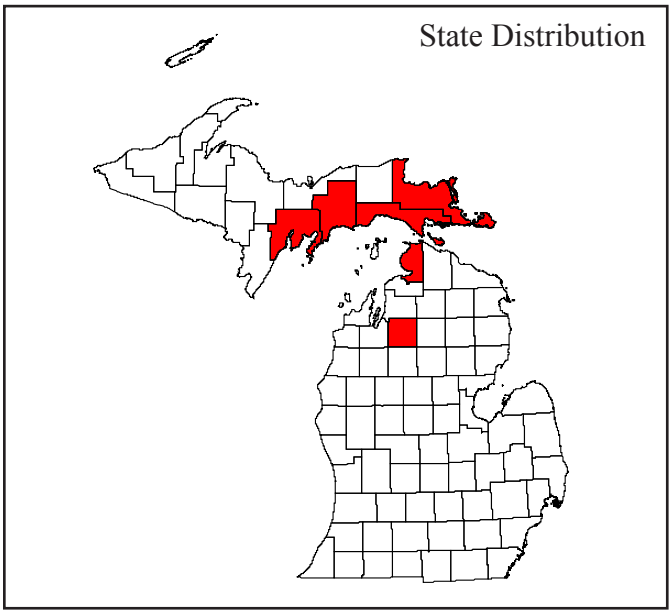
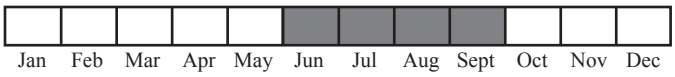
Vertigo nylanderi Sterki — deep-throat vertigo


Photo by Jeffrey C. Nekola



Best Survey Period



Status: State endangered

Global and state rank: G2/S1

Family: Pupillidae

Range: The deep-throat vertigo appears to be the rarest Vertigo snail in the eastern North America (Nekola 1998). This species is known from only four states in the U. S. (NatureServe 2007). These include Maine, Michigan, Minnesota, and Wisconsin. The species also occurs in Ontario and Nova Scotia in Canada (NatureServe 2007). The species also has been found in Pleistocene deposits in Illinois (Nekola and Massart 2000). Distribution data for this species in the U. S. and Canada are known to be incomplete.

State distribution: In Michigan, the deep-throat vertigo has been reported recently (i.e., 1998-1999) from only four counties in the eastern Upper Peninsula and one county in the northern Lower Peninsula (Nekola 1998, Nekola and Massart 2000, Michigan Natural Features Inventory (MNFI) 2007a). These include Chippewa, Delta, Mackinac, Schoolcraft, and Kalkaska counties (Nekola and Massart 2000). This species also was reported from Emmet County in the Lower Peninsula in the late 1980's (Burch and Jung 1988). However, it is unknown if the species still occurs in this county. Systematic surveys for the deep-throat vertigo have not been conducted throughout the state. Thus, potential exists for this species to occur at additional sites in which suitable habitat is available.

Recognition: The deep-throat vertigo is a minute land snail with a **light yellow-brown or cinnamon-colored, cylindrical or "beehive-shaped" shell** that is **1.3 to 1.8 mm (0.05 to 0.07 in) in height** and 0.75 to 1 mm (0.03 to 0.04 in) in width with 4.5 to 5 whorls (Burch and Jung 1988, Nekola and Massart 2000). The **transverse striae or growth lines on the shell** are **prominent and well-developed** (Burch and Jung 1988, MNFI 2007b). The **apertur**e, or main opening of the shell, has **six angular "teeth" or lamellae** (calcareous plates, ridges, or folds on the inside of the shell opening) (Burch and Jung 1988, MNFI 2007b). The **lower palatal lamella** (i.e., lower tooth along the outer lip of the aperture away from the main or center axis of the shell) is **deeply inserted within the aperture** (Burch and Jung 1988, Nekola 1998). The two columellar lamellae (i.e., teeth or folds located on the inside lip of the aperture along the main axis of the shell) consist of a substantial lamella above a tiny subcolumellar or basal lamella (Burch and Jung 1988). The two parietal lamellae (i.e., teeth along the top of the aperture) also consist of a well-developed, larger parietal lamella next to a thin, angular lamella (Burch and Jung 1988, MNFI 2007b).

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The deep-throat vertigo is distinct from other *Vertigo* snails in that it has a strong angular lamella and a columellar lamella of greater volume that the parietal lamella (Nekola 1998). The aperture also has a strong sinulus (inwardly projecting point on the outer lip), and the **outside of the shell has a deep, groove-like indentation or depression over the lower palatal lamella** (Nekola and Massart 2000).

