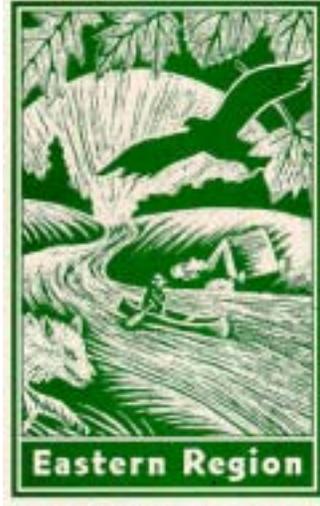


*Conservation Assessment  
for  
A Crayfish (*Orconectes placidus*)*



*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*This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation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 crayfish *Orconectes placidus* was first described by Herman Hagen in 1870. The species has a wide range, occurring in the Cumberland, Tennessee, and lower Ohio river drainages in Tennessee, Kentucky, and Illinois. It occurs in small to large creeks and rivers over substrates of gravel and cobble. Since the species has a wide range, threats to its continued existence are low. However, threats to localized populations 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 placidus* by Herman Hagen (1896), the species 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 placidus*, along with 21 other species, were assigned to the subgenus *Procericambarus* (Fitzpatrick, 1987). Males members of species assigned to the subgenus *Procericambarus* possess a form I pleopod with long (greater than 30% of total length of pleopod) terminal elements that are straight for most of their length and subparallel to one another.

## DESCRIPTION OF SPECIES

*Orconectes placidus* is a relatively large species of crayfish in the genus *Orconectes*. Adults of the species average 30 to 35 mm in carapace length (measured from posterior edge of carapace to anterior tip of rostrum), however, individuals exceeding 40 mm CL are frequently encountered. The species has an excavated rostrum, a long acumen, a low or no median carina, and rostral margins that are straight or slightly concave and that slightly converge anteriorly. Its carapace is flattened dorsoventrally, has large cervical spines, and an areola whose width is 11 – 15% of its length. Chelae are large and heavily punctate, and have long finger with a distinct gap at their bases. Chelae also have two to three rows of tubercles along the mesial margin of the palm. The form I (reproductively mature) male pleopod terminates in two long elements that are distally tapering and on average are 35% of total length of pleopod. The mesial process is straight while the

central projection is slightly arched caudistally and whose distal tip overhangs the mesial process.

Like most crayfishes, the overall color of *Orconectes placidus* is somewhat variable. The dorsal and lateral surfaces of the carapace and abdomen are usually light brown to yellow brown. The cephalothorax has two dark brown saddles running over the dorsal surface and down both sides. One saddle is centered on the cervical groove while other is centered on the cephalothorax/abdomen junction. The dorsal surface of the abdomen occasionally has darker brown patches. The dorsal surfaces of the chelae match the overall base color of the carapace and abdomen and have a thin, dark bar running lengthwise along the lateral margins. Fingers of chelae have red tips and wide subdistal black bands.

## **LIFE HISTORY**

Other than anecdotal observations, very little life history data exist for *Orconectes placidus*. Only a single paper discusses life history attributes specific to the species, Page (1985). Like most Midwestern species in the genus *Orconectes*, fertilization in *O. placidus* most likely occurs in the early spring and fall. In Illinois, Page (1985) collected form I males from September through January and in March. Ovigerous females (females with fertilized eggs attached to the pereopods on the underside of their abdomens) have been reported in March and late April from Tennessee (Walker et al., unpublished data) and Illinois (Page, 1985). The number of eggs carried by the female is positively correlated with carapace length (CL). Page (1985) counted 12 eggs on a female measuring 15.7 mm CL, 88 eggs on a 20.5 mm CL female, and 134 eggs on a 27.2 mm CL specimen. Page (1985) also suggested a two or three-year life span and a sex ratio of approximately 1 to 1.

The following information has not been reported specifically for *O. placidus*, 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. placidus* 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 *O. placidus* will mate with multiple partners and carry offspring sired by more than one male (Walker et al. unpublished data).

## **HABITAT**

*Orconectes placidus* occupies rocky riffles and pools with scattered cobble or fractured bedrock in small to large-sized streams and rivers (Page, 1985). Within these streams and river, the species is frequently found under rocks or cobble. Large individuals are

occasionally collected from woody debris in slower flowing regions of streams or pools. The species usually occurs at water depths ranging from 0.1 to 1.0 m. In Illinois, *O. placidus* is known only from first, second, or third order streams. Page (1985) reported the species from large river habitats in the Ohio and Mississippi rivers, however, subsequent work has identified those populations as *O. luteus* in the Mississippi (Wetzel and Poly, 2000) and an undescribed species of *Orconectes* in the Ohio (Poly and Wetzel, unpublished data). In Kentucky, the species usually occurs in second to fifth order streams.

## **DISTRIBUTION AND ABUNDANCE**

*Orconectes placidus* is a wide ranging species that occurs in the middle and lower Cumberland and Tennessee river drainages in Kentucky and Tennessee. The species has also dispersed across the Ohio River into Illinois, where it occurs in a single direct tributary of the Ohio, the Big Creek drainage in Hardin Co. (Fig. 1). As stated above the Mississippi River records from Randolph and Jackson cos. and the Ohio River records from Massac and Pulaski cos. reported by Page (1985) have been re-identified as *O. luteus* and *O. sp.* respectively. In Kentucky the species occurs commonly throughout the Cumberland River drainage from Whitley Co. to near its mouth in Caldwell Co. The species also occurs in the Clarks River drainage (Tennessee R. dr.) in western Kentucky. In Tennessee, the species occurs commonly in the middle Cumberland River drainage and in the Tennessee River drainage downstream of Cypress Creek (Wayne Co.).

