

*Conservation Assessment
for
The Indiana Crayfish (*Orconectes indianensis*)*



USDA Forest Service, Eastern Region

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This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. 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 taxon, please contact the Eastern Region of the Forest Service – Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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EXECUTIVE SUMMARY

The Indiana crayfish, *Orconectes indianensis*, was first described by William Hay in 1896 (Hay, 1896). The species has a limited range in the lower Ohio River Valley, where it occurs in southeastern Illinois and southwestern Indiana. Approximately five known Indiana crayfish populations occur in streams which flow through land under the ownership of the United States Department of Agriculture Forest Service. These sites fall within the Shawnee National Forest in southern Illinois and the Hoosier National Forest in southern Indiana. It occurs in shallow regions with gravel/cobble substrates in small to large creeks and small rivers. Threats to the species' continued existence include habitat alterations such as gravel/cobble removal and the damming of flowing waters, and the introduction of non-native crayfish species. The species receives some protection under the Illinois Endangered Species Protection Act while some habitat for the species is protected on USDA Forest Service lands. Management activities should include protection of habitat, monitoring of the species' distribution, and research to determine life-history characteristics.

NOMENCLATURE AND TAXONOMY

With the exception of five species that occur in the Pacific Northwest, all North American crayfish species belong to the family Cambaridae. The family Cambaridae is the largest of the three currently recognized families of freshwater crayfishes and of its roughly 400 species, 99% occur in North America. Originally described as *Cambarus indianensis* by William P. Hays (1896), the Indiana crayfish was later transferred to the genus *Orconectes* in Hobbs' (1942) generic revision of the crayfish subfamily Cambarinae. Fitzpatrick (1987) proposed a subgeneric classification system for the genus *Orconectes* and assigned all members of the genus into one of ten subgenera on the basis of reproductive structure morphology. *Orconectes indianensis*, along with *O. limosus* and *O. wrighti*, were assigned to the subgenus *Faxonius* (Fitzpatrick, 1987). Males members of the three species assigned to the subgenus *Faxonius* possess a form I pleopod with short (less than 20% of total length of pleopod) terminal elements that diverge from one another at an angle of approximately 20 degrees.

DESCRIPTION OF SPECIES

Orconectes indianensis is a relatively small species of crayfish, rarely exceeding 40 mm in carapace length (measured from posterior edge of carapace to anterior tip of rostrum). The species has an excavated rostrum that is slightly downturned anteriorly, a long acumen, a small median carina, and margins that slightly converge anteriorly. Its carapace is flattened dorsoventrally, has large cervical spines, and an areola whose width is 15 – 20% of its length. Chelae are large and heavily punctate, and lack a gap at the base of its fingers. Chelae possess two to three rows of tubercles along the mesial margin of the palm, the mesialmost row of tubercles usually has 7 to 9 tubercles. The form I (reproductively mature) male pleopod terminates in two short elements that are distally tapering and strongly divergent.

Like most crayfishes, the overall color of *Orconectes indianensis* is somewhat variable. The dorsal and lateral surfaces of the carapace and abdomen are usually dark brown to yellow brown. The dorsal surface of the abdomen and posterior edge of carapace usually has darker brown patches or small flecks. The dorsal surfaces of the chelae match the overall base color of the carapace and abdomen and have small, dark brown flecks scattered randomly. Fingers of chelae have red tips and subdistal black bands of approximately the same width.

LIFE HISTORY

Other than anecdotal observations, very little life history data exist for *Orconectes indianensis*. Only three papers discuss life history attributes specific to the species: Brown (1955), Page (1985), and Page and Mottes (1995). Like most Midwestern species in the genus *Orconectes*, fertilization in the Indiana crayfish most likely occurs in the early spring and fall. In Illinois, Brown (1955) collected form I males in September and November while Page (1985) collected them in the months of March, August, September, and October. Page and Mottes (1995) collected form I's in June and July from Indiana. However, copulation during the summer months rarely occurs (Hobbs III, 1991), as most species wait for the onset of cooler water temperatures and/or shorter daylight hours. Ovigerous females (females with fertilized eggs attached to the periopods on the underside of their abdomens) have only been reported in March and April (Page, 1985). The number of eggs carried by the female is positively correlated with carapace length (CL). Page (1985) counted 121 eggs on a female measuring 26.3 mm CL, 148 eggs on a 27.7 mm CL female, and 178 eggs on a 32.2 mm CL specimen. Page (1985) also suggested a two-year life span and a sex ratio of approximately 1 to 1.

