

FINAL REPORT
Fort Raleigh National Historic Site
Survey for Listed and Candidate Reptiles and Amphibians

Project Contract No. 1443PX519096120

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23 December 1997

PURPOSE OF PROJECT: This project was designed to document the presence or absence and the location of populations of amphibians and reptiles listed under the federal Endangered Species Act and State of North Carolina species of Special Concern within the boundaries of Fort Raleigh National Historic Site on Roanoke Island, Dare County, North Carolina. A secondary goal of this project was to provide the National Park Service with a complete as possible listing of the amphibians and reptiles that occur on the Fort Raleigh properties, and to provide management recommendations to help protect existing populations of sensitive species.

Listed species that are likely to occur or could possibly occur on Fort Raleigh property include: American Alligator (*Alligator mississippiensis*), Federal and State listed Threatened (S/A); Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*), State listed Special Concern and Federal Species of Concern; and Carolina Water Snake (*Nerodia sipedon williamengelsi*), State listed Special Concern.

The contract award (Order No. 1443PX519096120; Requisition No. RG9652) for the N.C. State Museum of Natural Sciences (NCSM) to perform the survey for Federal and State listed species of amphibians and reptiles on the Fort Raleigh National Historic Site was received on 30 July 1996. National Park Service permits were secured to facilitate proper documentation of the species found on the properties. Voucher specimens were collected for species not formerly documented from Fort Raleigh properties, and all collected specimens were placed in the N.C. State Museum of Natural Sciences' (NCSM) research collections. NCSM and other institutional catalog numbers are included in the Fort Raleigh and Roanoke Island species lists at Appendix A. Precautions were taken to not take any specimens that would cause jeopardy to local populations. All applicable state permits needed to perform this survey were secured in advance. Personnel of the NCSM involved with on site survey efforts included Jeffrey C. Beane, William M. Palmer, Laura Terry, and myself.

Field survey efforts totaled five trips to the area. Four trips consisted of three working days each and one trip consisted of one working day. On site work was conducted on 24 - 26 Sep 1996, 28 - 30 Apr 1997, 15 - 17 Jul 1997, 14 Aug 1997, and 10 - 12 Sep 1997. Survey efforts were expended in all the habitat types present on Fort Raleigh property as outlined on the map at Figure 1. Field survey techniques consisted of visual searches of habitats by day and night, dipnetting aquatic habitats, setting of turtle traps and minnow traps, turning of surface cover objects, and road searches by day and night. Museum collections around the country were checked for records documenting species presence on Fort Raleigh property and Roanoke Island. Based on proximity of documented species occurrence on the adjacent mainland and Outer Banks, a list of possible species yet to be found on Fort Raleigh property was formed (See Appendix B).

Preliminary results of all but the last field trip were presented in interim reports. The field efforts during 10 - 12 Sep 1997 resulted in the observation of 19 species of amphibians and reptiles on Fort Raleigh property. Among these observations were the first records of *Farancia erytrogramma* and *Nerodia fasciata* from Fort Raleigh property and Roanoke Island. During this time frame, but undiscovered until a newspaper clipping arrived through the NCSM's clipping

service, an adult Timber Rattlesnake (*Crotalus horridus*) was killed on a road near Fort Raleigh property (see Appendix A). This record was investigated and judged to be legitimate.

ACCOUNTS FOR TARGET SPECIES

Alligator mississippiensis, American Alligator: The American Alligator is a Federal and State listed Threatened (S/A) species. "S/A" = similarity of appearance, and refers to the similarity of the alligator's marketable hide to that of other crocodilians from around the world. Roanoke Island is at the periphery of the range of the alligator (Palmer and Braswell 1995). No documentation of the species presence on Roanoke Island could be found and no evidence of occurrence was noted during this survey. Because this is a large animal that can travel for considerable distances, occasional stray/wandering individuals are subject to occur some distance from established, reproducing populations. Large juveniles over four feet total length and adults would be more likely to make the trip from the mainland to Roanoke Island. A transient individual could set up temporary residence in the pond near Croatan Sound, north of U.S. 64, or in the marsh at the southern edge of the property. The relatively small amount of potentially suitable alligator habitat present on Fort Raleigh strongly suggests that permanent residency by an individual is unlikely, and that chances of establishing a reproducing population are improbable. Alligators are documented at three sites on mainland Dare County (Natural Heritage Program files). See the Alligator species account in Palmer and Braswell (1995) for an overview of the species' natural history in North Carolina.

Nerodia sipedon williamengelsi, Carolina Water Snake: The Carolina Water Snake is a subspecies of the Northern Water Snake that is adapted to the brackish waters of the sounds from the vicinity of Nags Head in Dare County to the vicinity of Beaufort in Carteret County. It is a State listed species of Special Concern and is endemic to North Carolina. Until this survey, it was the only water snake in the genus *Nerodia* documented from Roanoke Island, although the potential for *N. fasciata* and *N. erythrogaster* to occur there was considered high. Old remains of an adult water snake that appeared to be the Carolina Water Snake were found in the parking lot by the man-made pond along the north side of U.S. 64 just NE of Croatan Sound on 24 Sep 1996. A dead juvenile Carolina Water Snake was observed at the same site on 25 Sep 1996, and one live adult was observed in the pond on 29 Apr 1997. Five voucher specimens exist for localities on Roanoke Island off Fort Raleigh properties (see Appendix A). This snake is likely to occur in and near the brackish waters that surround the island, and in freshwater habitats near brackish habitats. The fresh/brackish marsh at the southern edge of the property should support this species, and it is the most probable water snake to be seen in the riprap along the shoreline near the theater. The Banded Water Snake *Nerodia fasciata*, is more likely to exploit the freshwater habitats on the inland parts of the island. Because the Carolina Water Snake is present in the sounds surrounding the island, it is likely to be seen on occasion at any point along the shoreline of the sound. The marsh at the south side of Fort Raleigh property is the best and most extensive habitat for this species, and every effort should be made to maintain it in good condition. Figure 2 shows the location of sightings and the probable distribution of the Carolina Water Snake on Fort Raleigh properties.

