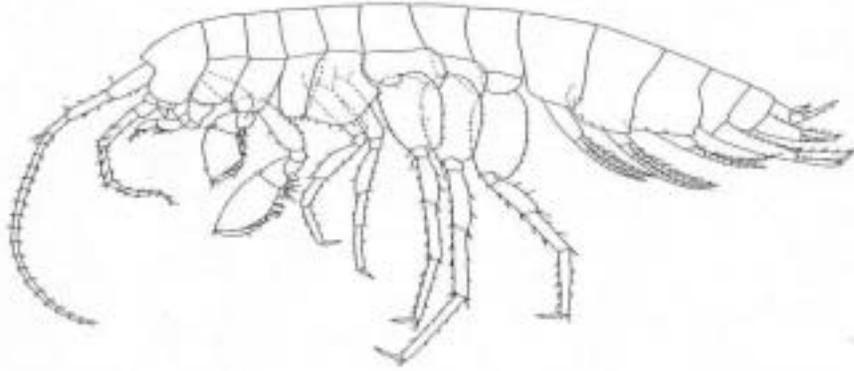


***Conservation Assessment
for
Packard's Cave Amphipod (*Crangonyx packardi*)***



(Zhang, 1997)

USDA Forest Service, Eastern Region
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This Conservation Assessment was prepared to compile the published and unpublished information on Crangonyx packardi. 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

Packard's cave amphipod is designated as a Regional Forester Sensitive Species on the Hoosier National Forests in the Eastern Region of the Forest Service. This species is also present in the area of the Shawnee National Forest and Mark Twain National Forest. 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 species.

Packard's cave amphipod is a subterranean crustacean known from a variety of groundwater habitats across a relatively wide range from Indiana west to Kansas.

NOMENCLATURE AND TAXONOMY

Classification: Class Crustacea
Order Amphipoda
Family Crangonyctidae
Gracilis Group

Scientific Name: Crangonyx packardi Smith

Common Name: Packard's cave amphipod

Synonyms: Crangonyx gracilis packardi
Eucrangonyx packardi

This species was described by Smith (1888) as Crangonyx packardi. Zhang (1997) pointed out that essentially every reference to a subterranean Crangonyx in the Interior Low Plateaus used the name Crangonyx packardi. Zhang recognized at least 4 other undescribed species misidentified as Crangonyx packardi, creating a long, convoluted and confusing list of synonyms among the species involved. Detailed descriptions including synonymies of all of the species involved have been prepared and are in the course of being prepared for publication (Holsinger & Zhang, in preparation). Synonyms of Crangonyx packardi are Crangonyx gracilis packardi (e.g., Hubricht, 1943) and Eucrangonyx packardi (e.g., Stebbing, 1899).

Crangonyx was previously placed in the Family Gammaridae (Holsinger, 1972), but Bousfield (1973; 1977) and Holsinger (1977) subdivided this large, heterogeneous family into a number of smaller families. The proper placement of the genus is in the Family Crangonyctidae (Holsinger, 1977).

DESCRIPTION OF SPECIES

The eyes of Crangonyx packardi are either reduced to a few pigment specks or absent entirely. The species is unpigmented and appears white or slightly straw-colored in life. The crustacean's length ranges up to 5.5mm in the largest males and 8.0 mm in the largest females. Identification of this species requires laboratory dissection and

examination of slide-mounted appendages under a compound microscope by a specialist in amphipod taxonomy.

LIFE HISTORY

Zhang (1997) reported that ovigerous females were present in collections from March to August and in November. Otherwise, little is known of the life history of this species.

