4. Distribution

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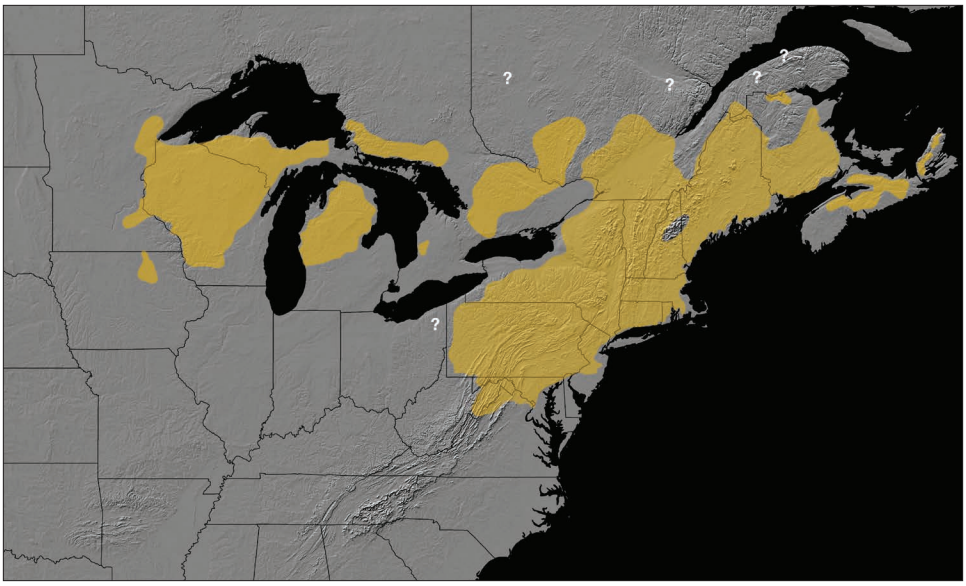
With the exception of the Snapping Turtle, Wood Turtles range north of the 45th parallel more extensively than other freshwater turtle species in eastern North America. In some areas of Maine and eastern Canada, Wood Turtles may be the only freshwater turtle species in fluvial habitats. American Turtle Observatory

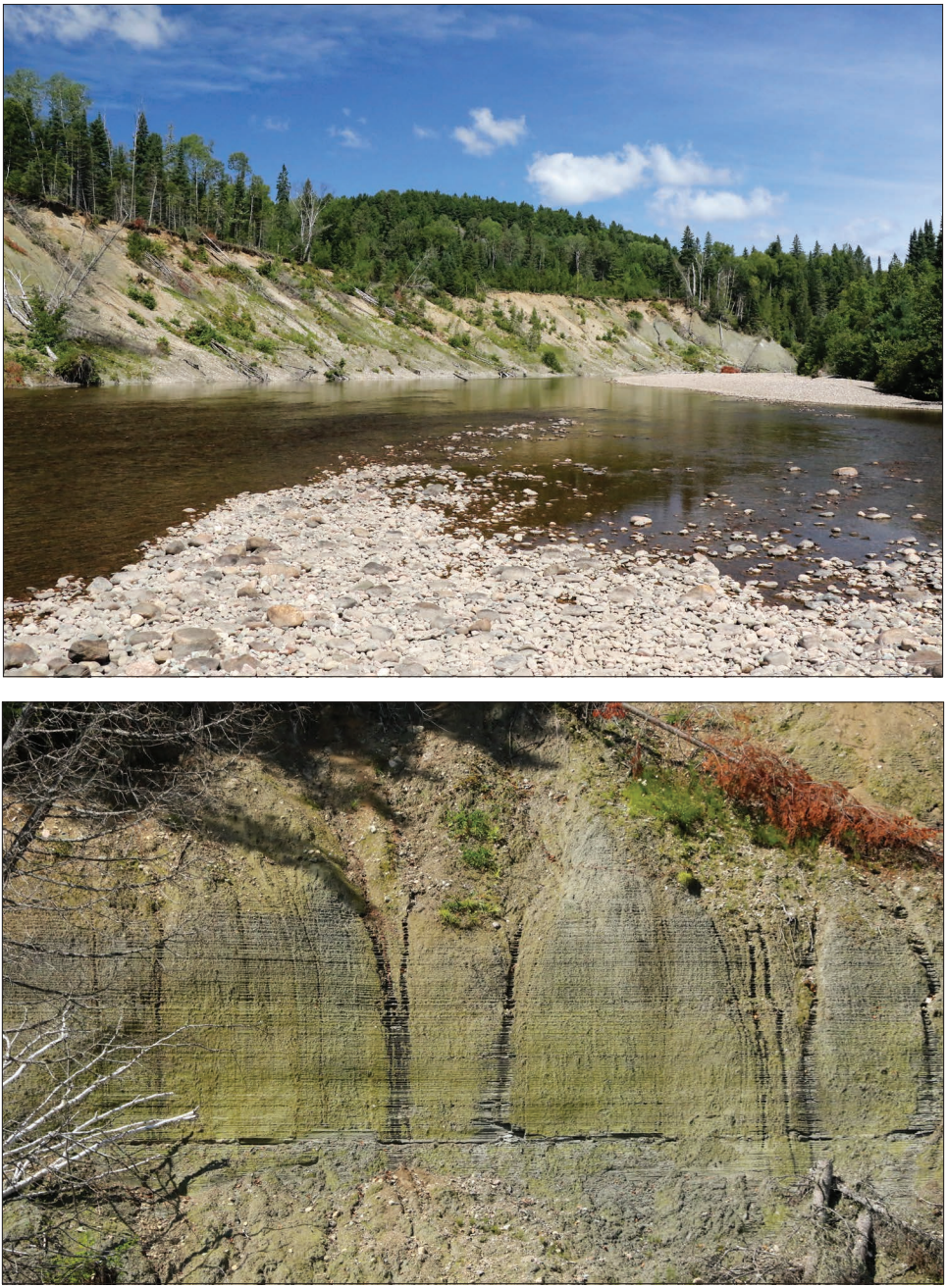


4.1—Recent distribution of the Wood Turtle. Base DEM created by Emmy Whistler / Antioch University New England.

