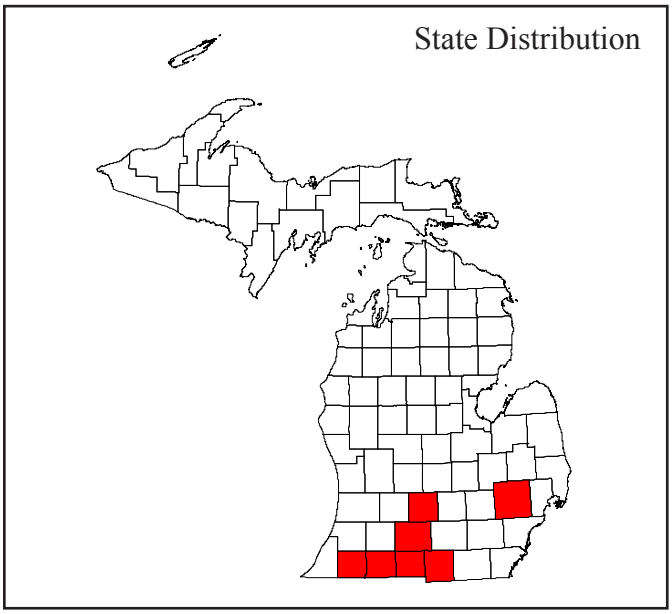
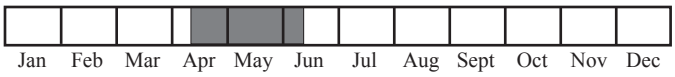
Nerodia erythrogaster neglecta Conant Copperbelly Water Snake

Photo by R. D. Bartlett



Best Survey Period



Status: Federally threatened (northern population segment only), state endangered

Global and state rank: G5T3/S1

Other common names: Copperbelly Watersnake, Copper-bellied Watersnake, Copper-bellied Water Snake

Family: Colubridae (typical snakes)

Taxonomy: The Copperbelly Water Snake is a subspecies of the Plainbelly or Plain-bellied Water Snake (*Nerodia erythrogaster*) (Conant 1949). Formerly, this species was classified in the genus *Natrix*.

Range: The Copperbelly Water Snake occurs in two distinct population segments. The southern population segment occurs primarily in the lower Ohio and Wabash River valleys in western Kentucky and adjacent southeastern Illinois and southwestern Indiana (Smith 1961, Harding 1997, Conant and Collins 1998, Phillips et al. 1999, NatureServe 2009). The northern population segment, which is federally listed, is comprised of disjunct populations in south-central Michigan, northwestern Ohio, west-central Ohio, and north-central and northeastern Indiana, although some of these populations are now extirpated (Harding 1997, Conant and Collins 1998, U. S. Fish and Wildlife Service (USFWS) 2008, NatureServe 2009). Isolated populations also have been documented, at least historically, in southern Indiana, north-central Kentucky, and northwestern Tennessee (Harding 1997, Conant and Collins 1998, NatureServe 2009). This species has declined dramatically and now persists only in scattered, isolated population clusters across its range (USFWS 1997).

State distribution: The Copperbelly Water Snake has been documented from only 13 sites in seven counties in southern Michigan (i.e., Hillsdale, Cass, St. Joseph, Branch, Calhoun, Eaton and Oakland counties) (Michigan Natural Features Inventory (MNFI) 2010), although occurrence of this species in Oakland County needs to be verified. Surveys conducted in the late 1990's and 2001-2003 reconfirmed Copperbelly Water Snakes at only four known sites, of which three are located in Hillsdale County and one in Cass and St. Joseph counties (Lee et al. 2005). Copperbellies have not been reconfirmed in the other counties from which it had been documented since the late 1950's to early 1990's despite recent surveys (MNFI 2010). Suitable habitat for the Copperbelly Water Snake, however, appears to still be available at or near many of the known sites and throughout parts of southern Michigan. Also, several reliable reports of the snake have been submitted recently but have not yet been confirmed. Thus, potential exists for the species to occur at additional sites in the state.