Malaclemys terrapin terrapin, Northern Diamondback Terrapin: The Diamondback Terrapin is a State listed species of Special Concern. The Northern Diamondback Terrapin is a Federal Species of Concern that was classified as a C2 Status Review species until that list was abandoned recently. Roanoke Island falls within the range of the Northern Diamondback Terrapin according to the original description of the subspecies (Hay 1904). However, the division between *M. t. terrapin* and *M. t. centrata*, the Carolina Diamondback Terrapin, in North Carolina is far from clear (Palmer and Braswell 1995), and the population in the vicinity of Roanoke Island should exhibit some characteristics of each. See the species account in Palmer and Braswell (1995) for a general review of the systematics and biology of this species in North Carolina.

Observations of the species were made during this survey, but no voucher specimens were taken. One individual was seen swimming in the man-made pond north of U.S. 64, just NE of Croatan Sound, on 25 Sep 1996. Eggshell fragments from a predator destroyed nest most likely belonging to this species were found on 11 Sep 1997. The nest was located on the narrow sandy ridge that separates the "low marsh" at the southern edge of the Fort Raleigh property from Croatan Sound. This marsh is the best habitat for the Diamondback Terrapin on the property, and the placement of the nest was consistent with the species' habits. In this particular location, it is unlikely that another turtle species would construct a nest; therefore, the nest was almost certainly laid by a Diamondback Terrapin. The lack of extensive brackish marsh on Fort Raleigh property and the few sightings during this survey indicates that the Diamondback Terrapin population is not large. Presence of the nest suggests that a small population resides in the brackish/fresh marsh at the southern edge of the property. Because this is a species of the brackish sounds that surround Roanoke Island, individuals are subject to occur anywhere Fort Raleigh property adjoins that habitat. Diamondback Terrapins prefer to nest in sand dune habitat adjacent to their aquatic habitat. Nesting frequently occurs on shallow dunes as little as 8 to 12 inches above the normal high tide mark. Although nesting might occur along any of Fort Raleigh's sandy shorelines, the area where the one nest was found is the most likely site for future nesting. The freshwater, man-made pond where at least one individual was sighted is not normal habitat for this species, and that turtle likely was a transient individual. Figure 3 shows the areas most likely to be used by Diamondback Terrapins and the location of the one sighting and the one nest site.

The document at Appendix C outlines the results and recommendations from a 1994 workshop on the ecology, status, and management of the Diamondback Terrapin. Protecting the quality of the "low marsh" at the southern edge of the property and the nesting habitat between the marsh and the sound are the best things Fort Raleigh can do for the Diamondback Terrapin.

SUMMARY AND DISCUSSION

A total of 28 species of amphibians and reptiles have been documented from Fort Raleigh properties as a result of this survey and previous documentation. The stranding record of a dead Loggerhead (*Caretta caretta*) was not counted in this species list because that species is not a resident of Fort Raleigh properties. An additional 18 species are known from Roanoke Island. Given the range of habitats present on the property (Fig. 1), the possibility of all amphibian and reptile species documented from Roanoke Island (Appendix A) occurring on Fort Raleigh properties is good. The lack of documentation for many species is most likely a product of few survey efforts and failure to secure voucher documentation when opportunities arose.

While the vegetation map depicted in Figure 1 is somewhat representative of the habitats on the ground, it should be noted that the transitions between habitats and many subtle changes within habitats are not well represented or are absent from this map. The gum/cypress habitat along the periphery of the "low marsh" at the southern edge of the property is not represented or is partly included in the "riparian" designation. All habitat types present, with the exception of the parking lots in the "open land" category, are important, to varying degrees, to the diversity of plants and animals on Fort Raleigh properties. The pond, creek, and wetland habitats are key areas for many species, including the two target species documented. Probably the least diverse and most expendable habitat type is the "pine plantation".

Beyond the target species detailed at the front of this report, sensitive species that do occur or are likely to occur on Fort Raleigh properties include *Ambystoma mabeei* (Mabee's Salamander), *Crotalus horridus* (Timber Rattlesnake), *Eumeces laticeps* (Broadhead Skink), *Pseudemys rubriventris* (Redbelly Turtle), *Bufo quercicus* (Oak Toad), *Desmognathus cf. auriculatus* (Southern Dusky Salamander), and *Rhadinaea flavilata* (Pine Woods Snake). These species are either restricted in the habitats they require, require very large habitats, are at the periphery of

the species' ranges, and/or exist in very small population sizes. Nearly all species that require ephemeral wetlands to complete their life cycles are declining in North Carolina because many wetlands of this type fall below regulatory size thresholds. Some species, like the Timber Rattlesnake that needs large tracts and Mabee's Salamander that breeds in ephemeral pools appear to be declining at a rate that may soon make them candidates for State and/or Federal protection. Species can more easily be lost from an island setting where habitats are limited and recolonization potential is reduced than from mainland settings. Fort Raleigh may become a refugium for many species as development progresses on surrounding private lands. A similar situation exists with Nags Head Woods on the Outer Banks where several species of amphibians and reptiles are found that do not occur in surrounding areas (Braswell 1988). The best hope of maintaining quality natural habitats on Roanoke Island likely is on publicly owned lands.

General suggestions aimed at multiple use of Fort Raleigh properties for the public's interest while maintaining maximum diversity of plant and animal communities are as follows:

1. Identify key natural areas and species that warrant protection and design use of Fort Raleigh property around their requirements.
2. Avoid wetlands loss, even for small ephemeral sites. Restore previously altered wetlands to the extent possible if that will enhance natural community structure and function. Some man-made ponds, marshes, etc., function just fine and should not be restored just to go back to the natural state. The key is to conduct adequate surveys before moving soil. Wetlands are frequently damaged by off-site activities that result in silt or effluents being carried into the site by wind and water, or that cause hydrology changes affecting life cycles.
3. Minimize development and centralize it to minimize impact on the overall area. Optimize use of natural communities for recreational/tourism attractions and let the private sector build the motels, tennis courts, swimming pools, etc., on private lands.
4. Purchase additional tracts that consolidate the overall Fort Raleigh holdings or enlarge the holdings as soon as possible. Once large tracts are fragmented, reconstructing them is frequently impossible or impractical. The best chance at consolidation/expansion appears to be the tract just south of U.S. 64 and west of the U.S. Fish and Wildlife Service tract.
5. Post signage at high use points, such as the pond, that reminds visitors that they are on park property and that all wildlife is protected.