HABITAT

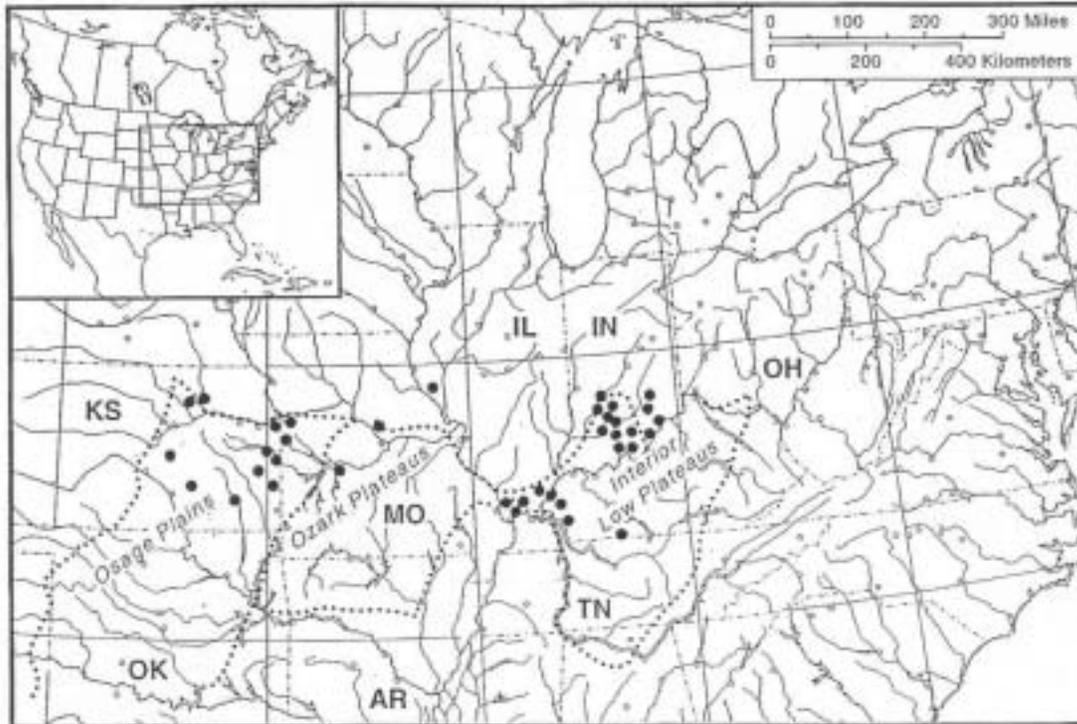
Zhang (1997) reported this amphipod from 56 sites, of which 46 were caves, 3 springs, 2 seeps and 5 wells. In caves the species has been taken from a variety of aquatic habitats including streams, stream pools and drip pools. In the Hoosier National Forest this species frequently occurs with other larger cavernicolous Crangonyx species, with Crangonyx packardi showing a preference for the interstices of cave stream gravels. Thus, although this species may frequently be present, it is frequently overlooked. Finding Crangonyx packardi usually requires extracting them from the stream bed by a method like the Karaman-Chappuis Technique. In this method water and gravel are dug from a cave stream, placed in a bucket and swished around, then the amphipods are removed from the supernatant fluid by pouring it through a plankton net.

Lewis (1998) reported this species from parafluvial stream gravel about one meter below the surface adjacent to the Blue River, collected via a Bou-Rouch pump. As evidenced by collection data and its wide range, Crangonyx packardi undoubtedly disperses through karst groundwater conduits (caves, etc.), the groundwaters of the epikarst, as well as the hyporheic habitats.

DISTRIBUTION AND ABUNDANCE

Crangonyx packardi is known from a range of over 600 miles encompassing the following area: southern Indiana south through Kentucky, then west into Illinois, across Missouri into the eastern third of Kansas (figure 1). Many of the collections examined by Zhang (1997) contained over a dozen specimens.

Figure 1. The distribution of *Crangonyx packardii* (from Zhang, 1997).



RANGEWIDE STATUS

G3 vulnerable: The global rank of G3 is usually assigned to species that are known globally from between 21-100 localities. *Crangonyx packardii* was recorded by Zhang (1997) from over 50 localities and additional cave populations have been found on the Hoosier National Forest (Lewis, 2001 in progress). Considering the wide range, demonstrated agility of dispersal, habitat breadth and presumptive abundance, a higher global rank might be suggested. However, the destruction of habitat and degradation of water quality across its range mitigates this consideration.

Indiana State Rank: S3 vulnerable; The state rank of S3 similarly is assigned to species that are known from between 21 and 100 localities within the state.

POPULATION BIOLOGY AND VIABILITY

Packard's cave amphipod occurs in cave stream communities with a variety of other subterranean species across its range. The fact that in the Hoosier National Forest area it occurs primarily in the interstices of cave stream gravels, while other larger co-occurring species live on the visible floor of the stream, suggests that a competitive habitat partitioning is occurring.

POTENTIAL THREATS

Due to the presence of Crangonyx packardii in a restricted groundwater environment, it is susceptible to a wide variety of disturbances. In particular, caves are underground drainage conduits for surface runoff, bringing in significant quantities of nutrients for cave communities. Unfortunately, contaminants may be introduced with equal ease, with devastating effects on cave animals. 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). In Indiana populations of Crangonyx packardii have been extirpated or degraded in Indian Cave, Clark Co. (domestic sewage contamination) and in Biehle Cave, Jennings Co.(animal lot fecal waste); (2) pesticides or herbicides used for crops, livestock, trails, roads or other applications. Crangonyx packardii was extirpated from the spring locality at Jordan Hall, (Indiana University), in Monroe Co., Indiana, by termiticides. Fertilizers used for crops or lawns are also important potential sources of groundwater contamination (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, 1996). The population of Crangonyx packardii at Firestone Creek Cave, Johnson Co., Illinois is almost entirely under a surface dump.

Habitat alteration due to sedimentation is a pervasive threat potentially caused by logging, road or other construction, trail building, farming, or any other kind of development that disturbs groundcover. Sedimentation potentially changes cave habitat, blocks recharge sites, or alters flow volume and velocity. Observation of brown floodwaters flowing into the Lost River System at Wesley Chapel Gulf are testimony to the magnitude of the sedimentation problems in some areas. Keith (1988) reported that pesticides and other harmful compounds like PCB's can adhere to clay and silt particles and be transported via sedimentation.