The following information has not been reported specifically for *O. indianensis*, but most likely applies to the species given the lack of variation in Cambarid life cycles. The occurrence of form I males and ovigerous females of *O. indianensis* from the dates listed above also support the following generalizations. On average, females carry their eggs for three to four weeks, with the release of juveniles most likely occurring in April and May. Since female crayfishes are known to store viable sperm for several months, fertilized eggs carried by females may be from copulations that occurred either the previous fall or only a few weeks prior to extrusion. Females will only raise a single clutch of eggs per season. New evidence also suggests that female crayfishes in the genus *Orconectes* may mate with multiple partners and carry offspring sired by more than one male (Walker et al. unpublished data).

HABITAT

The Indiana crayfish lives in rocky riffles and pools of small to medium-sized streams (Page, 1985). In Illinois and Indiana, the Indiana crayfish usually occurs in first, second, or third order streams. Within these streams, the species is frequently found under rocks and in woody debris. Brown (1955) reported finding some Indiana crayfish in shallow

(“several inches”) burrows under rocks in streambeds. Page and Mottesi (1995) reported collecting the species exclusively from sites with water depths less than 50 cm.

DISTRIBUTION AND ABUNDANCE

The Indiana Crayfish occurs in the lower Wabash and Ohio river drainages in extreme southeastern Illinois and southwestern Indiana (Fig. 1).

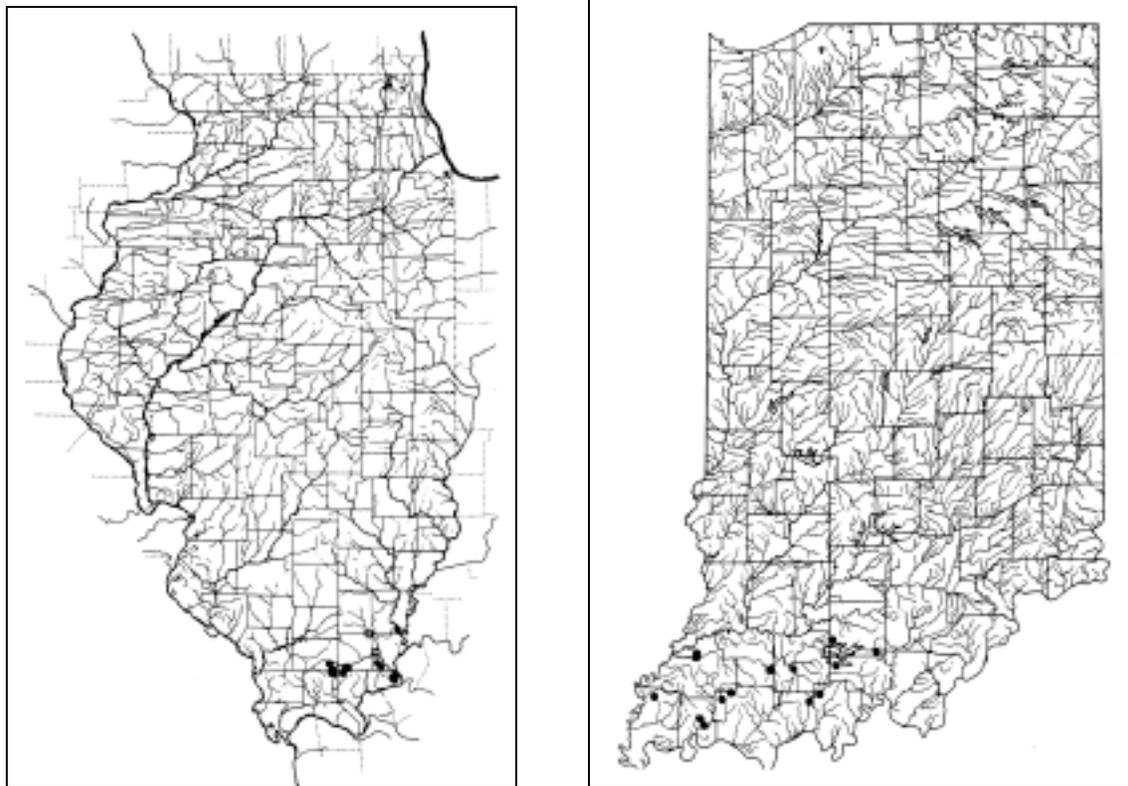


Figure 1. Range of the Indiana crayfish, *Orconectes indianensis*, in Indiana and Illinois. Maps from Page and Mottesi (1995).

