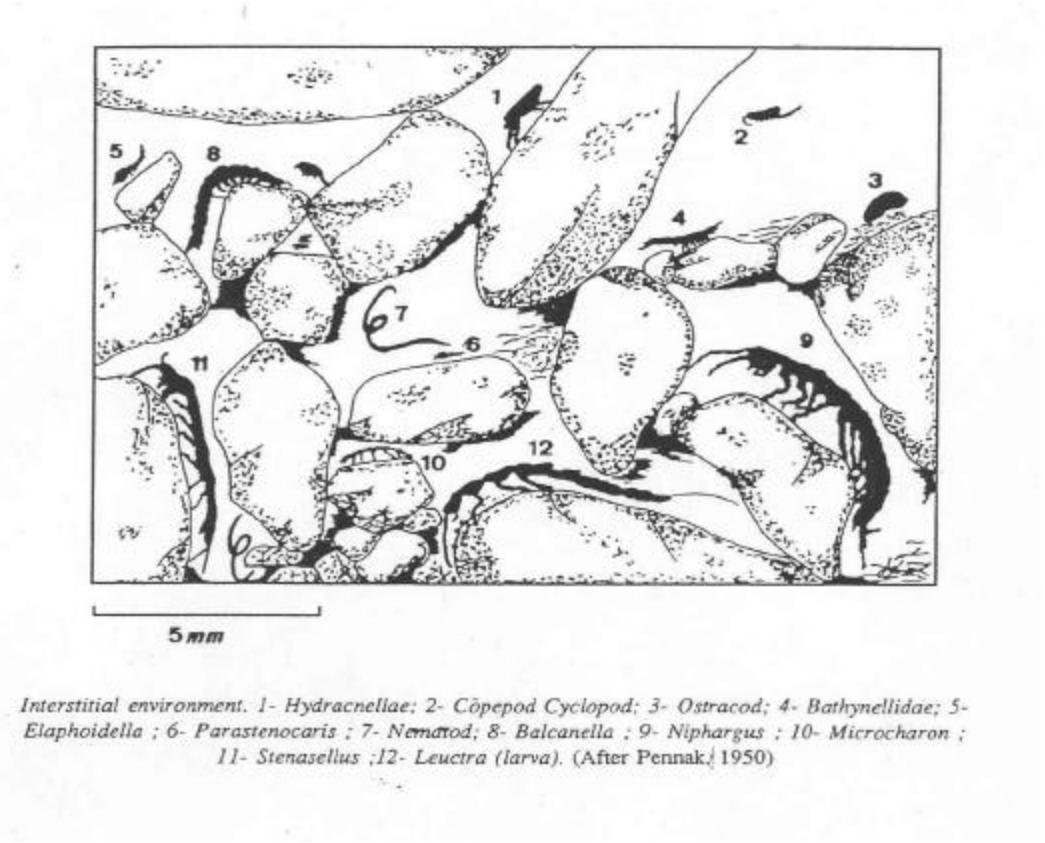
Community Conservation Assessment for Interstitial Aquifer Habitat and Associated Rare Animal Species



Interstitial environment. 1- Hydracnellae; 2- Copepod Cyclopod; 3- Ostracod; 4- Bathynellidae; 5- Elaphoidella ; 6- Parastenocaris ; 7- Nematod; 8- Balcanella ; 9- Niphargus ; 10- Microcharon ; 11- Stenasellus ;12- Leuctra (larva). (After Pennak, 1950)

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HOOSIER NATIONAL FOREST

This Conservation Assessment was prepared to compile the published and unpublished information on the interstitial aquifer habitat and associated rare animals species in the Hoosier National Forest. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community and associated taxa, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Milwaukee, Wisconsin 53203.

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EXECUTIVE SUMMARY

The purpose of this document is to provide the background information necessary to prepare a Conservation Strategy, which will include management actions to conserve the interstitial aquifer communities.

DESCRIPTION OF HABITAT AND COMMUNITY

The first name given to this habitat was the "nappe phreatique" by Daubree (1887), referring to groundwaters flowing through non-cave interstitial pore spaces in unconsolidated sediments. The inhabitants of these phreatic waters were termed phreatobites. Put more simply, this is the groundwater that flows through soil and gravel. In Indiana, there are two commonplace windows into this habitat: wells and drain tiles. The purpose of a well is to extend far enough into the ground that this groundwater is reached and can be tapped. The use of drain tiles is essentially the opposite. Where the soil remains saturated much of the time and prevents agriculture, a ditch can be dug and a perforated pipeline placed in it and backfilled, with an outlet carrying the water to a drainage ditch. Drain tiles systems are common in flat glacial or alluvial land otherwise desirable for row crops except for the bogginess of the soil.