Additional survey efforts that should provide a more comprehensive species list for Fort Raleigh and better information on the Carolina Water Snake and Diamondback Terrapin include:

1. Conduct drift fence surveys (Gibbons and Semlitsch 1982, Campbell and Christman 1982) in all upland habitats. This technique is labor intensive, but usually results in species being found that are not accessible otherwise, and can produce quantitative data hard to acquire otherwise.
2. Conduct more intensive surveys in the marsh and cypress/gum wetlands. The marsh is the area that probably supports the best populations of the Carolina Water Snake and the Diamondback Terrapin. The cypress/gum area has potential for Mabee's Salamander and other species not yet documented on Fort Raleigh properties. Neither of these areas lend themselves well to drift fence surveys.
3. Take advantage of opportunistic findings of undocumented species. Rarer species are harder to document, and the occasional road kill or visitor kill specimen can be quite valuable if properly documented. If a voucher can be salvaged and placed in a permanent research collection, that is the best documentation.

Literature Cited

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Figure 1. Habitat types present on Fort Raleigh National Historic Site properties. (Base map courtesy Fort Raleigh National Historic Site)

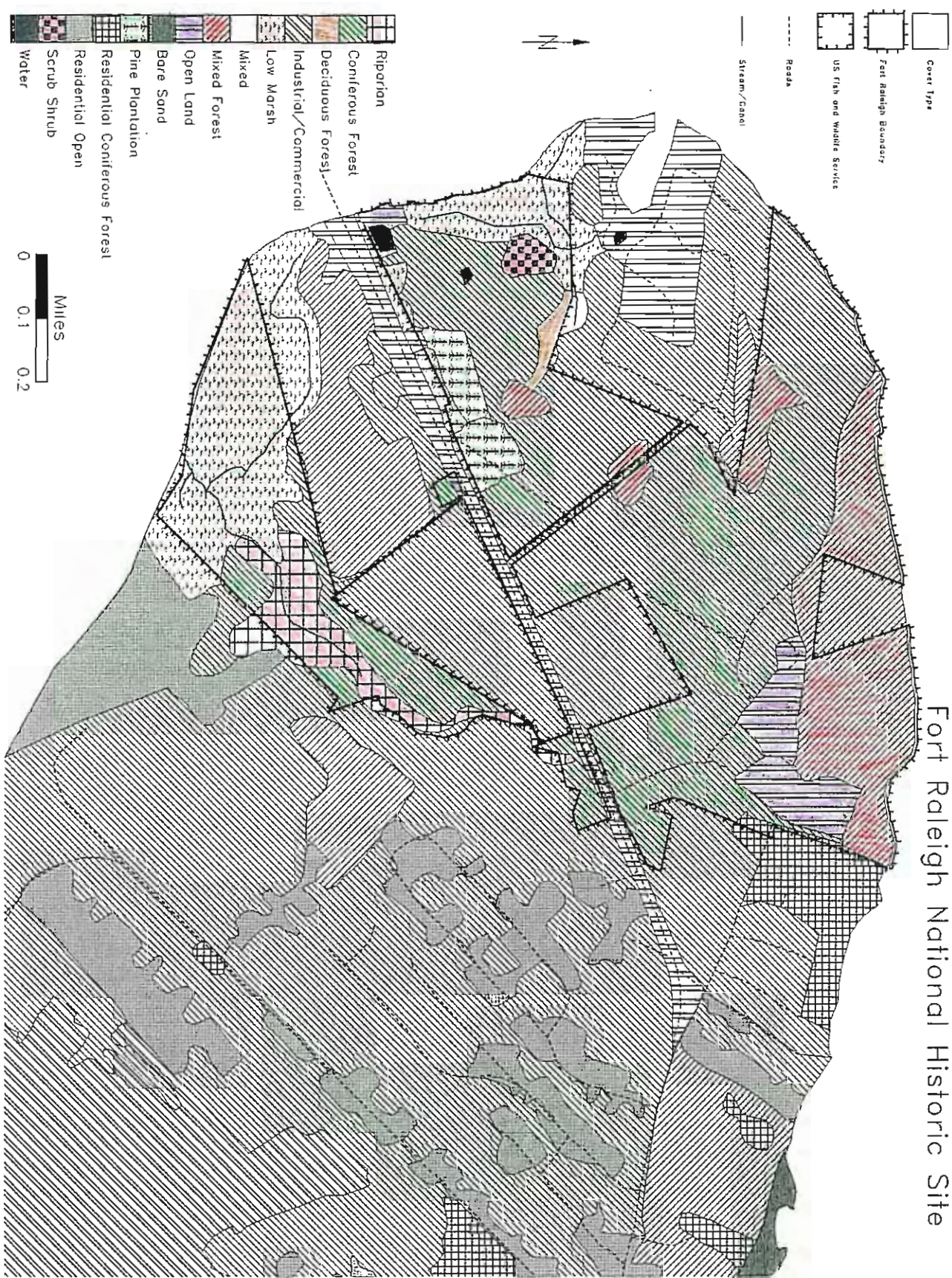


Figure 2. Areas of greatest probability of occurrence for the Carolina Water Snake (*Nerodia sipedon williamengelsi*), and location where species was observed.

 = Areas of probable occurrence on Fort Raleigh properties.

