treatment due to a severe fire ant infestation.

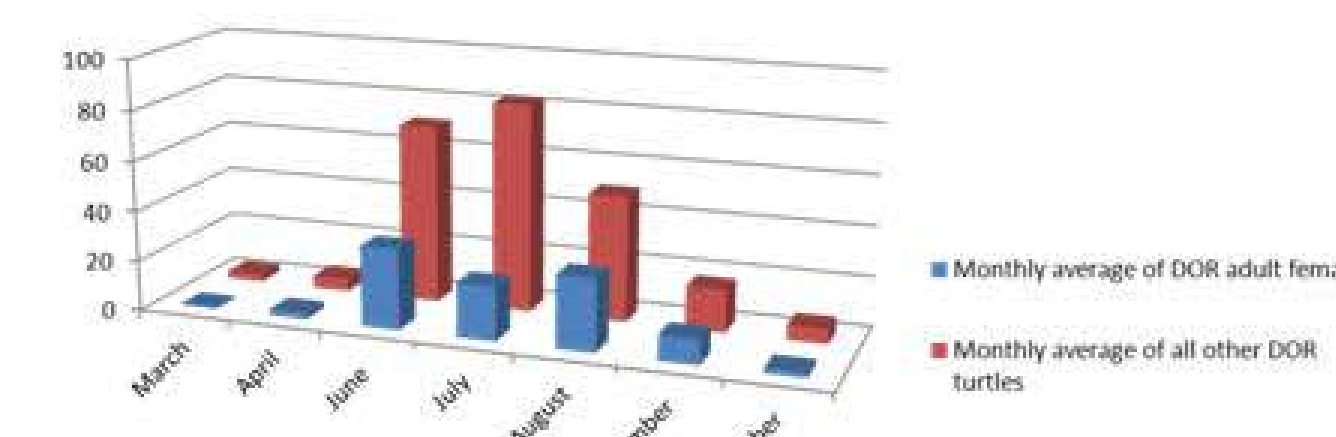


*T.s. elegans* hatchlings off HWY 190



Highway mortality

The following chart represents the average number of DOR turtles by month spanning the 3 field seasons. As nesting season begins for these species in the late spring and early summer months, the elevated mortalities found in June and July likely reflect these nesting occurrences.



The average number of DOR turtles per month in June (reflecting May and June mortalities) and July was 74.67. This is substantially higher than 20.89, the average number of DOR turtles per month outside of the nesting season, March-April and August-October.

