Evaluation of Diamondback Terrapin (*Malaclemys terrapin*) Nesting Ecology throughout Coastal Louisiana

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Terrapins and Crab Traps Special Session

68th Annual Meeting of the Gulf States Marine Fisheries Commission
Collaborators / Funding Sources

Collaborators

• Jon Wiebe, LDWF Oil Spill Program
• LDWF Office of Fisheries
• Dr. Will Selman, Rockefeller Refuge / Millsaps College
• Coastal Property Owners / Managers as well as Louisiana Landowners Association (LLA)

Funding Sources

• LDWF Office of Fisheries
• State Wildlife Grant T107
• Rockefeller Trust
Louisiana represents the largest amount of tidal shoreline and potential terrapin habitat within the Gulf Coast states.
Potential Terrapin Habitat in Louisiana

LA Brackish/Saline Marsh Total Area: 652,800 ha (~29.9% of habitat in Mt range)
Sasser et al. 2008 and 12,420 km Tidal Shoreline
Terrapin Research Groups and Historical Knowledge

Sources: http://sofia.usgs.gov/publications/posters/terrapin_pop/
Terrapin Knowledge in Louisiana

Louisiana is the state with the most terrapin habitat and has the least terrapin knowledge.

Prior to 2010

Only 34 location validated specimens had been collected within 1911-1972

22 Deltaic Plain (Red)
12 Chenier Plain (Blue)

THE GAP IS CLOSING.
Terrapin Knowledge in Louisiana

2010 – 2016

• Terrapin Population Descriptions
  • Selman et al. (2014) - SW
  • Pearson et al. (in prep.) – SE

• Genetic connectivity
  • Petre et al. (2015)

• Interactions with blue crab fishery
Louisiana Terrapin Project Objectives

1. Estimate terrapin abundance and distribution across coastal Louisiana.
   - Chenier - Collaborator Will Selman
   - Deltaic Plain – Our work

2. Evaluate individual terrapin population demographics.

3. Document terrapin nesting ecology and reproductive productivity across coastal Louisiana.
Louisiana Land Access Agreements

Private Coastal Landowners

Biloxi Marsh Lands Corporation
Lake Eugenie Land and Development, Inc.
Terre Aux Boeuf Land Company
ConocoPhillips Company
Edward Wisner Donation
T. Henderson Watt

Albert Crain
Lonnie Harper
Grey Estates
M.O. Miller Estate
Howard Romero
Turner’s Bay LLC
Miami Corporation

Public Coastal Land Managers

Louisiana Department of Wildlife and Fisheries
Plaquemines Parish Government
United States Fish and Wildlife Service
St. Bernard Parish School District

Sabine NWR
Louisiana State Lands
St. Mary Parish School Board
Coastwide Nest Searches

Identification of potential terrapin nesting habitat based on:

- Terrapin documented within LA coastwide abundance and distribution study

- Species’ nesting habitat suitability as described in literature and professional communication

Initial search areas were further refined utilizing available aerial imagery and opportunistic encounters
Methods: Nest Characteristics

• Nest Predators
  • Visual Observation
  • Track identification
  • Remote Camera

• Clutch Size
  • Intact nests
  • Depredated nests

• Egg Morphometrics
  • Length (mm)
  • Width (mm)
  • Mass (g)

• Nest Surface Characteristics
  • Depth
  • % vegetative cover
  • Surface Orientation
Results: Terrapin Nesting Searches

<table>
<thead>
<tr>
<th>Basin</th>
<th>Nests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pontchartrain</td>
<td>45</td>
</tr>
<tr>
<td>Baratarria</td>
<td>98</td>
</tr>
<tr>
<td>Terrebonne</td>
<td>108</td>
</tr>
<tr>
<td>2015 Study Site</td>
<td>92</td>
</tr>
</tbody>
</table>

- Nesting habitat on outer fringe of marsh
- Interior marsh nesting habitat is limited
Results: Incidence of Predation

<table>
<thead>
<tr>
<th>Basin</th>
<th>Nests</th>
<th>Intact Nests</th>
<th>Depredated Nests</th>
<th>% Predated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pontchartrain</td>
<td>45</td>
<td>14</td>
<td>31</td>
<td>68</td>
</tr>
<tr>
<td>Barataria</td>
<td>98</td>
<td>12</td>
<td>86</td>
<td>88</td>
</tr>
<tr>
<td>Terrebonne</td>
<td>108</td>
<td>26</td>
<td>82</td>
<td>75</td>
</tr>
<tr>
<td>Statewide (2013/2014)</td>
<td>252</td>
<td>52</td>
<td>199</td>
<td>79</td>
</tr>
<tr>
<td>*2015 Site</td>
<td>92</td>
<td>49</td>
<td>43</td>
<td>47</td>
</tr>
</tbody>
</table>

Species Account

- Ghost Crab: 66%
- Otter: 4%
- Raccoon: 25%
- Coyote: 78%

Nest predation rates are similar to those found in other studies (30-100%) across species’ range.