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Recognition: The Copperbelly Water Snake is a non-venomous, stout-bodied snake with adult total lengths typically ranging from about 30 to 48 inches (76 to 122 cm) up to a maximum of about 56 inches (142 cm) (Minton 1972, Harding 1997, Conant and Collins 1998). Adults are **solid black or dark brown on the top or dorsal side** of the snake with a plain, **unmarked, bright orange, red or orange-red belly or underside** (Harding 1997, Conant and Collins 1998). The dark dorsal coloration often extends onto the edges of the belly or ventral scales (Harding 1997, Conant and Collins 1998, Ernst and Ernst 2003). The **labial scales or "lips" of the snake also are orange or orange-red with dark edges,** and the chin and throat range from orangish to whitish (Harding 1997). Males are generally smaller than females and have longer tails (Harding 1997). The scales are keeled (i.e., have a raised ridge), and the anal plate is usually divided.

Newborn and juvenile copperbellies look different from the adults. They have dark blotches or banding outlined in white on a dark brown or reddish- to grayish-brown background on the back and sides of the snake (Harding 1997). The underside is still unmarked and usually a pale orange, yellow or pinkish color. The dorsal pattern disappears with age and usually is absent when individuals reach sexual maturity (Conant 1949). At birth, young snakes are generally about 8 to 11 inches (21 to 27 cm) in total length (Conant 1938, Minton 1972, Harding 1997).

Several snakes in Michigan look similar to and could be mistaken for the Copperbelly Water Snake. These include the Northern Water Snake (*Nerodia sipedon sipedon*), Kirtland's Snake (*Clonophis kirtlandii*), Queen Snake (*Regina septemvittata*), Northern Red-bellied Snake (*Storeria occipitomaculata occipitomaculata*), and Gray Ratsnake (*Pantherophis spiloides*, formerly Black Rat Snake, *Elaphe obsoleta obsoleta*). The Northern Water Snake has black, dark brown or reddish brown crossbands or blotches on a tan, brown or gray background on the back and sides. However, older individuals can appear solid dark brown or black on the back, particularly when snakes are dry (Harding 1997, USFWS 2008). The Northern Water Snake's underside is white, yellow, cream or light orange, and is usually marked with dark crescent-shaped spots or speckling, although ventral patterns can be highly variable (Harding 1997, USFWS 2008). The Kirtland's Snake is much smaller and has alternating dark, round blotches on its back and sides and a pink, red or orange belly with a row of black spots along each side of the belly (Harding 1997). The Queen Snake is solid brown, olive or gray on top with a yellow or cream-colored stripe along the bottom of the sides, and a yellow belly with four brownish lengthwise stripes (Harding 1997). The Northern Red-bellied Snake is a brown or gray snake with a solid, bright red underside usually, but this snake is much smaller than a copperbelly (8-16 in/20-41 cm long) (Harding 1997). The Gray Ratsnake is mostly black or dark brown with white labial scales, chin and throat, and the belly may be white or yellow with a dark checkerboard pattern (Harding 1997).

Best survey time: Copperbelly Water Snakes typically are active from mid- to late April to late October or early November (Harding 1997). The best time to survey for this species is in the spring from mid- to late April through the end of May and early June following emergence from overwintering sites and during the breeding or mating season (Kingsbury 2001). Snakes can be seen basking and foraging along the shore of water bodies and wetlands. This is also the best time to survey for this species because water temperatures are not too warm, and vegetation has not leafed out or is less dense than later in the season (Kingsbury 2001).