Introduction

Wood Turtles' extent of occurrence spans nearly 9° of latitude from the southernmost populations in Virginia and West Virginia (38.6°N) to the northernmost confirmed populations in Québec and New Brunswick (47.5°N). The configuration of the Wood Turtle's large distribution provides a unique lens through which to interpret the ecology and biogeography of eastern North America (4.1). For example, the Wood Turtle's current range occurs mostly within the area that was glaciated by the southernmost lobes of the Laurentide Ice Sheet during the final (or Wisconsinan) phase of the Pleistocene glaciation,[1] which ended roughly 18,000 years before the present (ybp) and affected most of the continental regions from Nova Scotia to Iowa. In fact, only about 18% of the Wood Turtle's current range remained unglaciated during the Wisconsinan, and an even smaller fraction was never glaciated during any of the Pleistocene glacial advances. As a result, in most areas, the local distribution of Wood Turtles is strongly influenced by the landforms, alluvium, till, and debris of the post-glacial landscape (4.2). Here we examine the Wood Turtle's distribution across the various ecological gradients and political boundaries of the eastern North American landscape, and consider the commonalities and differences across each of these areas, illuminating the biogeography of the North American continent.

1 The Pleistocene epoch is a geological time period that spanned from about 2.5 million years ago until 11,700 years ago, during which time eastern North America was heavily glaciated by the Laurentide Ice Sheet. The Laurentide ice expanded and contracted from a center of mass in eastern Canada, presumably displacing Wood Turtles to southern refugia (see Chapter 2, Evolution). Laurentide ice eroded mountains, left diverse debris fields of till (unsorted glacial rock, silt, and sand) and outwash (sorted meltwater soils). The glacial retreat rearranged watersheds and streamcourses, providing a footprint for recolonization by the Wood Turtle.



4.2—Less than 20% of the Wood Turtle's current range remained unglaciated during the Late Pleistocene. In most areas, the local distribution of Wood Turtles is strongly influenced by the landforms and debris of the post-glacial landscape. *Top:* A Wood Turtle stream exposes an extensive alluvial deposit from a proglacial lake in Ontario. *Bottom:* Varved sediments along this river in Ontario indicate the former presence of a proglacial lake. Mike Jones

4.3—Wood Turtles occur primarily within two major geological or physiographic provinces, the Canadian Shield and the various ranges of the Appalachian Mountains. *Top:* Wood Turtle habitat in the Adirondacks of New York, a southerly exposure of the Greenville Province of the Canadian Shield. *Bottom:* Wood Turtle habitat in a subsidiary range of the Appalachian Mountains in New England. Mike Jones

4.4—Most extant Wood Turtle populations lie within forested ecoregions of eastern North America. Only the small, isolated Wood Turtle populations in southeastern Minnesota and Iowa lie completely within the Great Plains Ecoregion. Mike Jones

Physiography

Today, Wood Turtles occur primarily within two major geological or physiographic provinces: (1) the Laurentian and Superior Uplands of the Canadian Shield, and (2) various ranges of the Appalachian Highlands (Fenneman and Johnson 1946) (4.3). Wood Turtles occur to a lesser extent on the interior plains, and tend to be quite rare upon, or absent from, the Coastal Plain portions of many eastern states.

Ecography

At a continental scale, Wood Turtle populations are strongly associated with the forested ecoregions of eastern North America. They are widely distributed within the southern tier of the Northern Forest and the northern reaches of the Eastern Temperate Forest (Omernik 1987; CEC 1997). Only the small, isolated Wood Turtle populations in Iowa and southeastern Minnesota are considered to lie completely within the Great Plains ecoregions (4.4). At a finer scale (i.e., USEPA Level II Ecoregions), Wood Turtles are mostly associated with the Atlantic Highlands, Mixed Wood Plains, Mixed Wood Shield, and Appalachian Forests ecoregions, with limited, and likely impaired, populations in the Southeastern Plains ecoregion of Pennsylvania, Maryland, and Virginia. As noted, the populations in Iowa and southeastern Minnesota are noteworthy as the only occurrences within the Temperate Prairies ecoregion.

Hydrography

Wood Turtles occur in streams and watersheds that flow to the Atlantic Ocean, the Gulf of St. Lawrence, and the Gulf of Mexico via the Mississippi River. On the Atlantic slope, Wood Turtles are widely distributed in every major watershed from the St. John River to the Potomac River. In

the Great Lakes (St. Lawrence) watershed, extant Wood Turtle populations are associated with the watersheds of southern Lake Superior, northern Lake Michigan, Georgian Bay, portions of Lake Huron, and eastern Lake Ontario. Historically, the species was more widely distributed around Lake Huron, Lake Erie, and Lake Ontario. Streams draining to the Gulf of Mexico that are occupied by Wood Turtles fall into two broad classes: those of the Upper Mississippi River, which include the populations in western Wisconsin, southeastern Minnesota, and Iowa; and those of the Ohio Valley, which include the Allegheny and (to a limited extent) Monongahela watersheds of Pennsylvania and West Virginia (Jones et al. 2015).

Our modern understanding of the Wood Turtle's native range was not firmly in place until the mid-20th century. The only significant, recent range extension—to Cape Breton Island, Nova Scotia—was published in 1973 (Gilhen and Grantmire 1973). Still, a few important biogeographical questions remain unresolved. For example, the current population status of Wood Turtles in Delaware and Ohio is unclear. Wood Turtles are likely native to, but functionally extirpated from, both states. And in Iowa, researchers are continuing to document the full distribution of the species (Tamplin 2019). The Wood Turtle's range has substantially contracted in recent decades (Willey et al. 2022). We know of no watersheds outside of the native range in which Wood Turtles have become established.[2]

Distribution in the United States and Canada

Connecticut

Wood Turtles have been reported from every county in Connecticut (Klemens 1993). Early distributional data were provided by Babcock (1919) and Finneran (1948). Populations seem to be rare in the coastal zone as well as parts of Windham and New London counties, but are more widely distributed in the hills of eastern Connecticut, between the Connecticut River Valley and the Quinebaug River Valley (Klemens 1993).