Best survey time: Surveys for the deep-throat vertigo can be conducted anytime during the year, but the best time to survey for this species is from June through September (Nekola and Massart 2000, MNFI 2007b). Because land snails require moisture, surveys are generally most successful in the spring (after snowmelt) and fall, particularly after rain events, when the soil is moist, and during higher relative humidity conditions and cooler temperatures (Taft 1961, Burch and Pearce 1990, MNFI 2007b). The best way to survey for this species is by soil litter sampling. This consists of collecting soil and leaf litter samples in the field and drying, sifting, and looking for snail shells in the samples in the laboratory (Nekola 1998, Nekola 1999).

Habitat: In Michigan, the deep-throat vertigo has been restricted to forested wetlands, primarily tamarack-sedge (*Larix laricina*-*Carex* spp.) wetlands (Nekola 1998, Nekola and Massart 2000). These wetlands have consisted of open tamarack stands with a speckled alder (*Alnus rugosa*) shrub understory and a dense sedge ground layer (Nekola 1998). This species has not been found in densely forested tamarack wetlands, tamarack wetlands containing *Sphagnum* moss, or cedar (*Thuja* spp.)-dominated wetlands (Nekola 1998). However, the deep-throat vertigo has been found at one site that contains a northern white-cedar (*Thuja occidentalis*)-tamarack swamp forest in which the tree canopy is dominated by white cedar (Nekola 1998). This species also appears to be limited to areas of shallow limestone bedrock, particularly along the Lake Michigan-Huron shoreline (Nekola 1998). The tamarack-sedge wetlands in which this species has been found in Michigan's Upper Peninsula are not common, and appear to be restricted to areas underlain by Niagaran Escarpment carbonate bedrock (Nekola 1998). As a result, the deep-throat vertigo may have a very limited distribution in Michigan (Nekola 1998).

Biology: Little information is available about the specific biology and life history of the deep-throat vertigo. In general, land snails require adequate moisture, shelter, abundant food supply, and an available source of calcium (Burch 1962, Burch and Pearce 1990). Land snails require moisture or water for basic physiological processes as well as locomotion and reproduction (Burch and Pearce 1990). For example, land snails generate mucous trails as they crawl, and mucous is largely comprised of water (Burch and Pearce 1990). Also, most snail eggs are highly susceptible to desiccation, and must be deposited in moist sites to survive (e.g., moist soil, under stones, logs, or leaf litter) (Burch and Pearce 1990, Martin 2000). Most land snails can minimize water loss and survive dry conditions by aestivating and closing their shell opening with an operculum (i.e., a calcareous "lid" that seals the opening) or a mucous film that hardens over the opening (Burch 1962, Burch and Pearce 1990).

Snails require calcium to maintain their shells. As a result, snails are often associated with habitats that are rich in calcium such as areas that are abundant in limestone (e.g., limestone outcrops), or have soils derived from limestone or are otherwise high in calcium carbonate (Burch and Pearce 1990). Snails also can occur in areas in which the soils are poor in calcium if the local vegetation can provide sufficient calcium (Burch and Pearce 1990). Snails ingest soil particles and scrape rocks or snail shells in order to obtain calcium (Fourníe and Chétail 1984). Snails also can obtain calcium that is dissolved in water by absorbing the water through their skin or drinking it (Heller and Magaritz 1983 in Martin 2000).

Availability of adequate shelter or refuges also is extremely important to land snails. Burch and Pearce (1990) have suggested that refuges may be the most important factor limiting the abundance of land snails. Refuges provide shelter from cold and hot weather conditions and desiccation as well as protection from predators (Burch and Pearce 1990). Refuges include soil humus, leaf litter, rotting logs and other woody debris, crevices and cavities in tree bark, rocks, soil crevices, and under the soil surface. Most land snails overwinter underground or under cover (Burch 1962).

Some land snails, including the deep-throat vertigo, appear to respond strongly to soil surface architecture (Nekola 2003). The deep-throat vertigo appears to prefer soils with a thin (< 4 cm/1.6 in) organic horizon underlain by an upper soil horizon firmly bound by

plant roots (i.e., "turf specialists") (Nekola 2003). Seventeen additional land snails across the Great Lakes basin appear to prefer similar thin soils, while twenty-eight other land snails in the region appear to prefer deeper (> 4 cm), loose soils comprised primarily of humus and mineral soil (i.e., "duff specialists") (Nekola 2003). Soil surface architecture may be important to land snails in general since almost 90% of land snails live within 5 cm (2 in) of the soil surface (Hawkins et al. 1998). The architecture of the organic litter layer and the underlying soil also may impact land snails (Cameron 1986, Nekola 2003).