Sources: Roosenburg and Place 1994, Feinberg and Burke 2003
# Results: Clutch Size

<table>
<thead>
<tr>
<th>Basin</th>
<th>Intact Nests</th>
<th>Depredated Nests</th>
<th>Combined Nests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pontchartrain</td>
<td>5.9 ± 2.9 (n = 15)</td>
<td>4.3 ± 2.9 (n = 32)</td>
<td>4.8 ± 2.9 (n = 47)</td>
</tr>
<tr>
<td>Barataria</td>
<td>7.2 ± 2.9 (n = 12)</td>
<td>5.3 ± 2.5 (n = 86)</td>
<td>5.5 ± 2.8 (n = 98)</td>
</tr>
<tr>
<td>Terrebonne*</td>
<td>6.6 ± 3.0 (n = 89)</td>
<td>5.4 ± 2.8 (n = 139)</td>
<td>5.6 ± 2.8 (n = 228)</td>
</tr>
<tr>
<td>2015 Study Site</td>
<td>7.1 ± 4.4 (n = 17)</td>
<td>5.1 ± 2.8 (n = 55)</td>
<td>5.7 ± 3.1 (n = 72)</td>
</tr>
<tr>
<td>Statewide</td>
<td>6.5 ± 3.0 (n = 116)</td>
<td>5.2 ± 2.8 (n = 258)</td>
<td>5.6 ± 2.9 (n = 371)</td>
</tr>
</tbody>
</table>

* Includes 2015 study site
## Results: Egg Morphometrics

Measurements from intact nests:

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pontchartrain</td>
<td>37.2 ± 2.5 (n=27)</td>
<td>23.9 ± 1.6 (n=27)</td>
<td>ND</td>
</tr>
<tr>
<td>Barataria</td>
<td>36.9 ± 2.1 (n=49)</td>
<td>23.0 ± 0.7 (n=49)</td>
<td>11.8 ± 2.4 (n=48)</td>
</tr>
<tr>
<td>Terrebonne</td>
<td>36.3 ± 2.4 (n=176)</td>
<td>23.2 ± 2.1 (n=176)</td>
<td>10.5 ± 1.9 (n=101)</td>
</tr>
<tr>
<td>2015 Study Site</td>
<td>36.0 ± 2.5 (n=144)</td>
<td>23.0 ± 1.8 (n=144)</td>
<td>10.5 ± 1.9 (n=101)</td>
</tr>
</tbody>
</table>
Results: Nest Characteristics

**Vegetative Cover**
- 60% non-vegetated
- 85% < 50% vegetative cover

**Nest Slope**
- North facing slope: 25%
- South facing slope: 12.5%
- East or West facing slope: 6.25%
# Results: Nest Characteristics (Depth)

<table>
<thead>
<tr>
<th>Basin</th>
<th>Avg. Depth to Nest Top (cm)</th>
<th>Avg. Depth to Nest Floor (cm)</th>
<th>Principal Nesting Substrate (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pontchartrain</td>
<td>9.4</td>
<td>13.9</td>
<td>Shell Hash</td>
</tr>
<tr>
<td>Barataria</td>
<td>5.4</td>
<td>9.1</td>
<td>Sand</td>
</tr>
<tr>
<td>Terrebonne</td>
<td>7.8</td>
<td>11.4</td>
<td>Shell Hash</td>
</tr>
<tr>
<td>2015 Study Site</td>
<td>10.9</td>
<td>14.6</td>
<td>Shell Hash</td>
</tr>
</tbody>
</table>

- Shell hash was the principal nesting substrate documented across most of Louisiana’s coast.
- Nests documented within shell hash were typically deeper than those located within sand substrate.
Methods: Detailed Study of a Single Nesting Beach (2015 Site)

Previous efforts (2014) yielded the location of significant terrapin nesting beach thereby providing an excellent opportunity to more fully characterize:

- Nest Characteristics
- Egg Morphometrics
- Incidence of Predation
- Nest survivorship
- Hatching Success
Reproductive Productivity (2015 Site)