Delaware

The historical status of Wood Turtles in Delaware is unclear (White and White 2002). Early summaries of reptiles and amphibians from Delaware did not report any specimens of Wood Turtle (Stone 1906, Fowler 1925, Conant 1945). Biologists have surveyed northern Delaware for other turtle species, including Bog Turtles (*Glyptemys muhlenbergii*; Arndt 1977) and Eastern Box Turtles (*Terrapene carolina*; Kipp 2003; Nazdrowicz et al. 2010), but none reported occurrences of Wood Turtles. Wood Turtles very likely occurred naturally within the past few hundred years in New Castle County, which borders Pennsylvania and Maryland, where Wood Turtle records have been reported from neighboring Cecil County, Maryland (Harris 1975), and Chester County, Pennsylvania (Hulse et al. 2001; PARS 2020). Jim White (2002) reported two individuals from New Castle County, but follow-up surveys failed to detect Wood Turtles. A single female turtle captured in New Castle County was radio-tracked for several years by Delaware Division of Fish and Wildlife, but no other Wood Turtles were found (Delaware DFW, unpubl. data). Suitable habitat— albeit fragmented—remains in northern Delaware (Willey et al. 2021), but it appears clear that the Wood Turtle is functionally extirpated from the state (4.5). A noteworthy archeological occurrence of Wood Turtle was reported by the Delaware Department

2 Note, however, that Witmer and Fuller (2011) include the Wood Turtle in an appendix of vertebrates that have been introduced to novel sites within the United States.

4.5—Although some suitable habitat persists in New Castle County, Wood Turtles appear to be functionally extirpated from Delaware. Mike Jones

of Transportation during excavations near Dover, Kent County: faunal remains recovered from the Tomas Dawson farm at Coopers Corners, Kent County, Delaware, reportedly included one fragment of Wood Turtle. The assemblage was dated to 1740–1780 (Bedell 2002).

Illinois

Wood Turtles are clearly not native to Illinois, but there are several enigmatic records from the state. One series of two specimens from Evanston, Cook County, were shipped to the Museum of Comparative Zoology between 1864 and 1872 (MCZ 4056), but it seems plausible that these turtles were erroneously labeled, given that Evanston is the home of Northwestern University. Another specimen was observed in the Des Plaines River Canal, Cook County (Miller 1993, in Iverson 1992), which is clearly atypical habitat as well as a highly disjunct observation, and does not appear to represent a local population. Cahn (1937) describes a Wood Turtle specimen from the Rock River south of Janesville, Wisconsin, "11 miles" north of the Illinois border, but dismisses it as a likely "transport"; nevertheless, he provides full treatment to the species in his *The Turtles of Illinois.*

Iowa

The Wood Turtle is narrowly restricted to the tributaries of the Upper Cedar River drainage of northeastern Iowa. The Iowa population likely extends across the Minnesota state border into the headwaters of the Upper Cedar River in Dodge, Freeborn, and Mower counties. The first (erroneous) report of Wood Turtles in the state was made by Palmer (1924), who reported a juvenile Wood Turtle from Ames, Story County, which extended the range south and west from recently discovered sites on the Wisconsin-Minnesota border (e.g., Wagner 1922). The location was highly unusual; not only did it constitute a new state record, but it was also near the geographic center of the state, and well within the Temperate Prairies ecoregion. Palmer's record was subsequently incorporated into large-scale compendia, such as Clifford Pope's *Turtles of the United States and Canada* (Pope 1939). Bailey (1941) discredited the observation as a misidentified juvenile Blanding's Turtle (*Emydoidea blandingii*). However, by the mid-1940s, Wood Turtles were well known to occur in the Cedar watershed of northeastern Iowa, and today the species is known to occur in Black Hawk, Bremer, Butler, Cerro Gordo, Floyd, Franklin, and Mitchell counties (Otten 2017). Isolated Natural Area Inventory records in Benton, Delaware, Iowa, and Washington counties from 1989 are likely misidentifications; no other specimens have been reported from these locations and there are no lotic water sources at the indicated

localities (Otten 2017). Recent reports of Wood Turtles in the Wapsipinicon River have not been substantiated, but the Wapsipinicon is an adjacent watershed to the Upper Cedar River and small tributaries of these two rivers lie in close proximity in Bremer, Chickasaw, and Mitchell counties (Tamplin, unpubl. data). Populations in Black Hawk and Butler counties are the subject of long-term research by biologists at the University of Northern Iowa (Tamplin et al. 2006a; 2006b; Tamplin et al. 2009; Spradling et al. 2010; Williams 2013; Berg 2014; Otten 2017; and Lapin et al. 2019).

Maine

Wood Turtles occur nearly statewide in Maine with the exception of outlying islands, and have been reported from all but Sagadahoc County (Hunter et al. 1999; Maine Department of Inland Fisheries and Wildlife, unpubl. data). Early accounts of Wood Turtles in Maine include Say (1825), and perhaps Williamson's (1832) account of a "speckled land turtle." Other early reports include those of Agassiz (1857), who reported a northern specimen from Aroostook County, and Fogg (1862). Verrill (1863) noted that Wood Turtles were "common" in the vicinity of Norway, Oxford County, but that the species was apparently uncommon east of the Penobscot River. Boardman (1903) reported Wood Turtles from the vicinity of Calais. The Wood Turtle is not native to any of the many islands of the Maine coast: records from Isle au Haut (Knox County) in 1999 and Mount Desert Island (Hancock County) in 1958 and 1989 (Brotherton et al. 2004; Maine Department of Inland Fisheries and Wildlife, unpubl. data) must represent released or escaped animals. Historical accounts of Wood Turtles (and other turtles) in Maine are summarized by McCollough (1997), who also noted that Wood Turtles are less abundant near the coast.