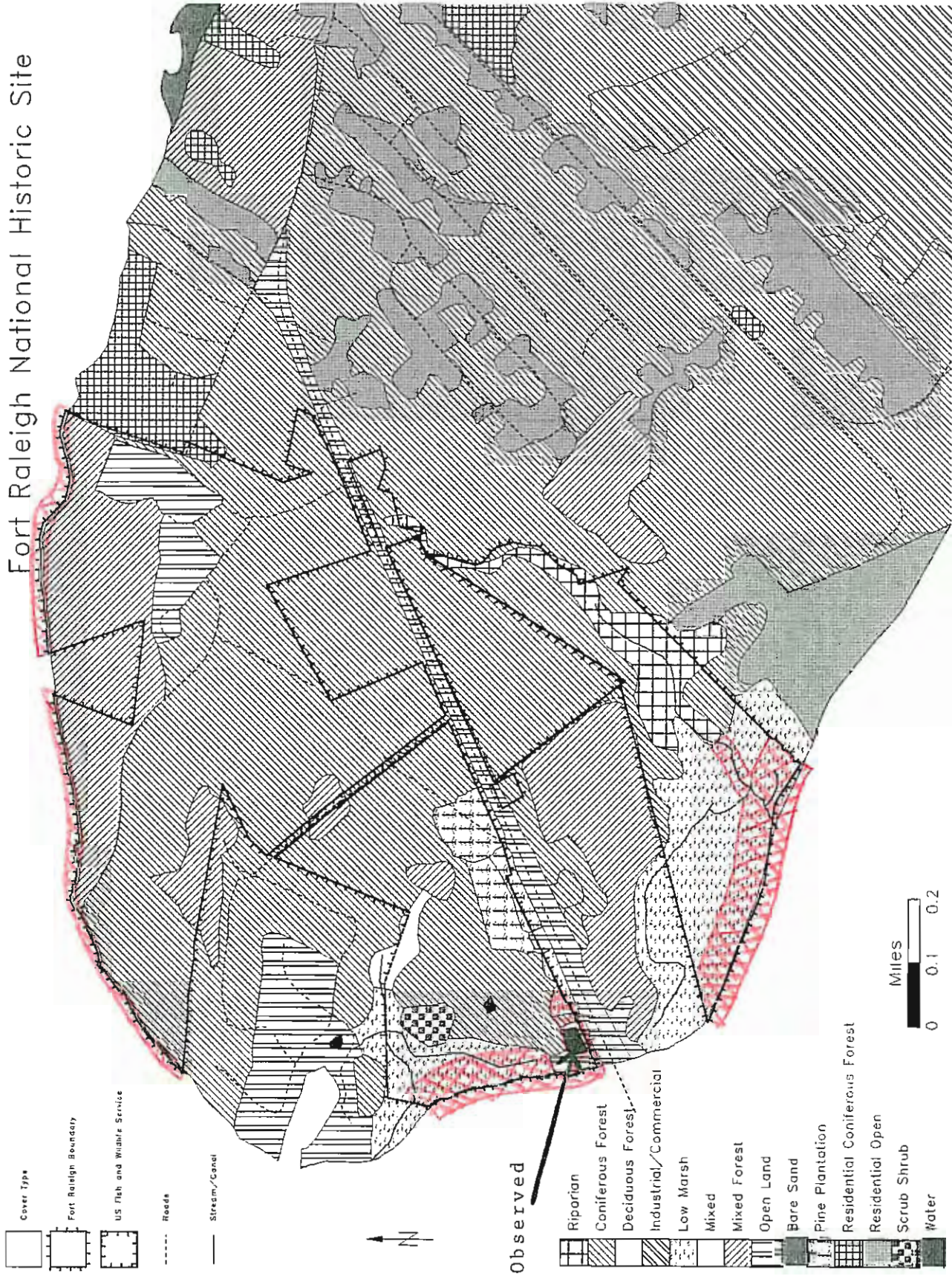
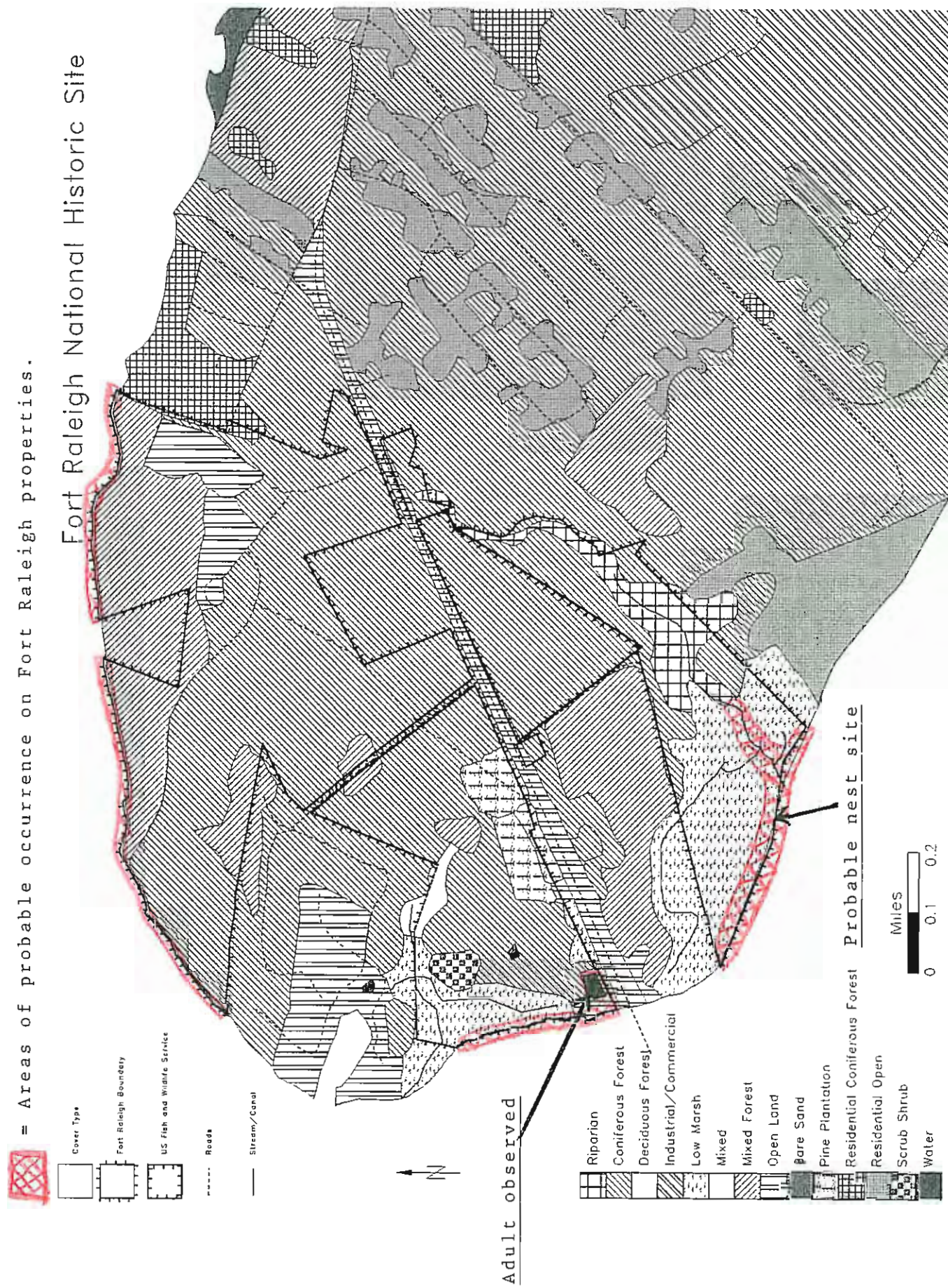


Figure 3. Areas of greatest probability of occurrence for the Diamondback Terrapin (Malaclemys terrapin), and locations where the species was observed.