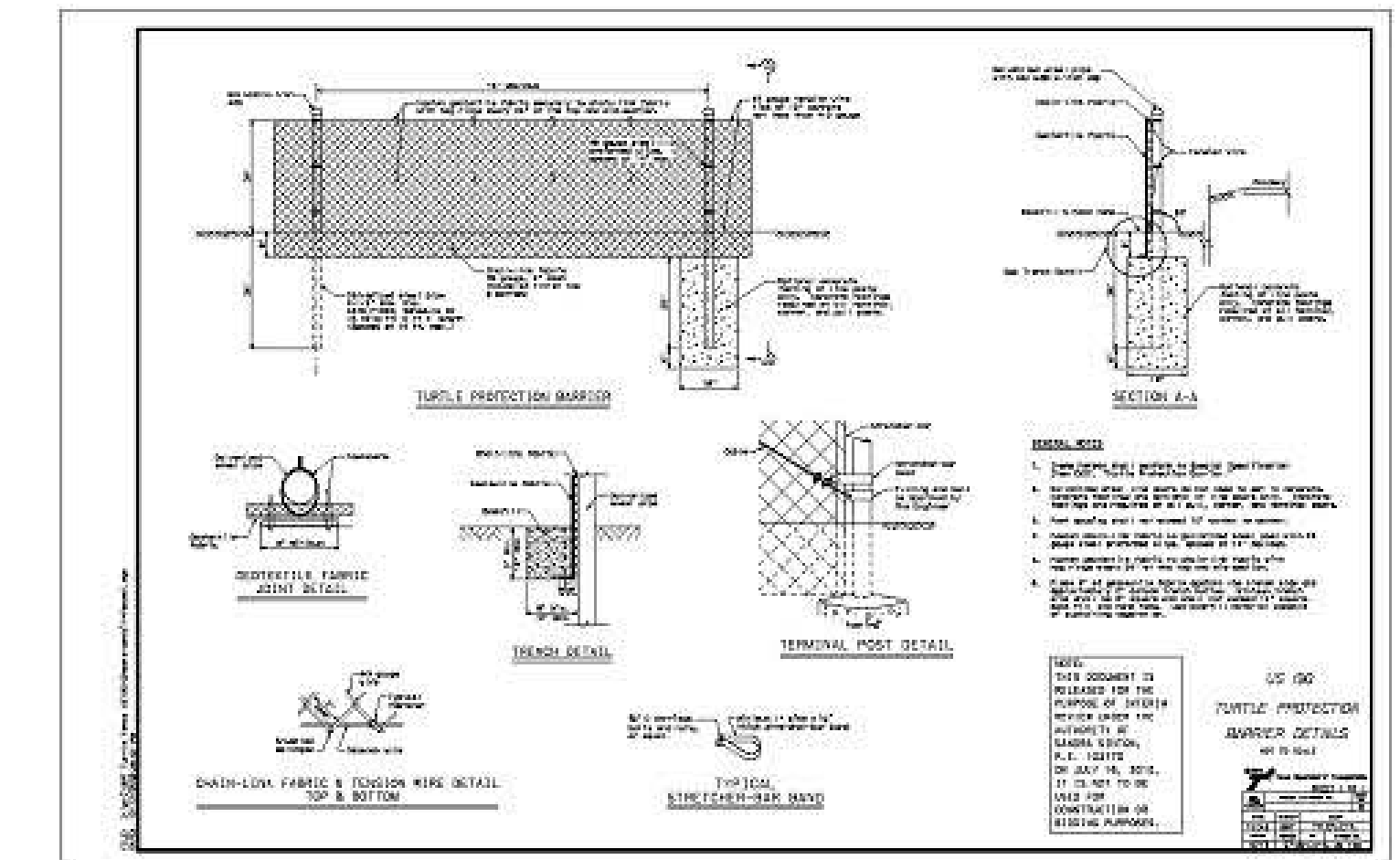
## Mitigation Efforts

Areas of confluence of high freshwater turtle abundance and activity and traffic need to be managed appropriately. Aresco (2004) showed that at Lake Jackson in Florida (the highest ranked site for freshwater turtle mortality in North America), using fences and culverts reduced turtle mortality from 9.7/km/day to 0.08/km/day.

A team comprised of the Houston Zoo, TxDOT, TPWD, and USFWS have worked together to develop mitigation strategies to reduce future turtle mortality on this east Texas causeway. A novel design for a turtle barrier was developed at TxDOT, in consultation with team members and experts around the country. A 5.3 km long fence was designed to act as a barrier on each side of the causeway. The goal of this design is to divert turtles that are trying to access the roadway, presumably to nest.

The fence will be constructed using galvanized fencing material covered with a geotextile fabric. The fence will be installed so that about 85 cm is above grade and will be entrenched and back filled to a minimum depth of 20 cm. The location of the installation relative to the edge of pavement and the ordinary high water mark is site specific. Generally, the barrier will be preferentially installed as close to the waterline as possible allowing for the presence of rip-rap at the toe of slope and several areas where mature woody vegetation impinges on the waterline. Mature woody vegetation removal is avoid and minimized to the extent possible. Rip-rap is not disturbed since it is an erosion control measure.

## Mitigation Design



Turtle behavior was considered in the design of the fence. Turtles are tenacious, strong, and surprisingly agile. The fence will be entrenched so that turtles cannot burrow under it. The geotextile fabric was added so that the turtles cannot see through the barrier to identify a destination. The combination of geotextile fabric and galvanized chain link fencing was added to decrease the likelihood that the fence can be scaled. The above grade height was chosen to minimize the ability of turtles to successfully scale the barrier. Finally, the ends of the fence are terminated in such a way that they cannot be circumvented.

This fence design should result in most turtles being excluded from the roadway. There are ample suitable nesting sites located away from the roadway. By incorporating design elements that provide a physical barrier and dissuade turtles from attempting to breach the barrier, we hypothesize that turtles will be re-directed away from this high mortality area while minimizing the energy the turtle spends in attempting to surmount or breach the barrier.

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## Partnering Institutions and Special Thanks



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