Maryland

In Maryland, Wood Turtles occur in the Central Appalachians, Ridge and Valley, Blue Ridge, and Northern Piedmont Ecoregions (Conant 1958; Harris 1975; Miller 1993) and in all of Maryland's western counties, with limited evidence of populations near the Coastal Plain. It

4.6—Wood Turtles were reported in the vicinity of the Conowingo Dam in the 1940s, providing additional support for native occurrences of Wood Turtles near the Coastal Plain in Maryland. Mike Jones

4.7—Historically, Wood Turtles were reported from Cecil County, Maryland. These outlying populations on Maryland's Coastal Plain is likely extirpated. Mike Jones

now seems clear that Wood Turtles occurred naturally in the lower Susquehanna and the lower Potomac Rivers very near the Coastal Plain, as well as several creeks in the vicinity of Washington, D.C., and Arlington, Virginia (Akre and Ernst 2006), though this has been a contentious subject. Norden and Zyla (1989) presented a series of 12 records from Coastal Plain counties (including the first for Anne Arundel County) and voiced support for a native population of Wood Turtles on the Coastal Plain. Miller (1993) questioned their conclusions, citing a lack of historical data and museum specimens. Wood Turtles collected near Havre de Grace, Cecil County (e.g., McCauley 1945) were presumed by Reed (1956) to be waifs displaced well into Pennsylvania from upstream in the Susquehanna. However, Wood Turtles were reported in the immediate vicinity of the Conowingo Dam by Cooper (1949), supporting the native occurrence of Wood Turtles in the lower Susquehanna (4.6). There was historically a population reported from Elk Neck, Cecil County (White and White 2002), which is apparently extirpated (4.7). A single record near Easton, Talbot County, Maryland (Reed 1956) is the only record from Maryland's eastern shore. This record was dismissed by McCauley (1945, in Reed 1956) and Conant (1958).

Massachusetts

Wood Turtles occur throughout much of Massachusetts below 610 m in elevation (Jones, unpubl. data) with the exception of the Coastal Plain, outlying islands, and the most urbanized areas (Lazell 1976; MassWildlife NHESP, unpubl. data). Wood Turtles had been well documented in eastern Massachusetts by the 1850s, and were included among the native turtles on the Commonwealth's first reptile list prepared by Smith (1833). Subsequently, Wood Turtles were reported by Storer (1840), Thoreau (many journal reports from 1854–1860), and Agassiz (1857).[3] Allen (1868) reported Wood Turtles to be "common" in the vicinity of Springfield, Hampden County, but Babcock (1919) reported Wood Turtles were not common around Dedham, Norfolk County.

3 A full account of the observations made by Thoreau and Agassiz are provided in Chapter 3.

4.8—Wood Turtles are mostly extirpated from the vicinity of Boston, although a few small populations remain within I-495. One such site in Middlesex County is pictured here. Mike Jones

Today, Wood Turtles occur throughout all mainland counties of Massachusetts (MassWildlife NHESP, unpubl. data) except Suffolk and Barnstable counties (Lazell 1976; Klemens 1993). Lazell (1976) discredited the single record from Mashpee, Barnstable County, on Cape Cod. Wood Turtles have been entirely extirpated from the greater Boston area within the inner beltway of Interstate 95, and they appear to be functionally extinct in many areas within Interstate 495, which encircles the greater Boston area (MassWildlife NHESP, unpubl. data) (4.8).

Michigan

Wood Turtles occur widely throughout the northern half of lower Michigan and much of the Upper Peninsula (Harding and Holman 1990; Harding 1997). The presence of Wood Turtles in Michigan has been known since Ruthven and Thompson (1915) reported the species in Schoolcraft County in the Upper Peninsula and Manistee and Missaukee counties in the Lower Peninsula. The Upper Peninsula of Michigan is ecologically and geologically an extension of the conditions found in northern Wisconsin; with the exception of the Keweenaw Peninsula, Wood Turtles occur continuously throughout the Upper Peninsula from the border of Wisconsin, in Gogebic County, to Schoolcraft County. On the Lower Peninsula, Wood Turtles occur from the northernmost counties (Cheboygan and Presque Isle) as far south as Muskegon, Montcalm, and Saginaw counties (Vogt 1981; Lee 1999). Isolated records from Allegan and Ingham counties in southern Michigan were discredited by Vogt (1981) and Lee (1999).

Minnesota

Wood Turtles are known primarily from three distinct regions in Minnesota: (1) watersheds draining into Lake Superior in St. Louis, Lake, Pine, and Chisago counties in the northeastern part of the state; (2) watersheds associated with tributaries to the Mississippi River in Rice, Goodhue, Steele, Dodge, Olmsted, and Mower counties in the southeastern part of the state;

4.9—Wood Turtles reach their westernmost extent of occurrence in the Mississippi drainage of south-central Minnesota. Mike Jones

(3) tributaries to the Upper Cedar River in Mower County on the Iowa border (Ernst 1973). Wood Turtles reach their westernmost range-wide extent of occurrence in south-central and southeastern Minnesota (Breckenridge 1958; Ernst 1973; Iverson 1992; Ernst and Lovich 2009) (4.9).

New Brunswick

Across the entire range of the species, the Wood Turtle's northernmost confirmed populations are in western New Brunswick. Wood Turtles are distributed patchily through New Brunswick with the exception of low-lying coastal areas in the southern part of the province and the central part of the highland plateau of northern New Brunswick (Bleakney 1958b; McAlpine and Gerrietts 1999). Wood Turtles occur around the periphery of the highland plateau, but populations in this region have not been intensively studied (Heward and McAlpine 1994; McAlpine and Gerriets 1999). Wood Turtles have been documented at low elevations in a very few watersheds in northern New Brunswick.