Amphibians and Reptiles Known From Fort Raleigh National Historic Site Property
September 1997

AMPHIBIANS:

Bufo fowleri Fowler's Toad - Observed on or very near property on 28 Apr, 15 & 16 Jul, and 11 Sep 1997. Voucher = NCSM 51041. Vouchers from elsewhere on island (or from unspecified localities on island) = NCSM 19556-57(2), 19558, 19559, 44355; CM 75780, 75781.

Gastrophryne carolinensis Eastern Narrowmouth Toad - Observed on 25 Sep 1996; 28 Apr and 12 Sep 1997. Voucher = NCSM 44366. Vouchers from elsewhere on island (or from unspecified localities on island) = NCSM 3352, 3353, 3366-68(3), 44356; AMNH 32970, 32972.

Hyla cinerea Green Treefrog - Common on Fort Raleigh property. Seen or heard on 26 Sep 1996; 28 Apr, 15 & 16 Jul, 14 Aug, and 11 Sep 1997. Vouchers = NCSM 44368-69(2), 51042. Vouchers from elsewhere on island (or from unspecified localities on island) = AMNH 32972, 36777.

Hyla femoralis Pine Woods Treefrog - At least one heard calling near pond off N side U.S. 64 just NE Croatan Sound on 15, 16, & 17 Jul 1997. Vouchers from elsewhere on island = NCSM 3354-56(3), 19564, 44348.

Hyla squirella Squirrel Treefrog - Common on Fort Raleigh property. Seen or heard on 24 Sep 1996; 28 Apr, and 15, 16, & 17 Jul 1997. Voucher = NCSM 44352. Vouchers from elsewhere on island (or from unspecified localities on island) = NCSM 4335, 4336; UMMZ 71478.

Plethodon chlorobryonis Atlantic Coast Slimy Salamander - Commonly observed on Fort Raleigh property. Observed on 24, 25, & 26 Sep 1996; 28 & 29 Apr, and 11 Sep 1997. Vouchers = NCSM 22058(15), 44349. Vouchers from elsewhere on island (or from unspecified localities on island) = NCSM 3298-300(3), 3370, 12906(13).

Pseudacris ocularis Little Grass Frog - One seen on 25 Sep 1996 and one on 16 Jul 1997. A few heard on 28 & 30 Apr, and 15 Jul 1997. Voucher = NCSM 44365.

Rana catesbeiana Bullfrog - Adults seen and/or heard in pond off N side U.S. 64 just NE Croatan Sound on 25 Sep 1996; 28, 29, & 30 Apr, 15, 16, & 17 Jul, and 11 & 12 Sep 1997. Vouchers = NCSM 52488 (2 larvae). Voucher from elsewhere on island (or from unspecified locality on island) = NCSM 3258.

Rana utricularia Southern Leopard Frog - Fairly common on property. Observed on 24, 25, & 26 Sep 1996; 28 & 30 Apr, 15, 16, & 17 Jul, and 10, 11, & 12 Sep 1997. Vouchers = NCSM 44351, 44357(2 larvae), 44370(2 larvae), 52489(larva). Vouchers from elsewhere on island (or from unspecified localities on island) = NCSM 3363-65(3).

REPTILES:

Agkistrodon piscivorus Eastern Cottonmouth - Apparently common in freshwater aquatic habitats on Fort Raleigh properties. Observed on property on 25 Sep 1996; 30 Apr, and 10, 11, & 12 Sep 1997. Vouchers from elsewhere on island = NCSM 17925, 18358.

Anolis carolinensis Green Anole - Fairly common on Fort Raleigh property. Observed on 25 & 26 Sep 1996; 29 & 30 Apr, 16 Jul, 14 Aug, and 11 Sep 1997. Vouchers = NCSM 44361-63(3). Voucher from elsewhere on island = NCSM 22061.

Caretta caretta Loggerhead - A few scattered bones found on beach along Croatan Sound off S side U.S. 64 on 15 & 16 Jul, and 10 Sep 1997. Voucher = NCSM 52662.

Chelydra serpentina Common Snapping Turtle - Adults observed on property on 25 Sep 1996; 29 Apr, 15 & 16 Jul, and 10 & 11 Sep 1997. Photo voucher = JCB 97-732. Vouchers from elsewhere on island = NCSM 15111, 15112.

Coluber constrictor Black Racer - Observed on property on 26 Sep 1996; 29 Apr, 16 Jul, and 11 & 12 Sep 1997. Voucher = NCSM 53618.

Crotalus horridus Timber Rattlesnake - Ries Collier (pers. comm.) reported having observed at least one specimen on Ft. Raleigh property. Palmer and Braswell (1995) reported a specimen from near Wanchese. A newspaper account of an adult killed by Byron Sawyer and disposed of by Stafford Berry on 10 Sep 1997 was investigated. Mrs. Stafford Berry (pers. comm.) indicated that the snake was killed on Dogwood Trail off Candella Drive (SR 1307). This site is ca. 2.4 air mi. WNW Manteo and near Fort Raleigh property. The photograph of the snake is clearly identifiable and has been placed in the NCSM files. These records suggest that a small resident population of Timber Rattlesnakes still exists on Roanoke Island.

Diadophis punctatus Ringneck Snake - Adult male taken 29 Apr 1997 under log along hiking trail off E side SR 1161. Voucher = NCSM 51181. Voucher from elsewhere on island = NCSM 19552.

Elaphe obsoleta Rat Snake - Juvenile dead-on-road and shed skins from two juveniles observed on 25 Sep 1996. Voucher = NCSM 44367. Vouchers from elsewhere on island (or from unspecified localities on island) = NCSM 3259, 19555, 52490.