The recommended survey method for this species is visual surveys. Surveys in the spring should focus on shallow wetlands and shallow margins of larger wetlands or water bodies, particularly areas with shrubs, emergent vegetation, downed logs or other woody debris, snags, and other habitat features that provide cover and basking opportunities for snakes (Kingsbury 2001). Surveys also should focus on the edge between open canopy areas and adjacent forested habitats (Kingsbury 2001). Visual surveys entail first scanning suitable wetland habitats from a distance with binoculars and then slowly walking along or near the shoreline and through areas with suitable habitat looking for snakes that are basking, resting, or foraging. Optimal weather conditions for visual surveys include partly sunny days of at least 68^{o} F (20^{o} C) or sunny days between about 65-86^{o} F (18-30^{o} C) (Kingsbury 2001), although snakes also can be observed on slightly cooler, sunny days or warm, cloudy days. Surveys also should be conducted during the day (i.e., 9 am to 5 pm) when sunlight is able to reach the ground (Kingsbury 2001). Surveys in early spring and on cool weather days should be conducted primarily during late morning and early to mid-afternoon, while surveys

during hot weather should be conducted in early morning and late afternoon (Kingsbury 2001).

Habitat: Copperbellies are strongly associated with wetland habitats, and generally prefer shallow wetlands (USFWS 2008). These include shrub swamps that are often dominated by buttonbush (*Cephalanthus occidentalis*) and willow (*Salix* sp.); emergent wetlands; and temporary or permanent, palustrine open water wetlands (Conant 1943, Diener 1957, Sellers 1991, Kingsbury 1996, Harding 1997, USFWS 1997, Coppola 1999, Hyslop 2001, Minton 2001, Herbert 2003, Kingsbury et al. 2003, Laurent and Kingsbury 2003). Copperbellies also utilize palustrine forested wetlands including forested swamps, woodland pools, and floodplain forests as well as small lakes, slow-moving rivers and streams, oxbows, sloughs, and seeps and springs, particularly in the southern part of the species' range (Conant 1943, Diener 1957, Wright and Wright 1957, Harding 1997, Conant and Collins 1998, USFWS 1997, Coppola 1999, Hyslop 2001, Minton 2001). Wetland community types in which copperbellies have been found in Michigan include pond, emergent marsh, southern wet meadow, inundated shrub swamp, southern floodplain forest, and southern hardwood swamp (Kost et al. 2006). Copperbellies also have been found in brushy ditches and vegetated canals adjacent to swamps (Sellers 1991). Small, ephemeral wetlands less than 2.5 acres (1 ha) in size appear to be regularly used by copperbellies (Roe 2002, Kingsbury et al. 2003). Areas which are sparsely vegetated and contain clear, deep waters are generally avoided (Minton 1972). Most of the known sites in Michigan contain permanent sources of water, such as ponds, streams, or rivers, in addition to wetlands (Kost et al. 2006). A recent study investigating copperbelly microhabitat use in wetlands in Michigan and Ohio found that copperbellies were more likely to be found in areas close to water, habitat margins or shorelines, and areas with more open tree canopies, thick shrub cover, herbaceous emergent vegetation cover and log cover (Herbert 2003, Kingsbury et al. 2003, Lee et al 2005 and 2007).

Copperbelly Water Snakes, particularly in northern populations, appear to utilize upland habitats extensively, including upland shrub-scrub, upland forests, old fields, pastures and mowed grass (Sellers 1991, Kingsbury 1996, Kingsbury et al. 2003). Upland natural community forest types primarily found at known copperbelly sites in Michigan include mesic southern forest and dry-mesic southern forest (Kost et al. 2006). Recent analyses of microhabitat use found that copperbellies appear more likely to utilize areas with shrubs and tall herbaceous vegetation in open upland habitats and areas with abundant grass cover in upland forested habitats (Kingsbury et al. 2003).

The soil at many of the known copperbelly sites in Michigan indicate significant capacity for water retention and presence of high water tables and extended periods of standing water (Kost et al. 2006). Kost et al. (2006) found silt- or clay-dominated soil horizons in at least some portion of all the natural communities evaluated at most of the known copperbelly sites in Michigan. All sites evaluated contained gleyed soil horizons, which form when mineral soil (e.g., sand, silt, and clay) is saturated for much of the year (Kost et al. 2006). Iron mottling, which is indicative of high water tables and fluctuating water levels, also was found at a number of sites (Kost et al. 2006).