In Illinois, the species is historically known to occur in Brushy Slough (Wabash River drainage), the Saline River drainage, and Honey and Rock Creeks (Ohio River drainage). It is known from the following counties and streams in Illinois: Gallatin County—Eagle Creek and Robinette Creek; Hardin County—Honey Creek, Sheridan Branch, and Rock Creek; Johnson County—Clifty Creek and Sugar Creek; Pope County—Burden Creek; Saline County—Little Saline River and Rock Branch; White County—Brushy Slough; and Williamson County—South Fork Saline River and Sugar Creek.

In Indiana, the Indiana crayfish is historically known to occur in the Patoka and Black river drainages (Wabash River drainage) and in the Ohio River drainage from Pigeon Creek in Vanderburgh Co. to the Anderson River in Perry Co. It is known from the following counties and streams in Indiana: Crawford County—tributary of Patoka Lake;

Gibson County—Patoka River and Robb Creek; Orange County—Bacon Creek and tributary of Patoka River; Perry County—Anderson River; Pike County—tributary of Patoka River; Posey County—tributary of Black River; Spencer County—Hurricane Creek; Vanderburgh County—tributary to Pigeon Creek, Locust Creek, tributary to Locust Creek; and Warrick County—Big Creek and Pigeon Creek.

Range-wide abundance values for the Indiana crayfish are not available. Site specific abundance values are available from Page (1985) and Page and Mottes (1995). The data presented by these authors indicate that at some sites with suitable habitat the Indiana crayfish occurs commonly. At a site on Honey Creek near Lamb, Hardin Co., IL, 51 specimens were collected on 23 March 1973. More recently, 22 individuals were collected from Sugar Creek near Creal Springs, Williamson Co., IL on 16 June 1993. In Indiana, a site on Bacon Creek near Bacon, Orange Co. and one on a tributary of Patoka River near French Lick, Orange Co. yielded 36 and 22 specimens, respectively, on 14 July 1993. Anecdotal observations made by the author at a site on Clifty Creek, Johnson Co., IL on 20 September 1994 found the species to occur at a density of approximately 15 individuals per m² of cobble habitat. Return visits to this same site on 20 May 1998 and 13 April 2002 yielded densities of approximately 4 individuals per m².

STATUS

The overall status of the Indiana crayfish appears to be stable. In Illinois, the species appears to have been extirpated from a portion of its range (North Fork Saline River drainage). However, that extirpation occurred sometime prior to Page (1985) and Page and Mottes (1995) concluded that the species' distribution in Illinois had not changed significantly in the preceding two decades. A statewide survey of crayfishes has never been conducted in Indiana and only six pre-1980 collections of the Indiana crayfish are known to exist in museum holdings. Given this lack of historical collections from the state, it is difficult, if not impossible, to determine if changes in the species' distribution and status has occurred. Page and Mottes (1995) found the species to be "common" in southern Indiana. It should be noted that nine years have elapsed since Page and Mottes (1995) conducted their field surveys for *O. indianensis*. Given the lack of intensive surveys for the species since then, any recent changes in the species' status would have gone undetected.

In Illinois, the Indiana crayfish is listed as State Endangered by the Illinois Endangered Species Protection Board. The State of Indiana does not recognize any conservation status for crayfishes. However, Simon (2001) recently recommended that the species be considered as State Special Concern since its primary distribution is in areas severely impaired by anthropogenic disturbances.

POTENTIAL THREATS

The primary threats to the continued existence of the Indiana crayfish fall into two main categories; habitat alteration and the introduction of non-native species. Currently, there

are no known diseases that could adversely affect the Indiana crayfish nor is there a high likelihood that overutilization for commercial, recreational, scientific, or educational purposes could occur.

HABITAT ALTERATION

Habitat alteration can take many forms, several of which have and potentially could affect the Indiana crayfish. While toxicological data pertaining to the effects of pollutants on the Indiana crayfish is nonexistent, circumstantial evidence suggests that the species is sensitive to water quality changes. That portion of the species' Illinois range (North Fork Saline River drainage) in which it no longer occurs is among the most damaged in Illinois (Page 1985). Smith (1971) reported that the drainage suffered from strip-mine and oil-field runoff and pollution. Simon (2001) pointed out that drainages in southern Indiana within which the Indiana crayfish occur are prone to land use alterations from oil and gas explorations, acid mine drainage, and coal mining. These factors support the legitimacy of the threat of water quality degradation from mining and industrial activities should they continue within the species' range. Without toxicological data for the Indiana crayfish, it is at this time unknown which chemical substances pose the greatest threats to the species.

