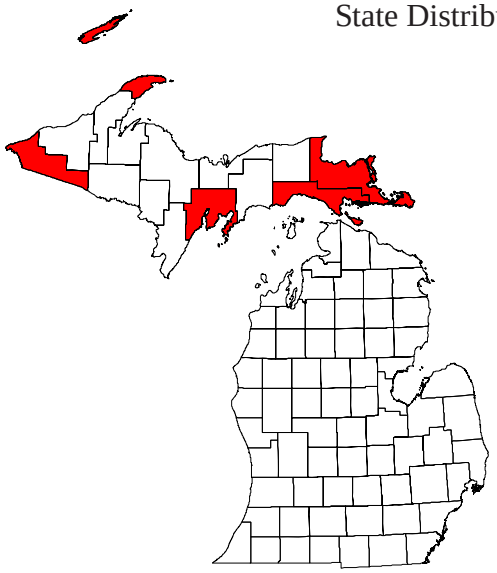
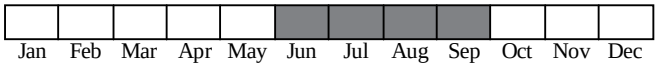
Vertigo cristata Sterki — crested vertigo

Photo by Jeffrey C. Nekola

State Distribution



Best Survey Period



Status: State special concern

Global and state rank: G5/S3

Family: Pupillidae

Range: The crested vertigo is known only from northern Minnesota, northern and southwestern Wisconsin, the Upper Peninsula of Michigan, Massachusetts, and southern Ontario (NatureServe 2007). The species also is relatively common and widespread in eastern and northern British Columbia (NatureServe 2007).

State distribution: In Michigan, the crested vertigo has been reported from only five counties in the Upper Peninsula (Nekola 1998, Michigan Natural Features Inventory (MNFI) 2007a). These include Chippewa, Delta, Gogebic, Keewanaw, and Mackinac counties (Nekola 1998, MNFI 2007a). However, systematic surveys for this species 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: This minute land snail has a **yellowish, cylindrical or "beehive-shaped" shell** with 4.5 to 5 whorls. The shell is about 1 mm (0.04 in) wide and **between 1.7 to 2.2 mm (0.07 to 0.09 in) long** (Nekola 1998, Nekola 2000). The **aperture** or main opening of the shell **has four lamellae,** or small, calcareous plates or "teeth," **arranged in a cross-shaped pattern** (Nekola 1998, Nekola 2000). The shell also exhibits a **prominent crest in back of the opening** and **strong, closely spaced shell striations** (Nekola 1998, Nekola 2000).

Best survey time: Surveys for the crested vertigo can be conducted anytime during the growing season, but the best time to survey for this species is from June through September (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 the western Great Lakes region, the crested vertigo has been documented in several different habitat types including igneous bedrock outcrops, igneous lakeshore outcrops, sandstone cliffs,

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carbonate lakeshore ledges, carbonate cliffs, coniferous forested wetlands dominated by northern white-cedar (*Thuja occidentalis*) and tamarack (*Larix laricina*), and other rocky woodlands (Nekola 2000). It also has been found upland coniferous forests comprised of jack pine and red pine (Nekola 2002). In Michigan, this species has been associated primarily with inland and lakeshore carbonate or calcareous cliffs and igneous outcrops (Nekola 1998). Natural community types in Michigan in which this species has been found include granite or limestone cliffs, lakeshore cliffs, and bedrock lakeshores as well as rich conifer swamp (MNFI 2007b). This species appears to prefer forested outcrops of igneous rock, with northern white-cedar commonly present (Nekola 2000). High population densities of this species also have been found in areas of cool air seepage at the base of open, basalt, talus slopes (Nekola 1998).

Biology: Little information is available about the specific biology and life history of the crested 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 (Burch and Pearce 1990). 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, Hotopp 2002). 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, Hotopp 2002). Snails ingest soil particles and scrape rocks or snail shells in order to obtain calcium (Fournie 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 also overwinter underground or under rocks, logs, and boards (Burch 1962).

Some land snails, including the crested vertigo, appear to respond strongly to soil surface architecture (Nekola 2003). The crested vertigo appears to prefer soils with a deep (> 4 cm/1.6 in) organic horizon (soil layer) underlain by a loose upper soil horizon comprised primarily of humus and mineral soil (Nekola 2003). Twenty-seven additional land snails across the Great Lakes basin appear to prefer similar deep, loose soils, while at least eighteen other land snails appear to favor soils with a thin organic horizon (< 4 cm) underlain by an upper soil horizon firmly bound by plant roots (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 large number of land snails associated with soils with deeper organic horizons may be because of greater thickness of organic litter in these areas (Nekola 2003). The abundance, diversity (Locasciulli and Boag 1987), and composition (Cameron and Morgan-Huws 1975, Barker and Mayhill 1999) of land snail communities have been found to correlate positively with organic litter depth (Nekola 2003). 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 land 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 relatively 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).

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 crested vertigo has been documented from only a small number of sites in Michigan, all known populations of this species should be protected and monitored. 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 would include activities that remove forest canopy cover or woody debris or cause disturbance, loss, or compaction of the soil surface and organic litter such as timber harvesting and salvage, residential development, and road building (MNFI 2007b). The species also is vulnerable to excessive trampling (e.g., recreational hiking) and off-road vehicle use (MNFI 2007b). Rock climbing also may impact this species as it has been found to negatively impact snail density, richness, and diversity (McMillan et al. 2003). Additionally, carbonate cliff, carbonate lakeshore ledge, white cedar wetland, and tamarack-sedge wetland habitats have been found to harbor a number of rare land snails, including the crested vertigo, and some of the richest land snail communities in the Upper Peninsula of Michigan (Nekola 1998). Forested carbonate cliffs and calcareous bedrock outcrops, in general, have been identified as "hotspots" of land snail biodiversity regionally and globally (Nekola 1999). These habitats should be prioritized for surveys and potential management or protection for the crested vertigo and other land snails.

Research needs: A systematic survey for the crested 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 crested vertigo's specific habitat requirements, life history, and ecology. An assessment of threats to the species also should be conducted. Studies to monitor and investigate the effects of various land-use activities, such as timber harvesting and recreational activities (e.g., rock climbing, off-road vehicle use), on the crested vertigo also are vital to ensure adequate management and protection of this species (Nekola 1998).

Related abstracts: Vertigo elatior, Vertigo morsei, Vertigo nylanderi, Vertigo modesta parietalis, Vertigo paradoxa, limestone bedrock lakeshore, granite bedrock lakeshore, rich conifer swamp

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Abstract citation

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