Eumeces inexpectatus Southeastern Five-lined Skink - Fairly common on Fort Raleigh property. Observed on 25 & 26 Sep 1996; 29 & 30 Apr, 17 Jul, 14 Aug, and 12 Sep 1997. Vouchers = NCSM 21598, 21599, 21600, 21686(9), 44364. Voucher from elsewhere on island = AMNH 97002.

Eumeces laticeps Broadhead Skink - At least 5 or 6 adults and 2 juveniles observed near Lost Colony Theatre on 17 Jul 1997, and one adult on 12 Sep 1997. Voucher = NCSM 52491.

Farancia erythrogramma Rainbow Snake - Small adult female found fresh dead on bank of pond off N side U.S. 64 just NE Croatan Sound on 12 Sep 1997 is only record for island. Voucher = NCSM 53620.

Malaclemys terrapin Diamondback Terrapin - One seen swimming in pond off N side U.S. 64 just NE Croatan Sound on 25 Sep 1996. Eggshell fragments from a predator destroyed nest found on 11 Sep 1997 along edge of Croatan Sound S of U.S. 64. True (1887) reported specimens from Roanoke Island. No known vouchers for island.

Nerodia fasciata Banded Water Snake - Juvenile found on beach between sound and marsh off S side U.S. 64 on 10 Sep 1997 is only known record for island. Voucher = NCSM 53617.

Nerodia sipedon williamengelsi Carolina Water Snake - Old remains of one adult *Nerodia*, apparently *N. s. williamengelsi*, observed dead-on-road in parking lot at pond off N side U.S. 64 just NE Croatan Sound on 24 Sep 1996. One juvenile observed dead-on-road at same locality, 25 Sep 1996. One adult observed in same pond on 29 Apr 1997. Vouchers from elsewhere on island = NCSM 15510, 17926; CM 23074; VCU 1377, 1378.

Opheodrys aestivus Rough Green Snake - Adult male taken on 29 Apr 1997 in vine tangle along bike train along N side U.S. 64, ca. 0.2 road mi. E. Croatan Sound. Another adult male observed in same area on 15 Jul 1997, and a small adult female on 16 Jul 1997. Voucher = NCSM 51043.

Ophisaurus ventralis Eastern Glass Lizard - Observed on property on 24 & 25 Sep 1996; 11 Sep 1997. Voucher = NCSM 44350. Vouchers from elsewhere on island (or from unspecified localities on island) = CM 22935, 22936, 23182.

Pseudemys rubriventris Redbelly Turtle - One taken in turtle trap in pond off N side U.S. 64 just NE Croatan Sound on 25 Sep 1996. At least one observed in same pond on 29 Apr 1997. Voucher = NCSM 44358.

Scincella lateralis Ground Skink - Fairly common on Fort Raleigh property. Observed on 24 & 25 Sep 1996; 29 & 30 Apr, 16 Jul, and 10 & 11 Sep 1997. Vouchers = NCSM 44360, 51044. Voucher from elsewhere on island (or from unspecified locality on island) = NCSM 3360.

Thamnophis s. sauritus Eastern Ribbon Snake - Adult taken dead-on-road near park entrance, 24 Sep 1996, is only known record for the island. Voucher = NCSM 44353.

Trachemys s. scripta Yellowbelly Slider - Common in pond off N side U.S. 64 just NE Croatan Sound. Observed there on 25 & 26 Sep 1996; 29 & 30 Apr, 16 & 17 Jul, and 10, 11, & 12 Sep 1997. Voucher = NCSM 44359.

**Additional Amphibians and Reptiles Known from Roanoke Island,
but not documented from Fort Raleigh property:***

AMPHIBIANS:

Acris g. gryllus, Southern Cricket Frog - Vouchers = AMNH 16813.

Ambystoma mabeei, Mabee's Salamander - Vouchers = NCSM 1900-02(3), 1903, 3257.

Bufo quercicus, Oak Toad** - Vouchers = NCSM 3293, 3294, 3362.

Desmognathus cf. auriculatus, Southern Dusky Salamander - Voucher = NCSM 12905.

Pseudacris brimleyi, Brimley's Chorus Frog - Vouchers = NCSM 24201(4).

Scaphiopus h. holbrookii, Eastern Spadefoot** - Vouchers = NCSM 3273, 3802, 20174, 44354.

REPTILES:

Carphophis a. amoenus, Eastern Worm Snake - Vouchers = NCSM 3357, 20390.

Cemophora coccinea copei, Northern Scarlet Snake - Voucher = AMNH 38157. Two additional specimens reported observed by Clay Gifford (pers. comm. to J. B. Funderburg; letter on file at NCSM).

Cnemidophorus s. sexlineatus, Six-lined Racerunner - Voucher = NCSM 22956.

Elaphe guttata, Corn Snake - Vouchers = NCSM 30738, CM 22882.

Farancia a. abacura, Eastern Mud Snake - Voucher = NCSM 24257.

Kinosternon s. subrubrum, Eastern Mud Turtle - Voucher = NCSM 17020.

Lampropeltis getula, Eastern Kingsnake - Vouchers = NCSM 3254, 17956, 19554; CM 22937.

Rhadinaea flavilata, Pine Woods Snake - Vouchers = NCSM 3255, 3409.

Storeria dekayi, Brown Snake** -- Voucher = NCSM 53619.

Storeria o. occipitomaculata, Northern Redbelly Snake - Vouchers = NCSM 22059; CM 23200.

Terrapene c. carolina, Eastern Box Turtle** - Vouchers = NCSM 1511, 19446.

Virginia striatula, Rough Earth Snake - Vouchers = NCSM 3295, 3296, 22060; CM 23201-203(3).

* A few of these specimens may have been collected on what is now Ft. Raleigh property; but the locality data are not specific enough to be certain.

** Collected or observed on Roanoke Island, but not on Fort Raleigh property, during this survey.

COLLECTIONS WITH VOUCHER SPECIMENS CITED ABOVE:

AMNH = American Museum of Natural History

CM = Carnegie Museum

JCB = Jeffrey C. Beane field number

NCSM = North Carolina State Museum of Natural Sciences

UMMZ = University of Michigan Museum of Zoology

VCU = Virginia Commonwealth University

AMPHIBIAN CHECKLIST

* Species that could occur on Roanoke Island.

** Species documented on Roanoke Island.

*** Species observed/documentated on Fort Raleigh National Historic Site.

Caudata

Amphiumidae

Amphiuma means*

Two-toed Amphiuma

Proteidae

Necturus punctatus*

Dwarf Waterdog

Sirenidae

Siren intermedia intermedia*

Eastern Lesser Siren

Siren lacertina*

Greater Siren

Salamandridae

Notophthalmus viridescens viridescens*

Red-spotted Newt

Ambystomatidae

Ambystoma mabeei**

Mabee's Salamander

Ambystoma opacum*

Marbled Salamander

Plethodontidae

Desmognathus cf. auriculatus**

Southern Dusky Salamander

Eurycea cirrigera*

Southern Two-lined Salamander

Eurycea cf. quadridigitata*

n. sp. "Carolina Dwarf Sal."

Hemidactylium scutatum*

Four-toed Salamander

Plethodon chlorobryonis***

Atlantic Coastal Slimy Sal.

Plethodon cinereus*

Redback Salamander

Pseudotriton montanus montanus*

Eastern Mud Salamander

Stereochilus marginatus*

Many-lined Salamander

Salientia (Anura)

Pelobatidae

Scaphiopus holbrookii holbrookii**

Eastern Spadefoot

Bufonidae

Bufo americanus americanus*

Eastern American Toad

Bufo quercicus**

Oak Toad

Bufo terrestris*

Southern Toad

Bufo fowleri***

Fowler's Toad

Hylidae

Acris gryllus gryllus**

Southern Cricket Frog

Hyla chrysoscelis*

Cope's Gray Treefrog

Hyla cinerea***

Green Treefrog

Hyla femoralis***

Pine Woods Treefrog

Hyla gratiosa*

Barking Treefrog

Hyla squirella***

Squirrel Treefrog

Pseudacris brimleyi**

Brimley's Chorus Frog

Pseudacris crucifer crucifer*

Northern Spring Peeper

Pseudacris nigrita nigrita*

Southern Chorus Frog

Pseudacris ocularis***

Little Grass Frog

Microhylidae

Gastrophryne carolinensis***

Eastern Narrowmouth Toad

Ranidae

Rana catesbeiana***

Bullfrog

Rana clamitans melanota*

Green Frog

Rana palustris*

Pickerel Frog

Rana utricularia***

Southern Leopard Frog

Rana sylvatica*

Wood Frog

Rana virgatipes*

Carpenter Frog

REPTILE CHECKLIST

* Species that could occur on Roanoke Island.

** Species documented on Roanoke Island.

*** Species observed/documentated on Fort Raleigh National Historic Site.

Crocodylia

Crocodylidae

Alligator mississippiensis*

American Alligator

Chelonia (Testudines)

Chelydridae

Chelydra serpentina serpentina***

Common Snapping Turtle

Kinosternidae

Kinosternon baurii*

Striped Mud Turtle

Kinosternon subrubrum subrubrum**

Eastern Mud Turtle

Sternotherus odoratus*

Common Musk Turtle

Emydidae

Chrysemys picta picta*

Eastern Painted Turtle

Clemmys guttata*

Spotted Turtle

Deirochelys reticularia reticularia*

Eastern Chicken Turtle

Malaclemys terrapin***

Diamondback Terrapin

Pseudemys concinna concinna*

Eastern River Cooter

Pseudemys concinna floridana*

Florida Cooter

Pseudemys rubriventris rubriventris***

Redbelly Turtle

Trachemys scripta scripta***

Yellowbelly Slider

Trachemys scripta elegans* (introduced)

Red-eared Slider

Terrapene carolina carolina**

Eastern Box Turtle

Sauria

Iguanidae

Anolis carolinensis***

Green Anole

Scincidae

Eumeces fasciatus*

Five-lined Skink

Eumeces inexpectatus***

Southeastern Five-lined Skink

Eumeces laticeps***

Broadhead Skink

Scincella lateralis***

Ground Skink

Teiidae

Cnemidophorus sexlineatus sexlineatus**

Six-lined Racerunner

Anguidae

Ophisaurus ventralis***

Eastern Glass Lizard

Serpentes

Colubridae

Carphophis amoenus amoenus**

Eastern Worm Snake

Cemophora coccinea copei**

Northern Scarlet Snake

Coluber constrictor***

Racer

Diadophis punctatus punctatus***

Southern Ringneck Snake

Elaphe guttata guttata**

Corn Snake

Elaphe obsoleta quadrivittata***

"Yellow Rat Snake"

Farancia abacura abacura**

Eastern Mud Snake

Farancia erythrogramma erythrogramma***

Rainbow Snake

Heterodon platirhinos*

Eastern Hognose Snake

Lampropeltis getula getula**

Eastern Kingsnake

Lampropeltis triangulum elapsoides*

Scarlet Kingsnake

Nerodia erythrogaster erythrogaster*

Redbelly Water Snake

Colubridae (continued)

<u>Nerodia fasciata fasciata</u> ***	Banded Water Snake
<u>Nerodia sipedon williamengelsi</u> ***	Carolina Salt Marsh Snake
<u>Nerodia taxispilota</u> *	Brown Water Snake
<u>Opheodrys aestivus</u> ***	Rough Green Snake
<u>Regina rigida rigida</u> *	Glossy Crayfish Snake
<u>Rhadinaea flavilata</u> **	Pine Woods Snake
<u>Seminatrix pygaea paludis</u> *	Carolina Swamp Snake
<u>Storeria dekayi</u> **	Brown Snake
<u>Storeria occipitomaculata</u> **	Redbelly Snake
<u>Thamnophis sauritus sauritus</u> ***	Eastern Ribbon Snake
<u>Thamnophis sirtalis sirtalis</u> *	Eastern Garter Snake
<u>Virginia striatula</u> **	Rough Earth Snake

Viperidae (subfamily Crotalinae)

<u>Agkistrodon contortrix</u> *	Copperhead
<u>Agkistrodon piscivorus piscivorus</u> ***	Eastern Cottonmouth
<u>Crotalus horridus</u> ***	Timber Rattlesnake

**WORKSHOP ON THE ECOLOGY, STATUS, AND MANAGEMENT
OF THE DIAMONDBACK TERRAPIN**

ORGANIZED BY RICHARD A. SEIGEL AND J. WHITFIELD GIBBONS

SAVANNAH RIVER ECOLOGY LABORATORY

2 AUGUST 1994

FINAL RESULTS AND RECOMMENDATIONS

Introduction

On 2 August, 1994, 35 experts from 13 states gathered at the Savannah River Ecology Laboratory in South Carolina to discuss the ecology, status, and conservation of the diamondback terrapin (*Malaclemys terrapin*). The Workshop was prompted by reports of potential declines of terrapin populations in several locations in its range. In addition to sharing data on terrapin ecology and status, the Workshop was designed to produce specific recommendations for action by local, state, and federal management agencies. Below, we have summarized some of the major findings and recommendations of the Workshop. Please bring these to the attention of the appropriate individuals in your area who have responsibility for managing this unique resource. Additional questions concerning the Workshop may be addressed to either Richard A. Seigel or J. Whitfield Gibbons (addresses listed below). A list of all attendees is also attached.

Research

1) Although some aspects of terrapin ecology are well-known in at least some parts of the range, many areas remain poorly studied. What follows is an unranked list of some areas the Workshop considered critical at this time. These areas warrant special consideration for funding by state and federal agencies:

- | | |
|----------------------------------|--|
| -Demography | -Genetic studies (e.g. DNA fingerprinting) |
| -Habitat use | -Movement patterns and home range size |
| -Ecology of juveniles | -Long-term life history studies |
| -Taxonomic studies on subspecies | -Behavioral ecology |

Status

1) Based on information developed at the Workshop, there is evidence for declines of populations of diamondback terrapins in seven states, evidence for stability or increases in populations in five states, and insufficient data are available for seven states. However, broad-scale data are lacking for most states within the range of the species.

2) There is insufficient evidence at this time to warrant listing the species under the Endangered Species Act. However, there is sufficient evidence to consider placing all subspecies as Category 2 candidates for listing (two subspecies are already listed as Category 2 candidates).

3) Based on results of a questionnaire distributed at the Workshop, most participants felt that terrapins merited Protected Status in most states where such protection was not already provided. The results of the questionnaire are attached.

4) There is an urgent need for better survey data throughout the range. Surveys should use multiple methods to insure reasonable sampling representation of sexes, size classes, etc.

The exact methods used will vary from region to region. Surveys should be repeated at appropriate intervals (i.e., a single year is not considered sufficient).

Threats

1) One of the major threats to populations of terrapins appears to be incidental drowning in crab traps. Immediate efforts should be made to reduce incidental killing in crab traps by the use of newly-developed excluder devices. In addition, efforts should be made to determine the extent of mortality in crab traps by determining the number of operational traps in optimal habitats of terrapins, and extrapolating from known mortality rates. Better data are also needed on mortality rates from other portions of the range.

2) Habitat loss continues to be a major concern. Examples include drainage and impoundment of salt marshes, human disturbance of nesting sites, and increased flow of fresh water into estuarine systems. Loss of habitat for both nesting and feeding areas should be estimated via GIS methods.

3) Other potential threats include (but are not limited to) commercial harvesting for the meat and pet trade, incidental kills by motor boats, road mortality, and predation on adults and eggs by raccoons and other predators. These threats require additional study.

SUMMARY

Although diamondback terrapins do not appear to be in immediate jeopardy of extinction, there is sufficient evidence that populations in some areas are declining as a result of the factors described above. Rather than call for an Endangered Species Listing at this time, the Workshop felt that proactive steps would help to both improve conditions for the species and avoid the restrictions imposed by such a listing. However, these proactive steps require sufficient funding by state and federal agencies for detailed surveys and research, as well as cooperation from research biologists. Failure to conduct the needed studies would likely result in continued population declines and eventual federal status. Thus, action needs to be taken before the species declines to the point where only dramatic interventions will help.

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SUMMARY OF TERRAPIN STATUS AND RESEARCH QUESTIONNAIRE

State	Source	Status	Recent Survey?	Threats (in rank order)	Steps Needed	Current Research?
MA	P. Auger	Stable or Increasing	Ongoing	Motor boat impacts; nesting habitat alteration	Retain "Species of Special Concern" status	Yes
RI	C. Goodwin	Unknown/Stable	Yes-1993	Predation, habitat loss, pollution, harvesting, motor boats	State Protected Status; regulations on motor boats	Yes
NY	S. Morreale	Stable	1991	Shoreline development; channelization of marshes; pollution	Habitat protection	No
NJ	R. Wood	Declining	No	Crab traps, habitat loss, road kills	Crab trap regulations	Yes
MD	W. Roosenberg	Declining/Stable	No	Crab traps, habitat loss, motor boats, harvesting	State Protected status; crab trap regulations	Yes
VA	J. Mitchell	Unknown	No	Crab trapping, harvesting, habitat loss, predation, pollution, pet trade	State Protected status; crab trap regulations	No; not planned
NC	A. Braswell. T. Conant	Declining or Unknown	Yes	Crab traps, predation, habitat loss, road kills, pollution, ~~predation~~	State Protected status; crab trap regulations	Yes
SC	J. Lovich, T. Zimmerman, K. Aifieri	Unknown (Lovich) Declining (Aifieri)	No (local only)	Crab traps, habitat loss, road kills, harvesting	State Protected status; crab trap regulations	Yes

State	Source	Status	Recent Survey?	Threats (in rank order)	Steps Needed	Current Research?
FL (Atlantic Coast)	R. Seigel	Declining	Yes (local)	Predation, habitat loss, crab traps, harvesting	State Protected species	Yes
FL (Keys)	R. Wood	Stable	No	None	None	No
AL	R. Clay	Unknown	No (planned for 1994-95)	Crab traps?, habitat loss, pet trade, harvesting	Crab trap regulations; education of enforcement officers	Yes
MS	T. Mann	Declining	Yes-1994	Crab traps; commercial harvesting; predation; habitat loss	Crab trap regulations; state protected status;	No
LA	R. Seigel	Unknown or declining	No (none planned)	Crab traps?	Unknown	No; not planned
TX	A. Price	Unknown	No (1984)	Habitat loss, crab traps, harvesting, pollution	State Protected status or game status; crab trap regulations	No; not planned