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The Status of Illinois' Rarest Fishes And Crustaceans

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ABSTRACT

Museum records are combined with field sampling to assess the status of 17 species of fishes and crustaceans in Illinois. These species are among the rarest of those listed on the "Checklist of Endangered and Threatened Animals and Plants of Illinois" and are known from only one or a few localities. As a result of our assessment, we recommend that all 10 species of fishes and four of the seven species of crustaceans investigated be treated by resource managers as endangered in Illinois.

INTRODUCTION

The rarest species on the "Checklist of Endangered and Threatened Animals and Plants of Illinois" (Illinois Endangered Species Protection Board 1999) are known from only one or a few localities. Although on the official list, the status of several of these species is unknown because of the paucity of recent information. Inadequate information is particularly characteristic of aquatic organisms, which are difficult to observe and often require taxonomic expertise available from only one or a few scientists. With funding provided by the Illinois Endangered Species Protection Board, we undertook a concerted effort to determine the status of extremely rare fishes and crustaceans in Illinois by reviewing the literature and museum records and by conducting additional fieldwork. The new information will contribute to improved habitat management and other protective measures.

Illinois is on the edge of the natural range of several of these species (e.g., the river chub, *Nocomis micropogon* and harlequin darter, *Etheostoma histrio*), and they may always have been uncommon in the state (Smith 1979). Consequently, it may seem that these species should receive lower priority for protection than is given to those that have disappeared over large areas of Illinois (e.g., the bigeye chub, *Hybopsis amblops*). However, populations on the edge of a species' range often are the most genetically divergent (Avise 2000) and their protection should be of special concern.

METHODS

Museum specimens of the target species were re-examined for agreement with reports in the scientific literature. As demonstrated by Warren and Burr (1988) in their reassess-

ment of the Illinois ranges of the bigeye chub, *Hybopsis amblops*, and the pallid shiner, *Hybopsis amnis*, misidentifications can be made by even the most competent taxonomists, and museum specimens provide the most reliable record for species occurrences.

All known historical localities for the crustaceans and all known localities where the fishes have been observed since 1960 and presumed extant were revisited, and other habitats with similar characteristics were sampled as time permitted. Sampling methods were those normally used for each target species or that most appropriate for the particular habitat sampled. Most habitats were sampled with dipnets and 10' x 4' minnow seines (1/4 or 3/8-inch mesh); large-river habitats were sampled with 30' x 4' bag seines, backpack shockers, and boat shockers. Disturbance of habitats was kept to a minimum, and no sampling was done with chemicals. In addition to sites visited specifically for the rare species, thousands of other collections have been made in Illinois during the past 20 years by scientists at the Illinois Natural History Survey (INHS) and Southern Illinois University at Carbondale (SIUC) and Illinois Department of Natural Resources streams biologists. Vouchers from these collections are deposited at INHS and SIUC. Conclusions about the statewide status of species are based on this larger collecting effort.

The most likely threats to long-term survival of each species studied are identified below. Threats include habitat degradation resulting from agricultural practices that result in large releases of silt, fertilizers, pesticides, and animal wastes into streams; dams; stream channelization; artificial stocking of predators such as northern pike and largemouth bass; and removal of native vegetation from riparian zones and destruction of wetlands which normally function as filters and reduce amounts of chemicals and silt reaching the river. The detrimental impacts of these forms of habitat degradation on native organisms have been studied at length and are reviewed in Smith (1971), Karr & Gorman (1975), Neves & Angermeier (1990), Detenbeck et al. (1992), Allan (1995), Moyle (1995), Cushing (1997), Page et al. (1997), and Cushing & Allan (2001).

RESULTS – FISHES

1. Northern Brook Lamprey, *Ichthyomyzon fossor* (Currently listed as State Endangered - Illinois Endangered Species Protection Board 1999)

The northern brook lamprey was collected in the Kankakee River, west of Momence, Kankakee County, in October 1963 (INHS 64406), at Aroma Park, Kankakee County, in June 1966 (INHS 5689), and south of Illinois, Kankakee County, on 10 September 1975 (INHS 26740). No other specimens for Illinois records of this species have been vouchered, although a sighting of the species was recorded for the Kankakee River near Rt. 50 in Kankakee, Kankakee County, in 1991 by Mr. Glen Kruse of the Illinois Department of Natural Resources, and the species recently was found (16 May 2001) in the Kankakee River in Indiana (INHS 90911).