Subterranean animals may enter the open water of the well or drain tile, from which they may be sampled, sometimes inadvertently by those wanting to drink from wells. In Indiana the interstitial aquatic fauna includes flatworms Sphalloplana sp., copepods Diacyclops jeanneli (Lewis, 1996a), isopods Caecidotea kendeighi, Caecidotea teresae (Lewis and Bowman, 1981; Lewis, 1982), and amphipods Bactrurus mucronatus (Koenemann and Holsinger, 2001).

ENVIRONMENTAL CONDITIONS

Camacho (1992) defined characteristics for the phreatic environment:

(1) Sediment grain size – The size of the constituent particles establishes the porosity of the habitat and is the limiting factor as to what kinds of animals can exist in the interstices. At some point there is a minimum threshold below which the pores in the sediment are too small to accommodate animals.
(2) Light—According to Pennak (1950) all light disappears with 10 centimeters of the surface. Thus no plant life occurs in the habitat and the animals present in this environment have morphological adaptations similar to animals living in caves.
(3) Water flow rate—Phreatic water flow is not static, there being an interplay between surface and subsurface waters. The current is also dependent upon the size of the sediment grains (determining porosity), the heterogeneity of the sediment, and the degree of compaction. Angelier (1962) stated that flow velocity decreased with increasing depth, as vertical movement decreases and laminar flow increases.
(4) Temperature—Surface waters respond to environmental changes on a constant basis. The temperature of the underlying groundwater is a function of the temperature of the surface water supplying it. However, the effect of surface temperature decreases with depth underground and in the deepest groundwater layers the temperature is practically constant and independent of daily or seasonal fluctuations.

(5) Dissolved oxygen—Of the many who have studied the oxygenation of phreatic groundwaters, there is no consensus as to how the constraining factors determining dissolved oxygen levels work. In general dissolved oxygen is a function of temperature. The concentration varies with depth and permeability of the sediment and the rate at which it is being renewed.
(6) Dissolved solids—The level of dissolved solids which determines pH, alkalinity, etc. is determined by the chemical nature of the ground through which the water is flowing, and varies tremendously from site to site.
(7) Organic matter—Organic matter is abundant on the surface and decreases with depth into the ground. The presence of decomposing organic matter determines the level of reduction in the environment, thus affecting dissolved oxygen levels. Evidence indicates that due to the contained nature of the habitat, organics persist in phreatic groundwaters significantly longer than in free flowing waters characteristic of surface streams.

CURRENT COMMUNITY CONDITION, DISTRIBUTION AND ABUNDANCE

In the Hoosier National Forest interstitial communities remain basically undetected, although they are certainly present. The best opportunity for sampling these shallow soil habitats would be wells in alluviated stream valleys.

REGIONAL FORESTER SENSITIVE SPECIES

At present there are no species listed as Regional Forester Sensitive Species from shallow soil interstitial habitats on the Hoosier National Forest.

POTENTIAL THREATS

Due to the close proximity to the surface interstitial aquifers are particularly susceptible to contaminants. Potential contaminants include (1) sewage or fecal contamination, including sewage plant effluent, septic field waste, campground outhouses, feedlots, grazing pastures or any other source of human or animal waste (Harvey and Skeleton, 1968; Quinlan and Rowe, 1977, 1978; Lewis, 1993; Panno, et al. 1996, 1997, 1998); (2) pesticides or herbicides used for crops, livestock, trails, roads or other applications; fertilizers used for crops or lawns (Keith and Poulson, 1981; Panno, et al. 1998); (3) hazardous material introductions via accidental spills or deliberate dumping, including road salting (Quinlan and Rowe, 1977, 1978; Crawford, 1985; Lewis, 1993, 1996b).

SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

Significant quantities of shallow soil interstitial aquifer habitat must certainly be present on the Hoosier National Forest. The only way to ascertain the presence of subterranean fauna is the sampling of wells, which should be managed in such a way as to safeguard them from accidents while continuing to allow groundwater sampling and monitoring.

SUMMARY OF MANAGEMENT AND CONSERVATION ACTIVITIES

No specific activities are currently being conducted concerning interstitial communities.

RESEARCH AND MONITORING

A bioinventory of subterranean habitats of the Hoosier National Forest is being conducted in which wells are sampled as encountered (Lewis, et al., 2002; and in progress).

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