New Hampshire

Wood Turtles are known to occur naturally in every county in New Hampshire (Taylor 1993; Taylor 1997). Huse (1901) reported Wood Turtles as common in New Hampshire. Oliver and Bailey (1939) provided records from eight of New Hampshire's 10 counties (except Strafford and Carroll counties). Wood Turtles are mostly absent from the White Mountain National Forest, probably due to a combination of climatic exclusion and scarcity of low-gradient stream habitats that are not subject to severe flooding related to steep upstream basins (Bowen and Gillingham 2004; Jones and Sievert 2009a).

New Jersey

The Wood Turtle's historical range included 17 of New Jersey's 21 counties (NatureServe 2021), with a noticeable gap in documentation in Camden County. It is likely that Wood Turtles were historically native to Camden County based upon records to the south in Gloucester (Stone 1906) and along a waterway in Burlington that serves as the county divide with Camden. Absent are any records from Salem, Cumberland, or Cape May Counties, and it's likely the species did not occur there, as with other Coastal Plain counties throughout the species range. Agassiz (1857) erroneously reported that New Jersey encompassed the southernmost range margin of the Wood Turtle. A record from Gloucester County in 1906, and two records from Atlantic and southern Burlington counties in 1945 and 1978, cannot be replicated today (Zarate, unpubl. data). Stone (1906) commented that he knew of no specimens from the Pine Barrens, and this has borne out over time. Today, the Wood Turtle's current distribution is constrained to 13 counties north of the central portions of Burlington and Ocean counties.[4] Wood Turtles are absent from heavily developed Hudson County (NatureServe 2021).

New York

Wood Turtles historically ranged throughout mainland New York from the Hudson and Mohawk Valleys to Lake Erie and eastern Lake Ontario. The original specimens that formed the basis of Le Conte's (1830) description were likely obtained from New York (Schmidt 1953). Early records from the Adirondack region were provided by De Kay (1842), who reported observations from tributaries of the St. Lawrence River, Lake Champlain, and the Hudson River. Wood Turtles were described as "common" in the Hudson Highlands of southeastern New York by Mearns (1898). Ditmars (1907) vaguely reported Wood Turtles from the vicinity of New York City but did not provide specific locality data. Wright (1918) described Wood Turtles as relatively common in the vicinity of Ithaca, Tompkins County, at the southern end of Cayuga Lake. Clausen (1943) reported three specimens from Tioga County on the Pennsylvania border. Confirmed Wood Turtle populations are rare in some westernmost counties such as Chautauqua, Orleans, Gennessee, Monroe, Livingston, Yates, and Seneca, and the lake plain south of Lake Ontario (Jones et al. 2015). Wood Turtles appear to be rare on the southern lake plain of Lake Ontario, but they evidently occur in many of the suitable drainages of Lake Champlain and the Hudson Valley. Although many distribution maps (e.g., Ernst and Lovich 2009) indicate that Wood Turtles are absent from a large portion of the Adirondacks, especially central Essex County, scattered populations have been confirmed throughout the Adirondack massif (Breisch, unpubl. data). Wood Turtles were described as "fairly common" in Essex County—in the Adirondacks—in the 1920s (Weber 1928). Wood Turtles have been reported from Long Island on multiple occasions, but none of these reports are sufficient to demonstrate that a population occurred there (Murphy 1916). Five Wood Turtles found washed ashore at Orient, Mattituck, Riverhead, and East Marion, eastern Long Island, between 1919–1926 may have been displaced during floods from the Connecticut River watershed in Connecticut (Latham 1971), and an individual found northwest of Islip, Suffolk County, in the 1980s, may have been a released captive.

4 A recent (2018) outlier observation of a Wood Turtle from central Ocean County—a coastal location—was genetically assigned to a Midwestern population and is not considered a valid state record (Zarate, unpubl. data).

4.10—Wood Turtles reach their extreme easternmost distribution in Nova Scotia. Mike Jones

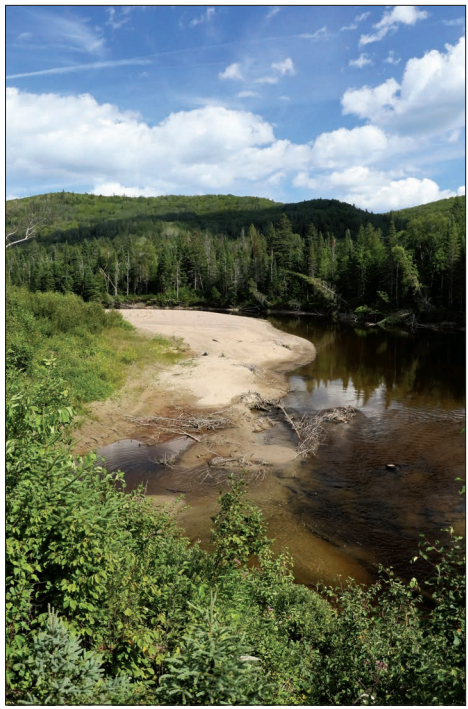
Nova Scotia

On the peninsula of mainland Nova Scotia, Canada's easternmost mainland province, Wood Turtles occur throughout the northern half of the mainland including Cumberland, Halifax, Hants, and Kings counties (Bleakney 1952; Bleakney 1958b; Bleakney 1963) and Guysborough County (Bleakney 1958b; Pulsifer et al. 2006; White et al. 2010). Wood Turtles reach their extreme easternmost distribution on Cape Breton Island, where they were not documented until the 1970s (Gilhen and Grantmire 1973; Gräf et al. 2003) (4.10).

Ohio

The natural history, distribution, and native status of Wood Turtles in Ohio is poorly understood, and supported by very few observations. The species was attributed to Ohio by Smith (1899) and repeated by Ditmars (1907) and Surface (1908). Conant (1938) considered the native status of Wood Turtles in Ohio to be "doubtful," although 13 years later, Conant (1951) stated of northeast Ohio that "probably *Clemmys* [=*Glyptemys*] *insculpta* and *Clemmys* [=*Glyptemys*] *muhlenbergii* occur in this region; they have been found in the adjacent part of Pennsylvania but repeated search for them in Lake, Geauga, and Ashtabula counties has resulted in failure." Ernst (1972) includes northeastern Ohio in his range description for *G. insculpta*. There have been at least two, and possibly three individuals observed in the Rocky River watershed near Cleveland in Cuyahoga County (Thompson 1953; Rice, pers. comm. to J. Iverson, in Iverson 1992). Rocky River is a large stream that enters Lake Erie about 150 km (90 mi) west of the nearest corroborated occurrences in Pennsylvania, and is otherwise isolated from the continuous main range in Ontario. Anecdotal accounts of Wood Turtles from Greene and Suit counties are unconfirmed (Salzberg, in Iverson 1992). A record in Stark County, Ohio in Iverson (1992) is a mislabeled record from Butler County, Pennsylvania (CM 31215). Conant (1951) searched for Wood Turtles unsuccessfully in the northeast corner of Ohio, but determined that Wood Turtles likely occurred naturally in that part of the state. As noted above, a specimen from Linesville, Crawford County, Pennsylvania, provides limited evidence of a historical population in the Linesville Creek–Shenango River

watershed (since 1934, flooded by the Pymatuning Dam), which straddles the Pennsylvania–Ohio border. Conant's (1951) repeated searches in the northeasternmost counties, and Thompson's (1953) report of two Wood Turtles in Rocky River, Cuyahoga County, may indicate the recent persistence of an isolated relict population not contiguous with populations in Pennsylvania. Recent sightings in Beaver, Mercer, Crawford, and Erie Counties, Pennsylvania (PARS 2019) bear relevance to determining the native status of Wood Turtles in Ohio. At present, it appears likely that Wood Turtles occurred naturally in eastern Ohio within the past few hundred years, but the species is functionally extinct.



4.11—Wood Turtles are distributed in isolated watersheds along the north shore of Lake Huron and Lake Superior in Ontario's Algoma and Sudbury Districts. Mike Jones

Ontario

In central Ontario, Wood Turtles are distributed in isolated watersheds along the north shore of Lake Huron in southern Algoma and Sudbury Districts (as far west as watersheds draining into Lake Superior near Sault Ste. Marie) (4.11), as well as several watersheds in the eastern portions of Algonquin Provincial Park and adjacent areas (Nipissing District and Renfrew County; COSEWIC 2018). In southern Ontario, Wood Turtles formerly occurred along the north shore of Lake Erie (e.g., near Wheatley, Hamilton, Burlington, Mississauga, Toronto, and Oshawa; Logier and Toner 1961), but these populations have been extirpated (COSEWIC 2007). Historical occurrences near Ottawa, Midland, Brechin, and Georgina have also been extirpated (COSEWIC 2007). The only remaining population in southern Ontario occurs in Huron County near the southeastern shore of Lake Huron (Logier 1939; Oldham and Weller 1989), but the long-term viability of this population is currently dependent on extensive and ongoing management efforts (i.e., headstarting, predator control, habitat creation/restoration; Mullin 2019). Ontario's Wood Turtle populations are isolated from those south of the Great Lakes in New York and Pennsylvania due to extensive habitat loss and fragmentation throughout southern Ontario, but there is potential for connectivity between eastern Ontario populations and those in Québec along the Ottawa River. The species has been extensively studied throughout most of its Ontario range, including populations in Algonquin Provincial Park and the surrounding area (Quinn and Tate 1991; Brooks and Brown 1992 *in* Foscarini and Brooks 1997; Brooks et al. 1992; COSEWIC 2018), Algoma District (Wesley 2006; Thompson et al. 2018), Sudbury District (Greaves and Litzgus 2007; 2008; 2009; Hughes et al. 2016), and Huron County (White and Mullen 2017; COSEWIC 2018; Mullin 2019).

4.12—Isolated Wood Turtle records from the northern coast of Québec's Gaspé Peninsula probably do not represent natural occurrences. Mike Jones

Pennsylvania

The Wood Turtle has been recorded statewide in Pennsylvania with the notable exception of the four westernmost counties (McCoy 1982; PARS 2020). Surface (1908) provided records from 22 counties ranging as far west as Venango County. Typical range depictions and descriptions (e.g., Surface 1908; McCoy 1982; Ernst and Lovich 2009) indicate that the Wood Turtle ranges west nearly to the Ohio border. In fact, there are historical records from Erie Harbor and the Presque Isle peninsula at Erie (Carnegie Museum of Natural History CM6880; McKinstry et al. 1987; 1991). However, from the information associated with these records, it is not possible to confidently assign the Erie County records to typical stream habitats. Historical records in the region may reflect populations formerly present along the Erie shore in an area that has been dramatically converted to urban and agricultural development. Interestingly, there is also a record in the Royal Ontario Museum from Long Point, Norfolk County, Ontario, 40 km due north across Lake Erie and encompassing a similar dune ridge island environment (Logier and Toner 1961), although this specimen is believed to represent a released captive animal (Saumure, unpubl. data). The nearest record to Erie, and one of the westernmost specimens from south of the Great Lakes, was collected at Linesville, Crawford County. Daniel A. Atkinson discovered this specimen on June 9, 1906 (CM2985), and he collected Wood Turtles across Pennsylvania throughout the spring of 1906. The Shenango River, which flows along the Pennsylvania-Ohio border, was dammed in the 1930s to create the Pymatuning Reservoir (McCoy 1982). It may have supported one of the westernmost populations of Wood Turtles south of Lake Erie. Other early reports of the Wood Turtle from Pennsylvania include Stone (1906), who reported specimens from Chester and Fulton Counties, Bristol, Bucks County, and Round Island, Clinton County; Dunn (1915), who reported two individuals from Delaware County; and Evermann (1918), who reported three individuals from Pike County. Conant (1942) reported anecdotal sightings from Dutch Mountain, Sullivan County. A series of excellent behavioral studies by John Kaufmann

(1986; 1992a; 1992b; 1995) were conducted in Centre County; and important studies by Carl Ernst (1986; 2001b) were conducted in Lancaster County. Strang (1983) studied Wood Turtles in Cumberland County.