As the Indiana crayfish occurs in stream habitats with coarse substrates such as gravel and cobble, water quality pollution in the form of siltation and stream channelization/debris or substrate removal pose additional threats. The species uses the spaces under rocks and woody debris for refuge from predation. These spaces would be made unavailable if overlaid by high levels of silt. Poor agricultural techniques and/or the removal of riparian buffer strips along stream margins represent the greatest source of increased silt loads in streams containing *O. indianensis*. The removal of woody debris through activities aimed at improving watershed drainage and the removal of bottom substrates by instream gravel and cobble mining could adversely affect the species. As mentioned above, the species uses woody debris and cobble for refuge. Removal of such habitat components would significantly increase predation rates.

The final category of habitat alteration that represents a threat to the Indiana crayfish is stream impoundment. The species occurs exclusively in flowing streams. While the species is occasionally encountered in slower flowing pools of streams, faster flowing riffle habitat is always found in adjoining stream reaches. Conversion of long stretches of lotic habitat to lentic conditions through stream impoundment would render that habitat uninhabitable by the Indiana crayfish. In addition to a fundamental change in habitat structure, stream impoundment could alter suitable Indiana crayfish habitat by increasing benthic silt loads and providing more desirable habitat for crayfish predators, mainly centrarchid sunfishes. If large enough for recreational fishing, the construction of reservoirs on streams containing the Indiana crayfish also substantially increases the risk for non-native crayfish introductions (see below).

NON-NATIVE INTRODUCTIONS

The impact of non-native crayfishes on native crayfish species has been substantial and overwhelmingly negative (Lodge et al., 2000). In North America, there are numerous documented examples of the effects of non-native crayfishes (Lodge et al., 2000), with most examples involving the rapid displacement of native crayfish species. In northern Wisconsin the introduction of the rusty crayfish, *Orconectes rusticus*, has led to a greater than 50% reduction in the number of native populations of the virile crayfish, *O. virilis*, with some populations being entirely eliminated (Lodge et al., 2000; Olsen et al., 1991). The same situation is also occurring in northern Illinois; however, in that region the native northern clearwater crayfish, *Orconectes propinquus*, is being rapidly displaced by *O. rusticus* (Taylor and Redmer, 1996). Non-native crayfishes can also carry pathogens harmful to native species. In Europe, *Pacifastacus leniusculus*, a species native to northwestern North America, has been responsible for the spread of the fungal crayfish plague *Aphanomyces astaci*. The crayfish plague, endemic to North America species and lethal to European species, has reduced populations of native European crayfish species by as much as 90% in some regions (Lodge et al., 2000).

Several mechanisms by which non-native crayfishes displace natives have been elucidated. Those include competition, predation, and reproductive interference (Lodge et al., 2000; Perry et al., 2002). In North America, the most common pathway for the introduction of non-native crayfishes has been through their use as fishing bait. Other pathways that have been documented in North America and abroad include legal and illegal stocking, aquaculture escape, and aquarium and pond trade escape (Lodge et al., 2000).

LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

Approximately five known Indiana crayfish populations occur in streams which flow through land under the ownership of the United States Department of Agriculture Forest Service. These sites fall within the Shawnee National Forest in southern Illinois and the Hoosier National Forest in southern Indiana. Populations of the species most likely occur in parts of the following streams flowing through the Shawnee National Forest property; headwater tributaries of the Eagle Creek drainage (Gallatin Co.), tributaries of and the Little Saline River (Pope and Johnson counties), Rock and Haney Creek drainage (Hardin Co.), and a 3/4 mile stretch of Sugar Creek approximately 4 miles northeast of Creal Springs (Williamson Co.). The exact number of stream miles with suitable Indiana crayfish habitat occurring on Forest Service property is unknown.

Within the Hoosier National Forest, the species is known to occur in Bacon Creek (Orange Co.). The Indiana crayfish has also been collected from the upper Anderson River in Perry Co. Mitchell and Sigler creeks (Crawford and Perry counties), both tributaries of the Anderson which flow through Hoosier National Forest property, could potentially harbor populations of the species. The exact number of stream miles with

suitable Indiana crayfish habitat that occurs on Forest Service property is unknown. Approximately 18.75 river miles of suitable Indiana crayfish habitat falls within the Patoka River National Wildlife Refuge and Management Area and is under ownership of the United States Department of Interior. Outside of these major federal land holdings, the majority of the remainder of the Indiana crayfish's range is owned by private parties too numerous to list.