Caged Nests (n=10)
  • 8 Hatched
  • 2 Depredated by coyotes

Natural Nests (n=10)
  • 6 Hatched
  • 4 Depredated

14 out of 20 Nests Hatched

Hatching Success
Eggs Laid (n=109)
Eggs Hatched (n=82)
Average Hatching Success: 75%
Clutch Range: 36% - 100%
Results: Hatchling Size

<table>
<thead>
<tr>
<th></th>
<th>Sample Size</th>
<th>Average (mm)</th>
<th>Standard Deviation</th>
<th>Max (mm)</th>
<th>Min (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carapace Length</td>
<td>31</td>
<td>31.4</td>
<td>2.9</td>
<td>38.0</td>
<td>26.0</td>
</tr>
<tr>
<td>Carapace Width</td>
<td>31</td>
<td>25.0</td>
<td>3.4</td>
<td>30.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Carapace Height</td>
<td>31</td>
<td>16.1</td>
<td>2.2</td>
<td>26.0</td>
<td>13.0</td>
</tr>
<tr>
<td>Plastron Length</td>
<td>31</td>
<td>26.3</td>
<td>4.9</td>
<td>32.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Plastron Width</td>
<td>31</td>
<td>15.5</td>
<td>1.6</td>
<td>18.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Mass</td>
<td>30</td>
<td>7.88 (g)</td>
<td>1.6</td>
<td>10.30</td>
<td>4.50</td>
</tr>
</tbody>
</table>

- Hatchling size falls within the published range.
Summary

Statewide surveys have

• Significantly increased our understanding of diamondback terrapin nesting ecology within coastal Louisiana.

• Continued research is necessary to improve our understanding of terrapin ecology and population status within Louisiana.

Management Relevance

• These results are important to inform management of potential interactions between terrapins and marine fisheries.

• Life history information can be used to model injury from anthropogenic impacts
  • Oil and gas spills
  • Mortality from fisheries interactions

• Can be used to inform restoration activities across the Louisiana coast.
Future Programmatic Goals

- Determine role(s) of nest site characteristics on hatching success and sex ratios
  - DWH Restoration
  - CWPRRA
  - CPRA Master Plan

- Further refine nesting season duration and peak periods

- Further refine nest predator communities

- Further refine fate estimates of diamondback terrapin nests
Ongoing and Proposed Research

Individual population dynamics within Deltaic and Chenier plain coastal basins.

- Mark – Recapture techniques within distinct fisheries management basins
- Population structure within basins may help explain differences in nesting parameters
Ongoing and Proposed Research

Evaluation of By-Catch within Derelict Crab Traps

• In 2014, completed initial systematic surveys (5 km each habitat / searched cell) within designated closure area in Terrebonne Bay
• Consisted of both shoreline & open water habitats
• Total traps sampled = 217; Traps without any Bycatch = 42%

Geographic distribution of by-catch species with >10 individuals.

<table>
<thead>
<tr>
<th>Species</th>
<th>#</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Crabs</td>
<td>370</td>
<td>Even</td>
</tr>
<tr>
<td>Sheepshead</td>
<td>85</td>
<td>Biased to brackish marsh</td>
</tr>
<tr>
<td>Stone Crabs</td>
<td>17</td>
<td>Biased to saltwater marsh</td>
</tr>
<tr>
<td>Diamondback terrapins</td>
<td>15</td>
<td>Biased to saltwater marsh</td>
</tr>
</tbody>
</table>
Select By-Catch
Geographic Distribution
Parting Thoughts

Diamondback terrapins continue to be impacted by environmental and anthropogenic sources

- **Habitat Loss** – Coastal Erosion of nesting beaches and saline marsh
- **Habitat Degradation** – Environmental pollutants may impact species’ physiological health as well as associated resource availability
  - Oil and gas spills
  - Present throughout brackish and saline marshes
    - Not regularly documented during spill response
    - Likely impacted regularly
- **Fisheries By-Catch** – Derelict Fishing Gear
  - Anderson and Alford (2014)
  - Program’s work (2014 Terrebonne Basin)
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Ben Stultz
Dane Cassidy
Amy Magro
Jeff Boundy
Mike Carloss
Buddy Baker
Todd Baker
Jimmy Anthony
Sam Holcomb
Matt Weigel

Kevin McDunn
Amity Bass
Brian Hardcastle
Marty Bourgeois
Brian Lezina
Brady Carter
Harry Blanchet
Rene LeBreton
Todd Folse
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Beau Gregory
Questions: