

## **The Distribution of Aquatic Turtles along the Ohio, Great Kanawha, and Little Kanawha Rivers, West Virginia, with Emphasis on *Graptemys ouachitensis* and *G. geographica*.**

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**Abstract:** Visual surveys were conducted to investigate the spatial distribution of the Northern Map Turtle (*Graptemys geographica*) and the Ouachita Map Turtle (*Graptemys o. ouachitensis*) in the Ohio, Great Kanawha, and Little Kanawha rivers, West Virginia, from May 24 to August 8, 2010. Both species were detected and photographed on the Ohio, Great Kanawha, and Little Kanawha rivers. Ouachita Map Turtles were documented in 3 new counties and Northern Map Turtles were documented in 2 new counties. Additionally, new county records were documented for Eastern Spiny Softshells (*Apalone s. spinifera*) and Eastern Musk Turtles (*Sternotherus odoratus*) and 42 photographs were deposited as vouchers at the West Virginia Biological Survey Museum. Further investigation is needed to determine the extent and continuity of Ouachita Map Turtle range in the Ohio River and its tributaries.

**Key Words:** *Graptemys ouachitensis*, *Graptemys geographica*, distribution, map turtle, basking

### **Introduction**

Turtles are relatively understudied in West Virginia (Phu 2010). Map turtles in particular are not well known, yet they may be vulnerable to the pollution, siltation, habitat alteration, and power boating seen on West Virginia's rivers (Moll and Moll 2004; Bodie 2001; Vandewalle and Christiansen 1996). Two species of map turtles occur in West Virginia: the Northern Map Turtle (*Graptemys geographica*) that ranges from Arkansas north to Minnesota and east to southern Quebec; and the Ouachita Map Turtle (*G. o. ouachitensis*) that ranges from eastern Kansas, Arkansas, and East Texas east to Tennessee and north to southwest Wisconsin (Conant and Collins 1998; Ernst and Lovich 2009). In West Virginia, data on distribution and status of both species are limited (Green and Pauley 1987).

Herpetologists have assumed that the Ouachita Map Turtle occurs as a disjunct population in Ohio and West Virginia (Ernst and Lovich 2009, Green and Pauley 1987, Wynn and Moody 2006); however, the extent and viability of this population in West Virginia is not known. The Ouachita Map Turtle was first reported as part of West Virginia's herptofauna by Richmond in 1953 from three specimens collected in 1952 on the Little Kanawha River in Wirt County (CM 31245, 31246, 32063). In 1955, another specimen was collected from the same area (CM 34142). In 2000, Watson and Pauley (2006) captured a juvenile male in the lower Great Kanawha River in Mason County during a systematic trapping survey of the river's turtle assemblages. They did not know if these individuals were part of an established population, released pets, or wayward transients. Additional surveys throughout West Virginia in 2003 failed to detect any *Graptemys* species (Phu 2010). In the summer of 2009, we observed a female basking on the lower Kanawha River (Putnam County), providing further evidence for a population in West Virginia.

Much of the Ouachita Map Turtle's range overlaps with that of the Northern Map Turtle (Ernst and Lovich 2009); Fuselier and Edds (1994) often found the two species sympatrically in Kansas. Ouachita and Northern Map Turtles living sympatrically practice dietary and habitat partitioning (Fuselier and Edds 1994, Temple-Miller 2008, Vogt 1981). In West Virginia, Northern Map Turtles have been documented in more locations than Ouachita Map Turtles, although records for both species are few. Northern Map Turtles have been documented in Cabell, Lewis, Mason, Monongalia, Putnam Raleigh, Summers, and Wirt counties (Green and Pauley 1987, Watson and Pauley 2006) and directly adjacent Wood County in Marietta, Washington County, OH (Conant, 1938).

Map turtles are shy and difficult to capture (Green and Pauley 1987) but populations have been successfully detected using visual searches from boats (Temple-Miller 2008). Researchers have successfully used spotting scopes and binoculars to study basking turtles (Carriere et al. 2008, Lindeman 1997, Phu 2010) and map turtles in particular (Coleman and Gutberlet 2008, Lindeman 1998, 1999a, 1999b, 1998). We investigated the distribution of map turtles in West Virginia using similar methods.

## Methods

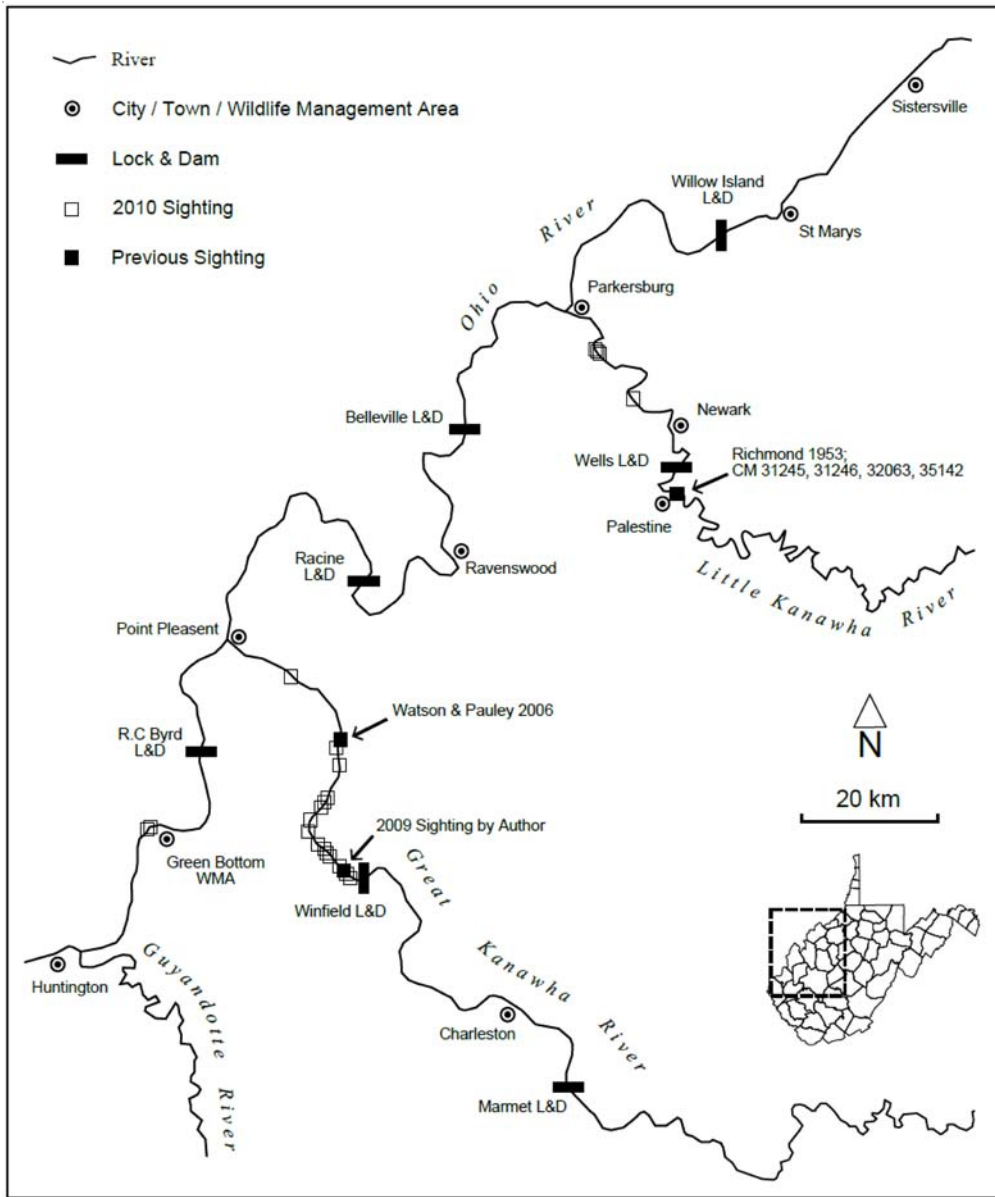
To investigate the spatial distribution of map turtles in West Virginia we conducted visual surveys for basking turtles on the Little Kanawha, Kanawha, and Ohio rivers from May 24 to the August 8, 2010. On the Little Kanawha River, we surveyed from the mouth to Newark and from the Elizabeth Locks to Henderson Run. On the Great Kanawha River, we surveyed from the mouth to Charleston. On the Ohio River, we surveyed from the mouth of the Guyandotte River to Green Bottom Wildlife Management Area, Ravenswood to Letart, Belleville to the mouth of the Little Kanawha River, and St. Marys to Sistersville. We also surveyed from St. Marys to approximately 4.5 km up Middle Island Creek. We searched the rivers from a 14 ft johnboat during daylight hours with most surveys occurring between 1100 and 1700 hours. We used binoculars, spotting scopes, and cameras equipped with telephoto lenses to identify turtles. When possible, photographs were taken and deposited as vouchers at the West Virginia Biological Survey Museum at Marshall University in Huntington, WV. We used a Garmin Vista HCx GPS unit (Garmin Ltd., Olathe, Kansas, USA; map datum NAD 83) to record the location of basking turtles and noted the type of basking object. We attempted to capture basking turtles with dip nets when basking logs provided an angle of approach that hid us from view. Specimens we captured were measured, photographed, and promptly released. We distinguished Ouachita Map Turtles from Northern Map Turtles by the former's strong vertebral keels with prominent spines, white irises, and large postorbital marks (Ernst and Lovich 2009).

## Results

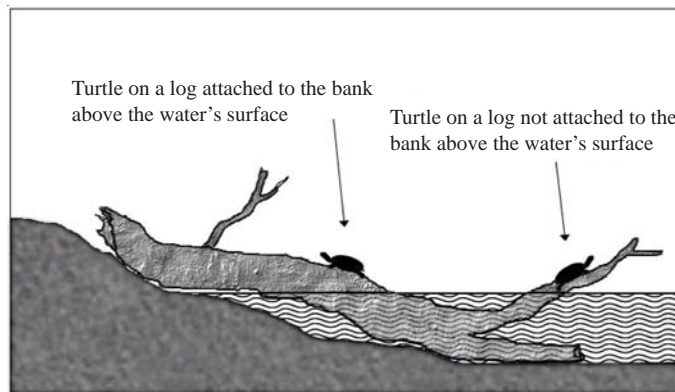
We observed 24 Ouachita Map Turtles on the Great Kanawha River at 15 locations, 3 on the Ohio River at 2 locations, and 5 on the Little Kanawha at 4 locations (Fig. 1). All but 3 Ouachita Map Turtles were observed basking on partially submerged logs which were not attached to the bank above the surface (one was on a rock, one was floating beside a partially submerged log not attached to the bank, and one was on a partially submerged log attached to the shore above the surface; Fig. 2). We captured a single male on the Great Kanawha River (weight: 170g; carapace length: 125mm; carapace width: 91mm; plastron length: 106mm; plastron width: 53mm). We also observed 19 Northern Map Turtles on the Great Kanawha River at 4 locations, 13 on the Ohio River at 7 locations, and 5 on the Little Kanawha River at 4 locations (Fig. 3). One Northern Map turtle was observed swimming while the rest were observed basking on partially submerged logs; however, unlike the Ouachita Map Turtles, logs attached and unattached to the bank above the surface were used.

We observed 10 basking map turtles that we were able to identify only to genus and 50 turtles that we were able to identify only as emydids before they dropped into the water. Additionally we observed 72 softshell turtles (*Apalone* sp.) including 11 identified to species (*A. s. spinifera*; Eastern Spiny Softshell) as well as three Red-eared Sliders (*Trachemys scripta elegans*), three Midland Painted Turtles (*Chrysemys picta marginata*), four Eastern Snapping Turtles (*Chelydra s. serpentina*), and three Eastern Musk Turtles (*Sternotherus odoratus*; Fig. 4). Our identification rate of emydid turtles was 63% to genus and 55% to species. We deposited 42 photographs as vouchers at the West Virginia Biological Survey Museum (Table 1).

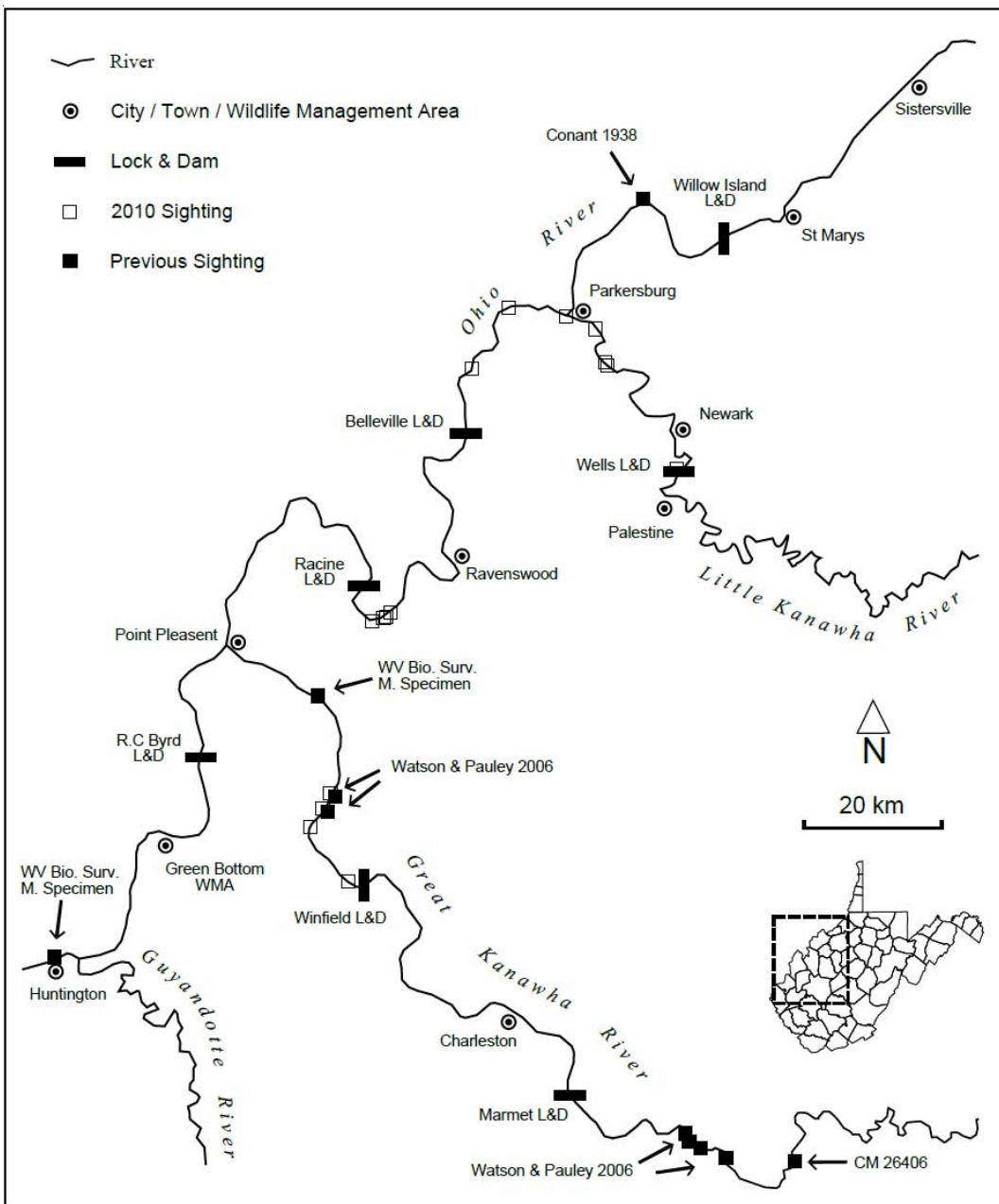
On June 25, we observed evidence of softshell turtle nesting activity on sand banks along the Great Kanawha River. We saw numerous softshell tracks leading from the river to holes dug in the bank and back to the water. We also saw numerous depredated turtle nests in the lower sandy portions of the riverbank and in the higher areas consisting of decomposed organic debris. Additionally, we noticed many Muskrat (*Ondatra zibethica*) tracks that led from the river to a series of shallow holes dug throughout the nesting area. We had not seen Muskrat activity on previous visits to these sandy areas.



**Figure 1.** Ouachita Map Turtle (*Graptemys ouachitensis*) distribution along the Ohio, Great Kanawha, and Little Kanawha rivers, WV, from a 2010 visual survey and previous sightings/records.



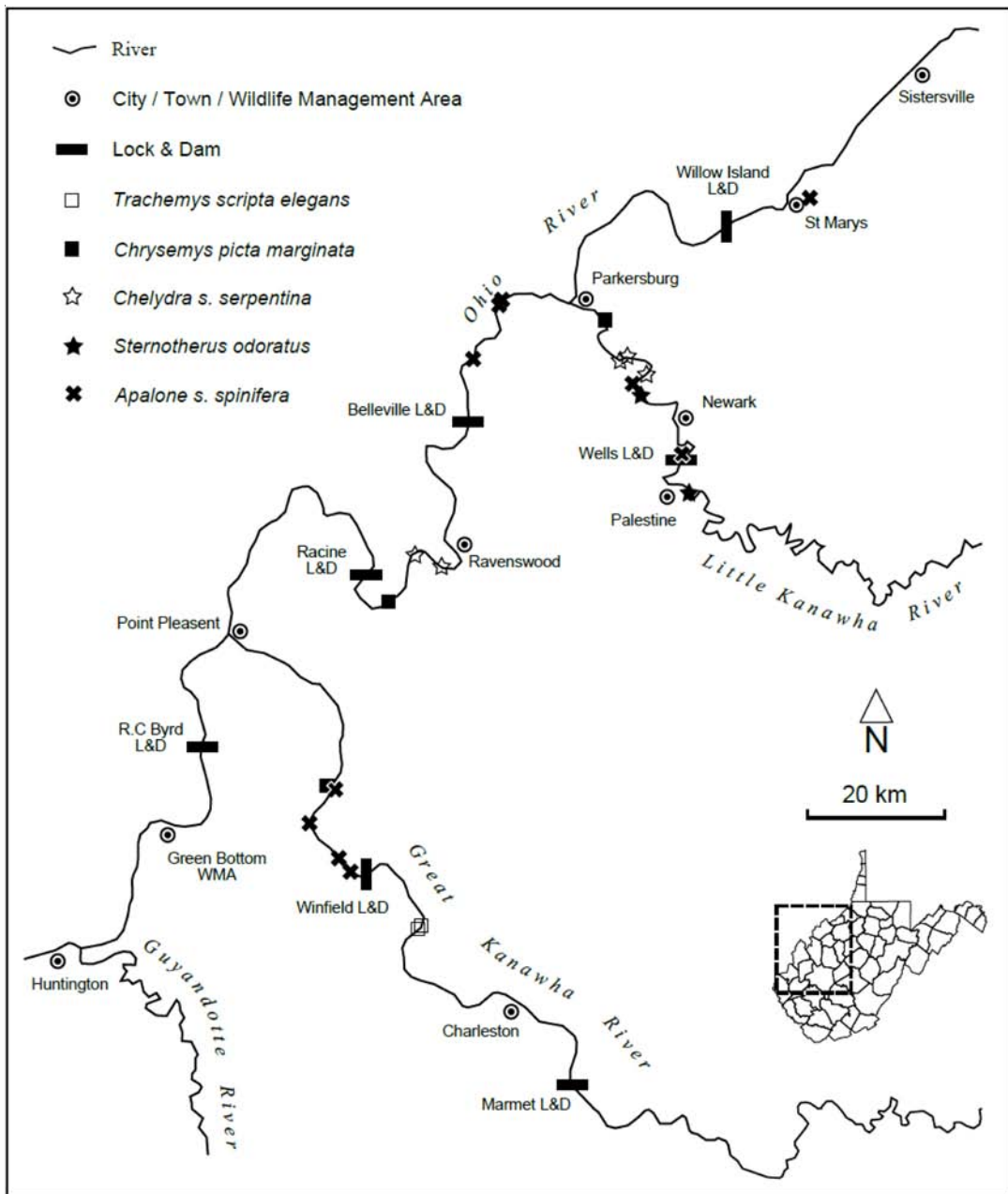
**Figure 2.** Turtles basking on a partially submerged log with positions attached and not attached to the bank above the water's surface.



**Figure 3.** Northern Map Turtle (*Graptemys geographica*) distribution along the Ohio, Great Kanawha, and Little Kanawha rivers, WV, from a 2010 visual survey and previous records

### Discussion

Ouachita Map Turtles and Northern Map Turtles were the most commonly encountered basking turtles along with softshell turtles during the course of our study. Watson and Pauley (2006) captured a single Ouachita Map Turtle after trapping the Great Kanawha River mainstem as well as its embayments and tributaries extensively. Their trapping efforts did yield numerous Midland Painted Turtles, Red-eared Sliders, Eastern Snapping Turtles, and Eastern Musk Turtles. Visual searches for basking turtles may represent a faster and more efficient method for detecting populations of map turtles on rivers compared to trapping, but a less productive method for other species. However, we likely would have observed these other species in abundance had we concentrated our efforts on backwaters and tributaries rather than river mainstems.



**Figure 4.** Red-eared Slider (*Trachemys scripta elegans*), Midland Painted Turtle (*Chrysemys picta marginata*), Eastern Snapping Turtle (*Chelydra s. serpentina*), Eastern Musk Turtle (*Sternotherus odoratus*), and Eastern Spiny Softshell (*Apalone s. spinifera*) sightings along the Ohio, Great Kanawha, and Little Kanawha rivers, WV, from a 2010 visual survey.

Our identification rate to species was less than we desired but similar to that of Temple-Miller (2008) on the lower Scioto River, Ohio. These low identification rates were likely due to the shy nature of map turtles and their willingness to rapidly abandon basking platforms upon approach of a boat. Red-eared Sliders and Midland Painted Turtles were more reluctant to retreat into the water. We thus expect that many of the emydid turtles that we were unable to identify to species were map turtles.

We observed fewer basking turtles on the Ohio River, which had higher recreational powerboat traffic during surveys, and fewer partially submerged logs than the Great Kanawha and Little Kanawha rivers. The Ohio River, unlike the other two rivers, also contained extensive emergent vegetation mats. Map turtles use emergent vegetation mats for aquatic basking (Bulté et al. 2010, Peterman and Ryan 2009) and would be more difficult to detect than

**Table 1.** Voucher photographs of turtles from a 2010 survey of the Ohio, Great Kanawha, and Little Kanawha rivers, WV, deposited in the West Virginia Biological Survey Museum at Marshall University, Huntington, WV. ‘\*’ indicates a new county record.

<i>Graptemys ouachitensis</i>			<i>Apalone s. spinifera</i>		
Catalog #	Coordinates	County	Catalog #	Coordinates	County
WVBS 14902	N38.57277 W81.98867	Putnam*	WVBS 14930	N38.53128 W81.93716	Putnam
WVBS 14903	N38.56621 W81.97828	Putnam	WVBS 14931	N38.54915 W81.95891	Putnam
WVBS 14904	N38.53466 W81.94032	Putnam	WVBS 14932	N38.58862 W82.00375	Putnam
WVBS 14905	N38.53490 W81.94047	Putnam	WVBS 14922	N38.62608 W81.97797	Putnam
WVBS 14906	N38.56232 W81.97601	Putnam	WVBS 14933	N39.06789 W81.38890	Wirt
WVBS 14907	N38.62055 W81.98312	Putnam	WVBS 14934	N39.16029 W81.46376	Wood*
WVBS 14908	N38.63324 W81.97301	Putnam	WVBS 14935	N39.40030 W81.16493	Pleasants*
WVBS 14909	N38.53814 W81.94611	Putnam	WVBS 14936	N39.19351 W81.73373	Wood
WVBS 14910	N38.60351 W82.00227	Putnam	WVBS 14937	N39.26656 W81.69006	Wood
WVBS 14911	N39.21316 W81.51927	Wood*	<i>Chelydra serpentina</i>		
WVBS 14912	N39.21238 W81.51881	Wood	Catalog #	Coordinates	County
WVBS 14913	N39.21141 W81.51894	Wood	WVBS 14938	N39.19173 W81.48820	Wood
WVBS 14914	N39.15269 W81.45957	Wood	WVBS 14939	N39.19522 W81.48004	Wood
WVBS 14915	N38.59030 W82.27246	Cabell*	WVBS 14940	N38.92377 W81.78522	Jackson
WVBS 14916	N38.59237 W82.26979	Cabell	WVBS 14941	N38.94331 W81.82642	Jackson
<i>Graptemys geographica</i>			<i>Chrysemys picta marginata</i>		
Catalog #	Coordinates	County	Catalog #	Coordinates	County
WVBS 14917	N38.62609 W81.97785	Putnam	WVBS 14942	N39.23991 W81.51643	Wood
WVBS 14918	N38.53399 W81.93864	Putnam	<i>Sternotherus odoratus</i>		
WVBS 14919	N38.53448 W81.94000	Putnam	Catalog #	Coordinates	County
WVBS 14920	N38.60545 W82.00081	Putnam	WVBS 14943	N39.21451 W81.52122	Wood*
WVBS 14921	N38.53468 W81.94002	Putnam			
WVBS 14922	N38.62608 W81.97797	Putnam			
WVBS 14923	N39.06789 W81.38890	Wirt			
WVBS 14924	N39.20560 W81.50960	Wood			
WVBS 14925	N39.24982 W81.52502	Wood			
WVBS 14926	N38.88089 W81.86922	Jackson*			
WVBS 14927	N38.87208 W81.89856	Jackson			
WVBS 14928	N39.19786 W81.73187	Wood*			
WVBS 14929	N39.27642 W81.66994	Wood			

turtles basking on partially submerged logs. Map turtle populations on the Ohio River could also be reduced due to the detrimental effects of powerboat traffic (Bulté et al. 2010) and lower deadwood density (Lindeman 1999b). Only a single map turtle was observed basking on a rock; all other basking map turtles were observed using partially-submerged logs. Northern Map Turtles in an urban Indiana canal were found to use rock substrate for basking more frequently than deadwood (Peterman and Ryan 2009); however, Lindeman (1999b) concluded that deadwood is needed to support large populations of map turtles. The apparent unwillingness of Ouachita Map Turtles to use partially submerged logs which are attached to the bank above the surface could be a result of habitat partitioning or a strategy to avoid terrestrial predators. This behavior requires further investigation to determine if basking log position is important when managing habitat for Ouachita Map Turtles.

We suspect that the Muskrat digging activity in the softshell nesting areas was an attempt to locate turtle eggs. If so, this represents the first evidence for Muskrats as turtle nest predators, although Muskrat predation on juvenile softshell turtles was documented by Parmalee (1989). Muskrats are primarily vegetarians but also incorporate a wide variety of animal matter into their diets including mussels and clams (Kurta, 1995; Schwartz and Schwartz, 2001). It is not unreasonable that a mammal which digs up mussels would also opportunistically predate turtle nests.

Our results confirmed the presence of Ouachita Map Turtle populations on the lower Kanawha River and their continued presence on the lower Little Kanawha River. We also expanded the known range of Ouachita Map

Turtles (with new county records in Cabell, Putnam, and Wood counties) and Northern Map Turtles (with new county records in Jackson and Wood counties) in West Virginia. Additionally we recorded new county records for Eastern Spiny Softshells (Wood and Pleasants counties) and Eastern Musk Turtles (Wood County). The presence of Ouachita Map Turtles on the Ohio River leads us to speculate that the West Virginia population is connected to western populations on the Ohio River and not disjunct as originally thought (Ernst and Lovich 2009, Green and Pauley 1987, Wynn and Moody 2006). Smith (2008) provided genetic evidence that Ouachita Map Turtles dispersed to the Ohio-West Virginia portion of their range following Pleistocene glaciations and do not differ genetically from those in the main portion of their range. Additionally Smith noted a report of Ouachita Map Turtles along the Ohio River in Pittsburgh, PA and suggested that the species may have a continuous distribution along the Ohio River. We suggest future investigations to determine the extent of Ouachita Map Turtle range on the Ohio River and its tributaries and whether the Ohio-West Virginia populations are truly disjunct. Also, the size and viability of Ouachita Map Turtle populations in West Virginia are not known and should be studied to determine if conservation efforts are needed.

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### Literature Cited

- Bodie, J.R. 2001.** Stream and riparian management for freshwater turtles. *Journal of Environmental Management* 62: 443-455.
- Bulté, G., M.A. Carrière, and G. Blouin-Demers. 2010.** Impact of recreational power boating on two populations of northern map turtles (*Graptemys geographica*). *Aquatic Conservation: Marine and Freshwater Ecosystems* 20: 31-38.
- Carrière, M.A., N. Rollinson, A.N. Suley, and R.J. Brooks. 2008.** Thermoregulation when the growing season is short: sex-biased basking patterns in a northern population of Painted Turtles (*Chrysemys picta*). *Journal of Herpetology* 42: 206-209.
- Coleman, J.L. and R.L. Gutberlet. 2008.** Seasonal variation in basking in two syntopic species of map turtles (Emydidae: *Graptemys*). *Chelonian Conservation and Biology* 7: 276-281.
- Conant, R. 1938.** The reptiles of Ohio. *American Midland Naturalist* 20(1): 1-200.
- Conant, R. and J. T. Collins. 1998.** *A Field Guide to Reptiles and Amphibians: Eastern and Central North America*, 3<sup>rd</sup> ed., Expanded. Houghton Mifflin Company, New York, NY. 616 pp.
- Ernst, C.H. and J.E. Lovich. 2009.** *Turtles of the United States and Canada*, 2<sup>nd</sup> ed. John Hopkins University Press, Baltimore, MD. 827 pp.
- Fuseier, L. and D. Edds. 1994.** Habitat partitioning among three sympatric species of map turtles, genus *Graptemys*. *Journal of Herpetology* 28: 154-158.
- Green, N.B. and T.K. Pauley. 1987.** *Amphibians and reptiles in West Virginia*. University of Pittsburgh Press, Pittsburgh, PA. 241 pp.
- Kurta, A. 1995.** *Mammals of the Great Lakes Region*; re. ed. University of Michigan Press, Ann Arbor, MI. 376 pp.
- Lindeman, P.V. 1997.** A comparative spotting-scope study of the distribution and relative abundance of river cooters (*Pseudemys concinna*) in western Kentucky and southern Mississippi. *Chelonian Conservation and Biology* 2: 378-383.
- Lindeman, P.V. 1998.** Of deadwood and map turtles (*Graptemys*): An analysis of species status for five species in three river drainages using replicated spotting-scope counts of basking turtles. *Chelonian Conservation and Biology* 3: 137-141.
- Lindeman, P.V. 1999a.** Aggressive interactions during basking among four species of emydid turtles. *Journal of Herpetology* 33: 214-219.
- Lindeman, P.V. 1999b.** Surveys of basking map turtles *Graptemys* spp. in three river drainages and the importance of deadwood abundance. *Biological Conservation* 88: 33-42.

- Moll, D. and E.O. Moll.** 2004. The ecology, exploitation, and conservation of river turtles. Oxford University Press, New York. 393 pp.
- Peterman, W.E. and T.J. Ryan.** 2009. Basking behavior of Emydid turtles (*Chysemys* [sic] *picta*, *Graptemys geographica*, and *Trachemys scripta*) in an Urban Landscape. *Northeastern Naturalist* 16(4): 629-636.
- Phu, L.D.** 2010. The natural history & distribution of riverine turtles in West Virginia. M.S. thesis, Marshall University.
- Richmond, N.D.** 1953. The false map turtle, a new addition to the fauna of West Virginia. *Proceedings of the West Virginia Academy of Science* 25: 35.
- Schwartz, C.W. and E.R. Schwartz.** 2001. *The Wild Mammals of Missouri*; 2<sup>nd</sup> re. ed. University of Missouri Press, Columbia, MO. 368 pp.
- Smith, A.D.** 2008. Intraspecific phylogeography of *Graptemys ouachitensis*. M.S. thesis, Ohio University. 31pp.
- Temple-Miller, K.G.** 2008. Use of radiotelemetry and GIS to distinguish habitat use between *Graptemys ouachitensis* and *G. geographica* in the Scioto River. M.S. thesis, Ohio University, Athens, OH. 56pp.
- Vandewalle, T.J. and J.L. Christiansen.** 1996. A relationship between river modification and species richness of freshwater turtles in Iowa. *Journal of the Iowa Academy of Science* 103: 1-8.
- Vogt, R.C.** 1981. Food partitioning in three sympatric species of map turtle, genus *Graptemys* (Testudinata, Emydidae). *American Midland Naturalist* 105: 102-111.
- Watson, M.B. and T.K. Pauley.** 2006. Spatial distribution of turtles along the Great Kanawha River, West Virginia. *Proceedings of the West Virginia Academy of Science* 78: 14-25.
- Wynn, D.E. and S.M. Moody.** 2006. Ohio turtle, lizard, and snake atlas. Ohio Biological Survey Miscellaneous Contributions Number 10. 81 pp.