Impoundments may detrimentally affect cave species. Flooding makes terrestrial habitats unusable and creates changes in stream flow that in turn causes siltation and drastic modification of gravel riffle and pool habitats. Stream back-flooding is also another potential source of introduction of contaminants to cave ecosystems (Duchon and Lisowski, 1980; Keith, 1988). Aquatic cave ecosystems potentially affected by impoundments in the Hoosier National Forest include several of the caves adjacent to the lake at the Springs Valley area and Megenity Peccary Cave at Patoka Lake.

Numerous caves have been affected by quarry activities prior to acquisition. However, at Cave Spring Cave, Hardin Co., Illinois limestone containing the cave (and Crangonyx) is being quarried away. Roadcut construction for highways passing through national forest land is a similar blasting activity and has the potential to destroy or seriously modify cave ecosystems. Indirect effects of blasting include potential destabilization of passages, collapse and destruction of stream passages, changes in water table levels and sediment transport (Keith, 1988).

With the presence of humans in caves comes an increased risk of vandalism or littering of the habitat, disruption of habitat and trampling of fauna, introduction of microbial flora non-native to the cave or introduction of hazardous materials (e.g., spent carbide, batteries) (Peck, 1969; Keith, 1988; Elliott, 1998). The construction of roads or trails near cave entrances encourages entry.

Clearly the relatively large number of localities from which Crangonyx packardi is known has subjected it to a concomitant number of threats.

SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

This species exists across a wide range and occurs on a mosaic of federal, state and privately owned lands. In the Hoosier National Forest this species occurs in numerous caves (Lewis, et al., 2002; and in progress). In Crawford County Crangonyx packardi has been found in the Hemlock Cliffs Special Area at Indian Cave (ephemeral, wet-weather run-off stream in sand) and Mesmore Spring Cave (in stream gravel), as well as Megenity Peccary Cave (pools). In Orange County this species occurs in the Little Africa area in stream gravel interstices at Dillon, Springs Spring and Snaggy Little caves. At the Springs Valley Recreation Area Crangonyx packardi was found in Campground, Diggers Delight, Tucker Dam Quarry and Tucker Lake Spring caves (in drip pools and from stream gravel interstices). This species has also been found in Wesley Chapel Gulf Cave (Wesley Chapel Gulf Special Area) and on the Blue River drainage in Duggins Spring Cave. Special areas of the national forest are managed to protect the ecosystems that lie within them (USDA Forest Service, 2000).

Elsewhere in southern Indiana this species has been taken from a Blue River gravel bar on property owned by The Nature Conservancy near Wyandotte, in Crawford County. It also occurs in the Donaldson Cave System (Donaldson Cave Nature Preserve and Spring Mill State Park), several caves at the Crosley State Wildlife Area (IDNR) and caves and wells in the Big Oaks National Wildlife Refuge. These areas offer varying levels of protection to the caves and their inhabitants.

In the Shawnee National Forest Crangonyx packardi was taken from a seep spring near the Illinois Iron Furnace, Hardin County.

The range of this species crosses the Mark Twain National Forest in Missouri, but there are no known localities on forest service land.

SUMMARY OF EXISTING MANAGEMENT AND CONSERVATION ACTIVITIES

No species specific management activities are being conducted concerning Crangonyx packardi. Cave and karst habitat located on the Hoosier National Forest are, however, subject to standards and guidelines for caves and karst protection and management as

outlined in the Hoosier National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service, 1991). These standards and guidelines include the following:

*Caves are protected and managed in accordance with the Federal Cave and Karst Resources Protection Act of 1988, Forest Service Manual 2353, Memorandums of Understanding between the forest service and the National Speleological Society, the Indiana Karst Conservancy, Inc., the Forest Cave Management Implementation Plan, and individual specific cave management plans.

*Except where modified by an existing cave management prescription, vegetation within a 150-200 foot radius of cave entrances and infeeder drainages with slopes greater than 30 percent will generally not be cut. No surface disturbing activities will be conducted on any slopes steeper than 30 percent adjacent to cave entrances. Similar protection areas will be maintained around direct drainage inputs such as sinkholes and swallow holes known to open into a cave's drainage system of any streams flowing into a known cave.

*Allow no sediment from erosion of access roads and drilling sites to wash into caves or karst features.

*Seismic surveys requiring explosives shall not be conducted directly over known cave passages or conduits.

*All caves will be managed as significant.

(USDA Forest Service, 1991)

The forest plan includes a cave and karst management implementation plan. This management plan places an emphasis on cave resource protection and mitigation. Understanding of the caves is established through mapping, bioinventory, cataloging of resources (e.g., archaeological, paleontological, speleothems, etc.), and estimating use levels and trends. Protection zones or other mitigation measures recommended by a management prescription will be established around caves entrances, sinkholes and swallowholes. Specific criteria will include consideration for protection of entrance and cave passage microclimate, animals inhabiting the cave, physical and chemical parameters and aesthetic values associated with the cave.

RESEARCH AND MONITORING

No species specific monitoring is being conducted of *Crangonyx packardii*. New localities within the Hoosier National Forest are being discovered as part of a bioinventory of caves (Lewis, et al., 2002; and in progress).

RECOMMENDATIONS

Retain on list of Regional Forester Sensitive Species.

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