The northern brook lamprey is known in Illinois only from the Kankakee River. Elsewhere, it occurs in southern Canada and the northern U.S. from the St. Lawrence River, Quebec, westward through the Great Lakes and northern Mississippi River basins to the Red River (Hudson Bay drainage) in southern Manitoba, in the Ohio River drainage of Pennsylvania, West Virginia, Kentucky, Ohio, and northern Indiana, and in the Missouri and Meramec River drainages in the Missouri Ozarks (Page and Burr 1991). The species

is highly localized throughout its range but can be locally common (e.g., in northern Missouri – Pflieger 1997). Adults live in clean, clear gravel riffles and runs of small rivers; ammocoetes (larval lampreys) live in quiet water over sand, silt, and debris.

Ichthyologists and fishery biologists have repeatedly sampled habitats of the Kankakee River in recent years, but no northern brook lampreys have been found. Efforts specifically directed at finding lampreys were made by INHS staff and IDNR streams biologists in 1994, 1998, 1999, and 2000. The Kankakee River at Aroma Park was sampled in 1994 and 2000, at Momence in 1999 and 2000, at Route 50 in 1998 and south of Illinois in 2000. Efforts included the use of backpack shockers, boat shockers, minnow seines, and bag seines. The fact that no lampreys were found suggests that the species is extremely rare or is extirpated from the Illinois portion of the Kankakee River. However, the northern brook lamprey is a difficult species to locate and still is present in the Kankakee River in Indiana just upstream of Illinois. In our opinion, the species is likely to be in the Kankakee River in Illinois and should remain protected as an endangered species.

Extant Illinois Populations: (1) Kankakee River, Kankakee County – status uncertain, but records in adjacent Indiana suggest that the species still occurs in Illinois.

Threats to Survival: Habitat degradation resulting from agricultural practices that result in large releases of silt, fertilizers, pesticides, and animal wastes into streams; stream channelization; artificial stocking of predators such as northern pike, largemouth bass, and bluegills. The negative impacts of toxicants and silt have been increased by the removal of native vegetation from riparian zones and destruction of wetlands, which would otherwise function as a filter and reduce the amounts of chemicals and silt reaching the river.

2. River Chub, *Nocomis micropogon* (State Endangered)

The river chub is known from Illinois only from two rivers, the Wabash River and the Little Vermilion River (Smith 1979, Burr et al. 1988, Burr et al. 1996). Both collections from the Wabash River were made in 1964; specimens were obtained southeast of Heathsville in Lawrence County on 28 August (INHS 9073), and north of Darwin in Clark County on 4 October (INHS 2483). Collections from the Little Vermilion River were made north of Humrick in Vermilion County in 1987, 1989, and 1992 (INHS 63435; SIUC 15043, 17617, 20720), and from east-southeast of Georgetown in 1989 and 1992 (SIUC 17639, 20609).

All known localities for the species on the Little Vermilion River were seined in 1994, 1996, 1997, 1999, and 2001. Several of these sites also were electroshocked in 1997 and 1999. Several sites on the Wabash River, including known localities for the river chub in Clark and Lawrence counties and were extensively sampled with seines in 1994, 1997, 1998, and 1999. Efforts to find the species in Illinois since 1992 were unsuccessful until one specimen was collected north of Humrick in Vermilion County on 19 May 2001 (INHS 91163).

The river chub ranges from Atlantic Slope drainages to the Wabash River drainage of east-central Illinois. It is common throughout most of its range, including streams in western Indiana. The species is found most often in rocky runs and flowing pools of small to medium rivers.

River chubs are extremely rare in Illinois. The Wabash River is a much larger stream than those in which river chubs normally are found, and individuals collected in the Wabash River may have been strays from tributaries in Indiana. The population in the Little Vermilion River is extremely small. However, habitats in the lower Little Vermilion River seem archetypal for the river chub, and the species may become more common if efforts are made to improve water quality. The river chub should remain protected as an endangered species in Illinois, following the recommendation of Herkert (1994).

