

Integrating Ecology and Genetics to Define Population Structure for a Continuously Distributed Species, Diamondback Terrapins (*Malaclemys terrapin*)

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The diamondback terrapin (*Malaclemys terrapin*) is distributed along the U.S. coast from Massachusetts to Texas in brackish-water habitats. This long-lived, sexually dimorphic turtle is subject to both terrestrial and aquatic threats, including by-catch in fishing gear, and roadkill on highways adjacent to salt-marsh habitat. Until now, no clear population definition had been established for this continuously distributed species. Therefore, effective conservation efforts to mitigate population-level threats have not been realized.

To determine ecologically and evolutionarily relevant management units, we used molecular techniques (i.e., microsatellite DNA) to test the hypothesis that *M. terrapin* in the U.S. exists as a single homogeneous population. To assess the magnitude of the threat that actively fished commercial crab pots pose for terrapins, we conducted experimental fishing studies with crab fishers in North Carolina and tested the ability of several by-catch-reduction devices (BRDs) to exclude terrapins but retain valuable blue crabs. We also used elasticity analyses to rank different BRDs among several management options. Finally, to estimate adult survival rate, capture probability, and population size for the elusive mangrove terrapin, we conducted a mark-recapture study in the Big Sable Creek (BSC) complex of the Florida Everglades and analyzed individual encounter histories.

Results indicate that *M. terrapin* comprises at least six distinct metapopulations or regional management units (MUs) throughout its range. These MUs do *not* coincide with previous morphologically based subspecies designations. Additionally, microsatellite analysis elucidated that male-biased dispersal exists in *M. terrapin*. Field studies revealed that terrapin interaction with blue-crab-fishery activity primarily occurs in the early spring, close (i.e., < 250 m) to shore. Terrapin by-catch in crab pots can be mitigated by using BRDs, although some BRDs still allow adult males to enter. Larger (i.e., 5.0 cm) BRDs did not significantly affect catch rates of crabs, but smaller (i.e., 4.5 and 4.0 cm) BRDs did ($p < 0.001$). Finally, we established that the adult survival rate (ϕ) for terrapins in BSC is = 0.79 (95% CI 0.60-0.91), and it is constant across time and gender. Mean probability of capture was 0.41, and this parameter varied seasonally (winter = 0.28, summer = 0.53). The distribution of terrapins in BSC lies largely in first-order tidal streams that contain an abundance of submerged, algal-covered logs.