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Development of a Habitat Suitability Index for the Texas Diamondback Terrapin, *Malaclemys terrapin littoralis*

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**Background**

The Diamondback Terrapin (*Malaclemys terrapin*) is the only turtle species to occur exclusively in brackish water marshes along the Atlantic and Gulf Coasts of the United States. They are currently listed as endangered in Rhode Island, threatened in Massachusetts, and a species of concern in Georgia, Delaware, Louisiana, and North Carolina. Like many marsh-dependent species, Texas diamondback terrapins (*M. terrapin littoralis*) populations are believed to be in decline. Adequate nesting habitats, associated with estuarine marsh are critical to the Texas diamondback terrapin life cycle and population sustainability. The potential impact of rising sea level, due to global climate change, combined with increased urbanization will likely severely impact essential terrapin habitat. The Habitat Suitability Index (HSI), was designed for a wide variety of applications including conservation planning and evaluation of alternative impact scenarios. A HSI model for Atlantic coast terrapin subspecies was published in 1988, but currently there is no HSI model for the Gulf Coast terrapin subspecies. Therefore in order to assess potential impacts on terrapin habitat along the Gulf coast we have developed a HSI model for the Texas Diamondback Terrapin and other Gulf subspecies.

**Study Area and Methods**

South Deer Island is a 0.3 km² island located 1.6 km north of Galveston Island in Galveston Bay. South Deer Island contains estuarine marshes (IEM) where they feed, bask, and brumate; and coastal uplands (U) where they nest. We are currently studying the terrapin population on South Deer Island since 2007. To date over 320 terrapin have been captured, tagged, and released in the coastal marshes in West Bay, Texas. This mark recapture study is on-going and when complete will provide us the most comprehensive, long term population data on the Texas Diamondback Terrapin. Capture location and associated habitat type (vegetation community) were tabulated and used to estimate preferred terrapin habitat. Remote sensing color infrared imagery was then used to extrapolate “potential” terrapin habitat beyond South Deer Island but within the Galveston Bay system. The current HSI that was developed for terrapin along the East Coast of the U.S. was then modified and adjusted for Gulf coast physical and topographic differences.

**Habitat Suitability Index**

Diamondback terrapins occur in basically three cover types: estuarine open waters (EOW) where they feed, bask, and mate; Intertidal estuarine marshes (IEM) where they feed, bask, and brumate; and coastal uplands (U) where they nest.

**Nesting Habitat Variables:**

- V1: percent canopy cover of vegetation
- V2: percent soil type = sand
- V3: percent soil type = clay
- V4: height above normal high tide (m)
- V5: mean substrate slope (°)
- V6: proximity to IEM (km)

\[
\text{HSI} = \left( S_{V1} \times S_{V2} \times S_{V3} \times S_{V4} \times S_{V5} \times S_{V6} \right)^{1/6}
\]

**Interpreting Model Outputs**

HSI values obtained by applying the terrapin model may not reflect actual population levels. Terrapin population levels may be influenced by non-habitat factors such as competition, seasonal storms, commercial crabbing mortality, the operation of outboard motors, and motorized vehicles in the animal’s habitat. Outputs for this model can be used to compare the potential of two areas to support terrapin at a single point in time, or at future points in time.

**Future Work**

The Environmental Institute of Houston (EIH) will continue to monitor the population of Texas diamondback terrapin in Galveston Bay, and will soon expand this effort to the entire Texas Coast. The data generated from this research will help define the extent of terrapin populations in Texas and provide the information needed by managers to define the status of the population. Field validation tests using this HSI will be performed to determine its effectiveness and to recalibrate it as necessary. Once the predictive power of the HSI is validated it will be ready for use in planning for future habitat restoration and protection along the Texas coast.

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**Acknowledgments**

For Further Information
Please contact wrast@uhcl.edu. More information on this and related projects can be obtained at EIH webpage: www.eih uğ.edu

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**Figure 1:** Habitat classification and terrapin captures on South Deer Island, Galveston TX

**Figure 2:** V2 suitability graph for % soil cover

**Figure 3:** V3 suitability graph for % soil type = clay

**Figure 4:** V4 suitability graph for height above normal high tide

**Figure 5:** V5 suitability graph for slope

**Figure 6:** V6 suitability graph for proximity to nearest IEM

**Figure 7:** Habitat classification and terrapin captures on South Deer Island, Galveston TX

**Figure 8:** Maximum likelihood classification on North and South Deer Islands, West Bay, TX