Photos of Copperbelly Water Snake habitat by Michael A. Kost (top) and Kile Kucher (bottom)

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Ecology: Copperbelly Water Snakes usually are active between April and late October or early November. After emergence from hibernacula sometime in April or early May, copperbellies migrate through forested or vegetated corridors to shallow ponds, lakes, shrub swamps and other shallow wetlands (USFWS 1997). In the spring, copperbellies tend to concentrate in these shallow wetlands, and can often be seen basking on vegetation, muskrat or beaver lodges, logs, wood piles or other woody debris along or near the shoreline (Harding 1997, USFWS 1997, Herbert 2003, Lee al. 2007). Copperbellies also can be seen breeding, foraging, and traveling along the edges of shallow wetlands (USFWS 1997). When the shallow wetlands begin to dry in late spring or early summer, the snakes disperse through wooded or vegetated corridors and shift their habitat use to permanent wetlands and uplands (USFWS 1997, Kingsbury et al. 2003). During summer, when air and water temperatures are fairly high, copperbellies become more crepuscular, and some will spend a significant amount of time aestivating underground or in shallow water (USFWS 2008). By mid-September, copperbellies become less active and start moving back to hibernation sites, and by mid-October, snakes are usually in their hibernacula (USFWS 2008).

Copperbelly Water Snakes require large landscape complexes comprised of diverse suitable wetland habitats and surrounding upland habitats (Kingsbury et al. 2003, Roe et al. 2003 and 2004). Copperbelly Water Snakes appear to be extremely vagile, regularly using and frequently moving between multiple, widely dispersed wetlands (Roe 2002, Kingsbury et al. 2003, Roe et al. 2003 and 2004). Roe (2002) reported mean daily copperbelly movements of 174 ft (53 m), mean total movement distances of over 3 mi (4.8 km), and mean home ranges of 32-40 ac (13-16 ha). Others also have reported copperbellies having home ranges of at least 16–20 ha (40-50 ac) (Sellers 1986, Harding 1997). Roe (2002) also found that most copperbellies in his study used four or more wetlands as part of their home ranges and moved on average nine times between wetlands. Mean overland distance traveled between wetland shifts was 469 ft (143 m) (Roe 2002). Wetland shifts were most frequent from May through July and became less frequent in August (Roe 2002). Copperbellies also are more likely to occupy wetlands farther from roads (Attum et al. 2007, Lee et al. 2007).

The Copperbelly Water Snake is considered one of the most terrestrial water snakes, spending considerable amounts of time in upland habitats away from water (Diener 1957, Wright and Wright 1957, Conant and Collins 1998, Kingsbury 1996, Kingsbury et al. 2003, Roe et al. 2003 and 2004). Copperbelly Water Snakes have been found to use upland habitats more frequently and at distances over twice as far from wetlands than Northern Water Snakes (Roe 2002, Kingsbury et al. 2003). Roe (2002) found that 95% of copperbelly locations in uplands were within 410 ft (125 m) of the nearest wetland, and all locations were within 0.1 mi (175 m) of the nearest wetland. The southern populations of Copperbelly Water Snakes, however, do not appear to utilize upland habitats as frequently as the northern populations (Coppola 1999, Hyslop 2001).

Mating occurs in the spring and early summer from late April to early June, with peak activity in May (Harding 1997, Kingsbury et al. 2003). Mating typically occurs on brush, logs, vegetation mats, muskrat or beaver lodges or on the shore in shallow ponds, lakes and swamps (Sellers 1991, Harding 1997). Females give birth to litters of 5 to 37 live young (average = 18) in early fall in September and October (USFWS 1993, Harding 1997). Birthing sites appear to be located in the uplands, and may be at or near hibernation sites (Sellers 1991, Kingsbury et al. 2003).