Québec

Wood Turtles occur widely throughout Québec south of about 47.5°N (Ministère des Forêts, de la Faune et des Parcs, unpubl. occurrence data; Giguère et al. 2011), on both sides of the St. Lawrence River (Tessier et al. 2005). Québec Wood Turtle populations are primarily constrained to the watersheds of the Ottawa River, the lower St. Lawrence River (including the Lake Champlain basin of Vermont), and Atlantic-draining watersheds shared with Maine and New Brunswick. Two early records from the vicinity of Mont-Tremblant were provided by D'Urban and Bell (1860). Bleakney (1958b) reported that Wood Turtles reach their northernmost range limit in the St. Maurice Valley, but isolated northern occurrences have been reported as far north as La Tuque. Extreme northerly records (near or north of 48°N) have been reported from the vicinity of Val-d'Or, Saguenay, and Cap-Chat (on the north coast of the Gaspé Peninsula). Of these, only the reports from Saguenay seem to be climatically appropriate for Wood Turtles (Giguère et al. 2011), but these are isolated by more than 150 km from La Tuque. The northern Gaspésie records are highly questionable because the climate is not conducive to Wood Turtles, and there are no confirmed occurrences within 100 km (4.12).

Rhode Island

The Wood Turtle has been consistently reported as rare in Rhode Island (e.g., Drowne 1905; Klemens 1993), where it is known to occur in Providence, Kent, and Washington counties. Yorks (unpubl. data) found a dead Wood Turtle on a beach near the saltwater Sakonnet River in Newport County in 1992. Consistent with regional trends, there are no records of Wood Turtles from any of the islands of Narragansett Bay.

Vermont

Wood Turtles are reported from all of Vermont's 14 counties, in both the Champlain Valley (St. Lawrence watershed) and the Connecticut watershed, and along both the west and east slopes of the Green Mountains (DesMeules 1997; Vermont Reptile and Amphibian Atlas 2020). Wood Turtles in Vermont were reported by Thompson (1853), together with Painted (*Chrysemys picta*) and Snapping Turtles (*Chelydra serpentina*). The earliest documented specimen from Vermont may be an animal collected at Sharon in Windsor County in 1900 by M. Parker (CAS 54480). A single specimen collected in South Hero, Grand Isle County in 1934 by L.H. Babbitt (BMNH 51-8451) is the only record from the Hero Islands (Grand Isle County) and one of relatively few from an island anywhere in the range.

Virginia

Wood Turtles occurred historically throughout much of the Potomac and Shenandoah River drainages in Virginia's northernmost counties, including Fairfax, Loudoun, Clarke, Frederick, Warren, Shenandoah, Page, and Rockingham (Akre 2002; Akre and Ernst 2006). The earliest published record of the Wood Turtle in Virginia was an individual collected by E.A. Preble in 1918 from Little Pimmit Run, Fairfax County, Virginia (Dunn 1920). Though the Wood Turtle was not on an early list of reptiles from the District of Columbia (D.C.) and vicinity (Hay 1902), Henshaw (1907) extended the known range southward to the shore of the Potomac River, less

4.13—Wood Turtles reach their southernmost distribution in Rockingham County, Virginia. Mike Jones

than 1 km from Virginia. Clark (1930) then added several records from the D.C. area, including three from Fairfax County near the Potomac River. Few additional localities were added until the 1970s when records collected over the following two decades established their presence in Loudoun County and the northern Shenandoah Valley (Simpson and Simpson 1977; Tobey 1985; Mitchell 1994; Mitchell and Reay 1999). However, an Arlington record from the mouth of Four Mile Run near the Potomac River and US-1 in 1953 (USNM 136639) was substantiated by a relatively recent (1993) record in the database of the Virginia Department of Wildlife Resources from approximately 8 km upstream. Simpson and Simpson (1977) found the Wood Turtle to be reasonably common in Frederick and Shenandoah counties. Surveys in the 1980s and 1990s added several records from Fairfax, Loudoun, and Frederick Counties, and at the same time, U.S. Forest Service personnel reported Wood Turtle records from the southern part of Rockingham County (Buhlmann and Mitchell 1989). Rockingham County today represents the species' southernmost extent of occurrence (4.13). The majority of records and populations come from west of the Blue Ridge and the Shenandoah River (Akre and Ernst 2006). Historical records in the vicinity of Great Falls, Fairfax County, Virginia, apparently represent a natural historical population, and numerous small creeks on the Virginia side of the lower Potomac once provided suitable habitat for Wood Turtles (Akre and Ernst 2006). The Potomac River has many sidearms and sidestreams that reduce the average flow volume and may have provided better habitat than the main channel. Available evidence suggests there was once a network of populations living in sidestreams on both sides of the Potomac River, both up- and downstream of Great Falls.

Washington, D.C.

