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

Jenny Wras†, George Guillen†, Mustafa Mokrech†, Erin McCarthy‡

† Environmental Institute of Houston, University of Houston Clear Lake, Houston, Texas 77058
‡ U.S. Fish & Wildlife Service, Coastal Program – Texas, Houston, Texas 77058

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 multiple waterways, and is dominated by cordgrass (*Spartina spp.*). The University of Houston-Clear Lake has been 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 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.

Future work for the GIS analysis of essential terrapin habitats includes the use of vegetation zoning, where different habitats can be found in different zones within the tidal frame – this requires high spatial topographical data (LiDAR data) and detailed tidal data and entails extensive ground-truthing. Future analysis may include the use of soft classification (fuzzy and/or linear mixture classifications) to reflect the mixed nature of these habitats.

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 (Optimum cover between 25% and 40%) (Figure 1)
- V2: percent soil type = sand (Optimum particle size classification between 25% and 100% sand) (Figure 2)
- V3: percent soil type = clay (Optimum particle size classification 52% clay) (Figure 3)
- V4: height above normal high tide (m) (Optimum height above normal high tide 20.5m) (Figure 4)
- V5: mean substrate slope (°) (Optimum mean substrate slope 7°) (Figure 5)
- V6: proximity to IEM (km) (Optimum proximity to nearest IEM 52km) (Figure 6)

\[ HSI = \left( S_{I_1} \times S_{I_2} \times S_{I_3} \times S_{I_4} \times S_{I_5} \times S_{I_6} \right)^{1/6} \]

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.

Acknowledgments

We thank USFWS and the Houston Zoo for funding terrapin research in Galveston Bay. We also thank Emma Clarkson, Diana Ramirez, 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 Further Information

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