Copperbelly Water Snakes have been found to hibernate in upland and bottomland forested habitats (Sellers 1991, Kingsbury and Coppola 2000, Kingsbury et al. 2003). Copperbelly hibernation sites have included crayfish burrows (Kingsbury et al. 2003), rotting stumps (Kingsbury and Coppola 2000), dense brush piles, fieldstone piles, beaver lodges, and perhaps muskrat lodges (Sellers 1991, Kingsbury and Coppola). Hibernation sites in forested uplands appear to be located at or above than the floodstage line and ponding areas (Sellers 1991, Kingsbury and Coppola 2000), although they can survive several weeks of flooding during hibernation (Kingsbury and Coppola 2000, USFWS 2008). Roe (2002) reported copperbelly hibernation sites from within the wetland boundary up to 475 ft (145 m) and on average 176 ft (53.5 m) from the nearest wetland. Copperbellies also appear to return to the same or nearby hibernation site from year to year (Roe 2002).

Copperbelly Water Snakes have been reported to feed primarily on anurans (frogs and tadpoles) but also salamanders, crayfish, and fish (Minton 1972, Winn and Gillingham 1987, Harding 1997, Kingsbury et al. 2003). Natural predators, particularly for juvenile copperbellies, include raccoons, skunks, opossums, foxes, mink, otters, herons, hawks, large fish, and snapping turtles (Sellers 1991, Harding 1997). Copperbellies also have been killed by domestic and feral dogs and humans (Sellers 1991).

Conservation/management: The main threats that have led to the decline of Copperbelly Water Snake populations are habitat loss and fragmentation, primarily due to human activities including the draining of wetlands for agricultural use, residential and commercial development, dredging, and stream channelization (USFWS 2008). In addition to the loss of wetlands, the loss of hibernation sites and forested uplands also have contributed to the species' decline (USFWS 2008). Many of the remaining habitat complexes in which the species occurs has been fragmented by roads and unsuitable habitat such as agricultural land, developed land, and rural residences (USFWS 2008). Vehicle-caused mortality and injury may pose a significant threat to populations as suitable habitat becomes fragmented by roads (Roe et al. 2006, USFWS 2008). Snakes also may avoid roads which can disrupt the species' ecology and normal behavior, and limit dispersal within and between populations (Roe et al. 2006, USFWS 2008). This can lead to isolation of local population clusters, increased potential for inbreeding, and increased risk of local extirpations (USFWS 2008). Habitat fragmentation also may reduce availability of suitable cover and increase snakes' vulnerability to predators during migrations (USFWS 2008). Increased sedimentation and contamination from runoff of fertilizers and other chemicals due to agricultural activities, construction, and other land use activities may adversely impact copperbelly habitat (USFWS 2008). Collection of snakes for commercial, recreational, scientific, or educational purposes (e.g., pet trade, museum specimens) and indiscriminant killing by humans represent additional threats (USFWS 2008). Additionally, during recent surveys, several copperbellies were observed with blisters and other skin abnormalities indicative of blister disease, and some were adversely affected by this condition (e.g., facial deformities around eyes and mouth likely affecting vision and ability to forage, and mortality in one instance) (Lee et al. 2007). The prevalence and degree to which this condition poses a threat to copperbelly populations are currently unknown and need to be monitored and further investigated (USFWS 2008). The small, isolated nature of existing copperbelly populations makes them especially vulnerable to extirpation due to chance events (USFWS 2008). Conflicting natural resource management efforts at or near extant copperbelly sites also may threaten this species. For example, planting and/or maintaining row crops between occupied wetlands, maintaining or restoring large grasslands for upland birds, increasing water levels in wetlands, and stocking wetlands with game fish can adversely impact the species (USFWS 2008).