Temperature, moisture, and light intensity are the primary factors regulating or influencing land snail activity (Burch 1962, Burch and Pearce 1990). Land snails are primarily nocturnal, but may be active during the day following a rain event (Burch 1962, Burch and Pearce 1990). High relative humidity and cooler temperatures also can cause increased snail activity (Burch and Pearce 1990). Land snails generally do not move much except to find food or reproduce (NatureServe 2007). They actively migrate fairly slowly and over short distances (i.e., usually only centimeters or meters) under favorable environmental conditions (Burch and Pearce 1990, NatureServe 2007). Long-distance dispersal is thought to occur passively through transport by animals (i.e, mammals, birds, or insects) or by humans such as on food, plants, or machinery (Burch and Pearce 1990, NatureServe 2007).

Land snails exhibit a number of different sexual systems and reproductive strategies, behaviors, and anatomy (Martin 2000). The deep-throat vertigo is hermaphroditic (i.e., possesses both male and female sex organs) (Martin 2000). Although such land snails can self-fertilize, they commonly exhibit reciprocal mating or outcrossing in which each hermaphroditic partner acts as both male and female and exchange sperm during copulation (Martin 2000). The deep-throat vertigo also is likely oviparous (i.e., lays eggs) (Martin 2000).

Most land snails are generalist herbivores (Burch and Pearce 1990). Many also feed on fungus or detritus. A few snail species are carnivorous, consuming other snails, slugs, and invertebrates in the soil (Burch and Pearce 1990). Land snails are preyed upon by various organisms including birds, small mammals, amphibians, reptiles, other snails or slugs, beetle and fly larvae, and other insects (Burch and Pearce 1990).

Conservation/management: Given that the deep-throat vertigo has been documented from only a small number of sites in Michigan, all known populations of this species should be protected and monitored. The deep-throat vertigo has been recommended for listing as State endangered and may even warrant listing as a federally endangered species given its extreme habitat restrictions and limited distribution in the U. S. (Nekola 1998). Land-use activities that impact or alter critical habitat requirements including suitable microclimate and soil surface architecture as well as adequate moisture, calcium, food, and refuge should be avoided at known occupied sites (MNFI 2007b). These include, but are not limited to, activities such as timber harvesting, recreational or urban development, and road construction (Nekola 2002). The deep-throat vertigo also is vulnerable to excessive trampling (e.g., from recreational hiking or other uses), off-road vehicle use, and hydrological alterations (MNFI 2007b).

Prescribed fire has been found to significantly reduce land snail species richness and abundance in grassland habitats presumably because it removes the detritus layer to which a majority of land snails are restricted (Nekola 2002). Although prescribed fire has been found to negatively impact a number of land snails that are considered "turf specialists," the deep-throat vertigo does not seem to respond to fire (Nekola 2002). However, as the impacts of fire on this species continue to be studied, use of prescribed fire in occupied sites should still be avoided, if possible, or applied conservatively, leaving multiple refugia and using a burn interval of at least 15 years (Nekola 1998, Nekola 2002, MNFI 2007b).

Tamarack sedge wetlands have high conservation value for land snails. This is because of their limited distribution and the number of rare snail taxa associated with this habitat including the deep-throat vertigo (Nekola 1998). These habitats should be prioritized for surveys and potential management or protection for the deep-throat vertigo and other land snails.

Research needs: A systematic survey for the deep-throat vertigo is needed to identify additional occupied sites and determine this species' status and distribution in Michigan. Additional surveys and monitoring of known sites are warranted to determine their population

status, extent, and viability. Research is needed to obtain information about the deep-throat vertigo's specific habitat requirements, life history, and ecology in Michigan. An assessment of threats to the species also should be conducted. Studies to monitor and investigate the effects of various land-use and recreational activities such as off-road vehicle use, prescribed fire, and others on the deep-throat vertigo are vital to ensure adequate management and protection of this species (Nekola 1998). It also is important to know how much buffer from management and recreational activities is needed to provide adequate protection for land snails (Nekola 1998).

Related abstracts: Vertigo cristata, Vertigo morsei, Vertigo elatior, Vertigo modesta parietalis, Vertigo paradoxa

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