Wood Turtles probably occurred naturally in the area that is now Washington, D.C., as suggested by substantial evidence from adjoining Maryland and Virginia. A specimen from Washington, D.C. in the National Museum (USNM 62556) may have originated near Bennings in eastern Washington, D.C. (Shufeldt 1919; Miller 1993). Two sight records from

4.14—Wood Turtles persist in the Driftless Area of southwestern Wisconsin, which was left unglaciated by successive advances of the Laurentide Ice Sheet. Mike Jones

the Anacostia watershed along the eastern border district in Maryland (Norden and Zyla 1989) provide additional support for the natural historical occurrence of Wood Turtles in the Anacostia drainage, but these were questioned by Miller (1993). Wood Turtles are now considered "possibly extirpated" by the District Department of the Environment.

West Virginia

Wood Turtles occur in the panhandle of West Virginia including Jefferson, Berkeley, Morgan, Mineral, Hampshire, and Hardy counties, reaching the southernmost confirmed populations in Pendleton County (38.6°N). Outlying occurrences in Grant County (WV DNR, unpubl. data) are noteworthy. Bond (1931) reports Wood Turtles as "not uncommon" in Monongalia County, although this report was discounted by Breisch (2006). Recent sightings in Beaver County, Pennsylvania (PARS 2020), suggest that Wood Turtles may have occurred in neighboring Hancock County, West Virginia.

Wisconsin

Wood Turtles occur widely throughout northern, western, and south-central Wisconsin (WDNR 2015), and they are associated with forested regions adjacent to clear, moderate- to fast-moving streams and rivers (Vogt 1981), including the Driftless Area of southwestern Wisconsin (4.14).[5] Despite their widespread distribution, their full extent in Wisconsin has yet to be delineated, due in part to a lack of thorough statewide survey efforts (WDNR, unpubl. data). There is general agreement that the species is not present in the southeast and extreme southern portions of Wisconsin, due to the lack of data confirming existing wild populations. Wood Turtles

5 Wisconsin's Driftless Area remained unglaciated during all of the major glaciations of the Pleistoeene.

were first confirmed in 1917 in Wisconsin near St. Croix Falls in Polk County, the westernmost record at the time (Wagner 1922). Casper (1996) noted that the sporadic reports from urban areas in the southern Lake Michigan drainage counties were likely "released or escaped pets." A single record from the Rock River, south of Janesville in Rock County, has not been replicated and is an unusual outlier (Cahn 1937). Casper (1996) also questioned the legitimacy of the Dane and Rock County records, describing both as being possibly "displaced" individuals. Records from the Wisconsin Department of Natural Resources (unpubl. data) suggest northern Wood Turtle populations are more viable (e.g., more abundant, robust, and less fragmented); whereas populations in western (Driftless Area) and south-central Wisconsin (Lower Wisconsin River watershed) are more vulnerable to population decline, characterized by smaller populations, increasing isolation, and a general decline in suitable habitat. Two Wisconsin specimens collected in the "Fox River" (UA R107 and UA R108) in 1951 by W.A. Lemberger have been attributed to Kenosha County on the Illinois border, which would lend weight to Illinois and southern Lake Michigan specimens (see discussion of Illinois records, earlier), but these more likely originated in a different Fox River watershed, such as the one that flows through Outagamie and Brown counties to reach Lake Michigan at Green Bay. Additional locality data are provided by Casper (1996). Several distributional updates have been published in recent years for Dunn County (Schuler and Badje 2019), Clark County (Badje 2019), and Langlade County (Arrowwood et al. 2019). Johnson et al. (2015) provide a brief discussion of the documentation for Wood Turtle occurrence in Vernon County.

Summary

Wood Turtles occur broadly throughout the forested regions of eastern North America south of the 48th parallel, from southern Minnesota to Cape Breton, Nova Scotia and south to West Virginia and Virginia. The northernmost populations are in New Brunswick, although they have been questionable reports farther north in Québec. Ecologically, the Wood Turtle's current distribution is divided between the Canadian Shield, the Appalachian Mountains, and the interior basin areas. Ecologically, the species is found in coniferous, transition, and hardwood forests, with marginal populations extending into the Great Plains and prairie ecoregions. Finally, hydrologically the Wood Turtle is distributed between the watersheds of the Atlantic Coast, the Gulf of St. Lawrence, and the Mississippi River. Consequently, extant populations differ substantially in terms of ecological and geopolitical context.

BIOLOGY & CONSERVATION *of the* WOOD TURTLE

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Editors

Published by Northeast Association of Fish and Wildlife Agencies, Inc., 2021

Printed in USA on FSC certified paper

Designed and typeset by Matthew R. Burne

ISBN: 978-0-9883535-2-7 (Paperback)
ISBN: 978-0-9883535-3-4 (eBook)
Library of Congress Control Number: 2021904217

This publication was supported by State Wildlife Grants, including the Northeast Association of Fish and Wildlife Agencies, Inc. (NEAFWA) Regional Conservation Need (RCN) program and the Competitive State Wildlife Grant program. This project was also made possible by key contributions from American Turtle Observatory (www.americanturtles.org), the Wood Turtle Working Group (www.northeastturtles.org), and Northeast Partners for Amphibian and Reptile Conservation (www.northeastparc.org). Early drafts of portions of this book appeared in Part I of *Status and Conservation of Wood Turtle* (2015).

Publisher's Cataloging-in-Publication data

Names: Jones, Michael T., editor. | Willey, Lisabeth L., editor.

Title: Biology and Conservation of the Wood Turtle / Michael T. Jones ; Lisabeth L. Willey, editors.

Description: Includes bibliographical references. | Petersburgh, NY: Northeast Association of Fish & Wildlife Agencies, Inc., 2021.

Identifiers: LCCN: 2021904217 | ISBN: 978-0-9883535-2-7 (paperback) | 978-0-9883535-3-4 (ebook)

Subjects: LCSH Wood turtle. | Turtles--North America. | Forest animals. | Animals--Habits and behavior. | Reptiles--North America. | Natural history--North America. | Wildlife conservation--North America. | BISAC NATURE / Animals / Reptiles & Amphibians

Classification: LCC QL651 .B56 2021 | DDC 597.9/097--dc23

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