Indiana crayfish habitat that falls within the Shawnee National Forest receives protection under the Amended Land and Resource Management Plan (USDA FS, 1992). Under that Plan, the Forest Service is directed to "protect and/or manage habitat to ensure the continued existence" of the Indiana crayfish. Specifically, the plan calls for the protection of all pool/riffle complexes in streams known to contain the species from activities that may result in habitat degradation.

While not currently listed as a Regional Forester's Sensitive Species (RFSS), in the Hoosier National Forest, Indiana crayfish habitat is afforded some protection under the Land and Resource Management Plan for that Forest (USDA FS, 1991). Under this Plan, riparian strips 50 – 100 feet wide that border streams are to be protected and managed to enhance water quality and within-stream habitats. The Plan also bans commercial timber harvest within riparian strips and the instream mechanical removal of sand, gravel, or other minerals within management zones.

PAST AND CURRENT MANAGEMENT AND CONSERVATION ACTIVITIES

Other than the habitat protection measures listed above under **LAND OWNERSHIP AND EXISTING HABITAT PROTECTION**, the only other known conservation activities directed towards the Indiana crayfish comes from its listing as Endangered under the Illinois Endangered Species Protection Act (IESPA). The IESPA prohibits the possession, taking, transportation, sale, offer for sale, or disposal of any listed animal without a permit issued by the Illinois Department of Natural Resources (IESPB, 1999). These protective measures apply to both private and governmental parties and are only afforded to Illinois populations of the species. Indiana populations of the Indiana crayfish receive no such protection as that state does not recognize any conservation status for crustaceans.

MANAGEMENT AND RESEARCH PRIORITIES

Management

Continued protection of existing suitable habitat for the Indiana crayfish must be a management priority. Evidence suggests that without clean, coarse substrates in flowing habitats, the species will not persist. In addition, decreased water quality from siltation and toxic substance runoff may adversely affect the species.

Management activities within the watersheds known to contain the Indiana crayfish must minimize or eliminate:

- 1) the impoundment of flowing streams,
- 2) the instream removal of gravel/cobble substrates and woody debris, and
- 3) the input of runoff from agricultural and industrial activities.

A prudent management activity would also be to discourage the use of crayfish as bait and ban the interbasin transfer of aquatic species on publicly owned property. The effects of non-native crayfishes are well documented and the introduction of a species such as the rusty crayfish into the narrow range of the Indiana crayfish would have disastrous results.

Research

Life-history and population data specific to the Indiana crayfish is lacking. A detailed life-history study should be conducted with the goal of determining exact breeding season, breeding behavior, clutch size, longevity, and diet of the species. Data gathered from such a study will assist in estimating total population size and determining if crucial resources or more sensitive life-history stages exist for the Indiana crayfish.

In a Species Data Collection Form prepared for the USDA Forest Service by J. Sipiorski of Southern Illinois University in 2002, it was suggested that two major subpopulations of the Indiana crayfish exist. According to that document, the Wabash River might act as a barrier to dispersal and divide the total range of the species into one population west of the Wabash River and the other occurring to the east of the River. An analysis of the level of genetic variation within the range of the Indiana crayfish is therefore suggested. A study of this type would determine if genetically distinct subpopulations occur and what, if any, steps would be required to preserve the genetic diversity of the species.

Finally, it is suggested that continued monitoring of the Indiana crayfishes' distribution and status be conducted. Monitoring activities should involve continued sampling of historical localities to determine if local populations are persisting and what, if any, threats are pressuring those populations. As of this writing, the city of Marion, Illinois is on schedule to construct a large reservoir on Sugar Creek (South Fork Saline R. dr.) in Johnson and Williamson counties. The Indiana crayfish occurs in Sugar Creek and the construction of a reservoir that will receive fishing pressure on that stream creates a potential pathway for the introduction of non-native crayfishes into the range of *O. indianensis*. Field sampling of historical sites would provide the first warning of non-native crayfish introductions. It is also suggested that field surveys be conducted in undersampled streams in the Shawnee and Hoosier National Forests to determine if previously unknown populations of the Indiana crayfish exist.

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