Protection and restoration of remaining extant copperbelly populations and associated habitat complexes are essential for conservation of this species. Maintaining or restoring large landscape complexes of suitable wetland and upland habitats is required for maintenance of viable copperbelly populations (e.g., 3-5 square miles for a population of 500-1,000 individuals, at least 500-600 acres) (Harding 1997, Roe et al. 2003, Roe et al. 2004, Roe et al. 2006, USFWS 2008). These landscape complexes should consist of high densities of shallow (generally less than 1 ft/30 cm deep) and diverse wetlands, embedded within a forested matrix, with limited barriers or hazards and terrestrial corridors between wetlands that provide safe passage for snakes (Roe et al. 2004, Roe et al. 2006, USFWS 2008). Maintaining, restoring, or creating wetland densities of one wetland every two to three hectares would be ideal (Kingsbury 2008). Habitat complexes should include diverse wetland types of various sizes and hydroperiods (i.e., permanent, semi-permanent, and ephemeral wetlands) (Kingsbury 2008). Maintaining abundant prey populations also is critical for supporting high densities of copperbellies (USFWS 2008). Many fish prey on amphibian eggs and larvae, so wetlands should not be stocked with fish to maintain dense prey populations (Kingsbury 2008). Hibernation sites also may be somewhat limited in extent and constrained to burrows of crayfish in the Cambaridae family (USFWS 2008). It is especially important to identify and maintain suitable hibernation sites for copperbellies at or near occupied habitats and maintain connectivity and access to these sites within a habitat complex (USFWS 2008).

Land management practices need to be sensitive to protecting copperbellies and their habitat. Implementing land management practices such as timber harvesting, mowing, brush hogging, or prescribed burning when the snakes are inactive (i.e., November through March) or less active can avoid or reduce the potential for adverse impacts to copperbellies (Kingsbury 2008). Wetlands should be buffered following best management practices during these management activities to minimize input of sediments and chemical pollutants into adjacent wetlands. Hydrological alterations such as drawdowns or flooding should be conducted prior to the initiation of hibernation to reduce the potential for causing winter mortality due to desiccation or freezing. Additionally, due to the small number and size of existing copperbelly populations, augmentation of extant populations and reintroduction or introduction of this species at additional sites may be needed to meet species recovery goals (Kingsbury 2008).

Finally, people need to be educated about the biology, ecology and value of the Copperbelly Water Snake in order to reduce direct harassment and harm to individual snakes and promote conservation of this species. Most of the remaining extant copperbelly populations are located on private lands. Therefore, conservation of this species and associated habitats will require working with public and private landowners and managers. Land managers and the general public should be informed that this species is protected and should not be collected or harmed. Any suspected illegal collection of Copperbelly Water Snakes should be reported to local authorities or DNRE conservation officers or wildlife biologists.

Research needs: Additional field surveys and monitoring are needed to determine this species' current status and distribution, and identify additional extant sites for conservation and management. Additional work is needed to obtain long-term data on extant populations to assess and determine their viability and conservation needs and evaluate impacts and effectiveness of species conservation and management efforts. Continued research is needed to improve our understanding of the species' biology and ecology as well as impacts of various threats and management practices. The genetic diversity of extant populations needs to be examined. Research is needed to develop and implement effective conservation strategies for this species including reintroduction or introduction of this species at additional sites. Effective methods to educate the public about this species and habitat also need to be researched and implemented.

Related abstracts: Blanchard's Cricket Frog, Blanding's Turtle, Smallmouth/Small-mouthed Salamander, Marbled Salamander, Eastern Box Turtle, Gray Ratsnake, Spotted Turtle, Regal Fern Borer, Dukes' Skipper, Indiana Bat, Red-shouldered Hawk, Cerulean Warbler, Prothonotary Warbler, Louisiana Waterthrush, Watermeal, Virginia Snakeroot, Pumpkin Ash, Goldenseal, Ginseng, Red Mulberry, Showy Orchis, Purple Twayblade, Dry-mesic Southern Forest, Floodplain Forest, Inundated Shrub Swamp, Mesic Southern Forest, Southern Hardwood Swamp, Southern Wet Meadow, Vernal Pools

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