Range-wide abundance values for *O. placidus* are not available. Field observations made by the author at sites across Kentucky and Tennessee in past 5 years indicate that the species is one of the most common crayfishes at sites with suitable habitat, occurring at densities of over 5 individuals per m<sup>2</sup>. The species has only been collected on a few occasions in the past five years in Illinois; 6 individuals were collected from a tributary of Big Creek near Karbers Ridge in 2001 while 5 individuals at another site near Gross in that same year. The lack of recent collection records in Illinois is most likely the result of a low level of collection effort, rather than a decline in species abundance.

## **STATUS**

The overall status of *O. placidus* is stable. In Kentucky and Tennessee, collections made by the author (Taylor and Schuster, unpublished data; Illinois Natural History Survey Crustacean Collection Database) from 1997 to 2002 indicate that the species still occurs commonly in its historical range. In Illinois, *O. placidus* continues to persist in the Big Creek drainage, however, it is unknown if the total population in that drainage has experienced significant changes in the recent past.

In Illinois, *O. placidus* is listed as State Endangered by the Illinois Endangered Species Protection Board (IESPB, 1999). Its listing as Endangered is due mainly to its limited distribution in the State. The Commonwealth of Kentucky does not officially recognize any conservation status for crayfishes and the species is not listed as in need of conservation attention by the appropriate state agencies in Tennessee.

## POTENTIAL THREATS

Given *O. placidus*' wide range in two major river drainages (Cumberland and Tennessee), there are no current or potential threats in the foreseeable future to its continued existence. However, threats to the continued existence of localized populations such as the one inhabiting the Big Creek drainage of Illinois are real and fall into two main categories, habitat alteration and the introduction of non-native species. These threats are discussed below. Currently, there are no known diseases that could adversely affect the *O. placidus* 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, including water quality changes from point source pollution, substrate removal/stream channelization, and stream impoundment. While toxicological data pertaining to the effects of pollutants on *O. placidus* is nonexistent, circumstantial evidence suggests that other species in the genus *Orconectes* are sensitive to water quality changes. Page (1985) reported that strip-mine and oil-field runoff and pollution may have contributed to the extirpation of several populations of the Indiana crayfish, *O. indianensis*, in Illinois. With this in mind, it seems prudent to assume that large influxes of pollutants into streams inhabited by *O. placidus* would be detrimental to it.

As *O. placidus* 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. placidus*. 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 *O. placidus* 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 *O. placidus*. In addition to a fundamental change in habitat structure, stream impoundment could alter suitable *O. placidus* 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

*O. placidus* could also substantially increase 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**

In Illinois, most of *O. placidus*' range occurs on land under the ownership of the United States Department of Agriculture Forest Service, falling within the Shawnee National Forest. Upstream of the Township 12 south, Range 8 east, section 8 and 9 boundary line across Big Creek (Hardin Co.), the USDA owns most of the land over which Big Creek and its tributaries flow. This includes Goose and Hogthief creek, both of which are known to harbor populations of *O. placidus*. The species is also known to occur in lower Big Creek (T12S, R8E, sec. 21) which is in private ownership.

*Orconectes placidus* 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 *O. placidus*. 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.

In Kentucky and Tennessee *O. placidus*' known range encompasses several thousand square miles. As such, it is not feasible to list all of the public and private entities that own land within the species' range. One noteworthy exception is that portion of the Cumberland River drainage between the Big South Fork's confluence with the Cumberland River in Pulaski County, KY and the Cumberland River at Williamsburg in Whitley County, Kentucky. Most this region is in the ownership of the United States Department of Agriculture Forest Service, falling within the Daniel Boone National Forest. The species is known to occur sporadically in this portion of the Cumberland River drainage (Taylor and Schuster, unpublished data).

## **PAST AND CURRENT MANAGEMENT AND CONSERVATION ACTIVITIES**

Other than the habitat protection measure listed above under LAND OWNERSHIP AND EXISTING HABITAT PROTECTION, the only other known conservation activities directed towards *O. placidus* 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.

## **MANAGEMENT AND RESEARCH PRIORITIES**

### **Management**

Continued protection of existing suitable habitat for *O. placidus* must be a management priority, especially in regions known to harbor isolated populations such as the Big Creek drainage in southern Illinois. This disjunct population occurs approximately 40 air miles from the next nearest population of *O. placidus* in the lower Cumberland River drainage of Kentucky. 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 *O. placidus* 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 Illinois range of *O. placidus* would have disastrous results.

## RESEARCH

Life-history and population data specific to *O. placidus* 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 *O. placidus*.

The Illinois populations of *O. placidus* are separated from the bulk of the species' known range in Kentucky and Tennessee by the Ohio River. Big Creek is separated from the mouths of the Cumberland and Tennessee rivers by approximately 35 river miles. The Ohio River has acted as a barrier to dispersal for several other species of *Orconectes* (*O. bisectus*, *O. margorectus*, and *O. tricuspis*) that occur in western Kentucky but not southern Illinois or Indiana. An analysis of the level of genetic variation within the range of *O. placidus* is therefore suggested. A study of this type would determine if the Big Creek populations of *O. placidus* are genetically distinct from Cumberland and Tennessee river populations in Kentucky and Tennessee and would thus require an increased level of conservation recognition.

Finally, it is suggested that continued monitoring of *O. placidus*' distribution and status be conducted, especially in the disjunct Big Creek drainage. 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. Two reservoirs that receive recreational fishing pressure occur in the Big Creek drainage, Lake Tecumseh and Whoopie Cat Lake in Hardin Co. Their presence increases the likelihood of a "bait-bucket" non-native crayfish introduction within the drainage. Field sampling and continued monitoring of historical sites would provide the first warning of non-native crayfish introductions.

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