Extant Illinois Populations: (1) Little Vermilion River, Vermilion County.

Threats to Survival: Habitat degradation resulting from agricultural practices that result in large releases of silt, fertilizers, pesticides, and animal wastes into streams; stream channelization; removal of native vegetation from riparian zones; introductions of non-native species.

3. Bigeye Chub, *Hybopsis amblops* (State Endangered)

The bigeye chub once was common in east-central Illinois. Records for the late 1800s and early to mid-1900s (through 1961) exist for the Vermilion River, Brouilletts Creek, Embarras River, Little Wabash River, and upper Kaskaskia River drainages (Warren and Burr 1988). However, the only recent records for the species in Illinois are from the Little Vermilion River in Vermilion County (east-southeast of Georgetown, 2 Sept. 1992, 8 July & 22 Sept. 1997, and north of Humrick, 19 May 2001; (SIUC 20608, INHS 41538, 43137, 91162) and the Middle Fork of the Vermilion River (east-southeast Collison, 30 March 2001; INHS 90240). The species has disappeared from all other streams in Illinois.

The bigeye chub occupies the Lake Erie drainage and the Ohio River drainage from New York to eastern Illinois and south to the Tennessee River drainage of Georgia and Tennessee (Page and Burr 1991). The species lives in rocky flowing pools of small to medium rivers and is common throughout much of its range, including streams in western Indiana. It is often found near vegetation. Its demise in Illinois appears to be related to poor agricultural practices that have resulted in large releases of silt, fertilizers, and pesticides into streams (Smith 1971, 1979; Warren and Burr 1988; Page et al. 1997).

The bigeye chub is extremely rare in Illinois. Populations in the Little Vermilion and Middle Fork Vermilion rivers are indicative of the good water quality in these two streams. The bigeye chub should remain protected as an endangered species in Illinois.

Extant Illinois Populations: (1) Little Vermilion River and (2) Middle Fork Vermilion River, Vermilion County.

Threats to Survival: Habitat degradation resulting from agricultural practices that result in large releases of silt, fertilizers, pesticides, and animal wastes into streams; stream channelization; removal of native vegetation from riparian zones; introductions of non-native species. Herbicides appear to have contributed substantially to the loss of aquatic vegetation and thus to the loss of most Illinois populations of the bigeye chub and other fishes

dependent on vegetation for habitat and food organisms (mostly aquatic insects and crustaceans) living on plants.

4. Pallid Shiner, *Hybopsis amnis* (State Endangered)

Although once found throughout Illinois (Warren and Burr 1988), the pallid shiner has been observed at only three localities since 1978: a section of the Kankakee River from Custer Park to Ritchie (many observations between 1978 and 1992; voucher specimens at INHS); the Illinois River, south-southwest of Channahon, Grundy County, 1987-89 (INHS 65295); and the Mississippi River near Cordova, Rock Island County, 12 April 1979 (INHS 27091) and 7 October 1986 (INHS 62318). Only the Kankakee River population is considered large and stable; other populations are extremely small. The demise of the species throughout Illinois appears to be the result of habitat degradation related to the poor agricultural practices that result in large releases of silt, fertilizers, and pesticides into streams, as well as the channelization of otherwise meandering streams, the construction of dams, and urban pollution (Smith 1971, 1979; Warren and Burr 1988; Page et al. 1997). The pallid shiner should remain protected as an endangered species in Illinois.

The pallid shiner occupies the Mississippi River basin from Wisconsin and Michigan south to Louisiana, and Gulf Coast drainages of Louisiana and Texas (Page and Burr 1991). The species is found most often in pools of medium to large rivers. It is fairly common throughout the southern half of its range, but is uncommon to rare in the north.

Extant Illinois Populations: (1) Kankakee River, Will County, (2) Illinois River in the vicinity of Grundy County and (3) Mississippi River in the vicinity of Rock Island County. Note that the collections from the Illinois and Mississippi rivers contained very few specimens and this suggests that its status is uncertain.

Threats to Survival: Habitat degradation resulting from agricultural practices that result in large releases of silt, fertilizers, pesticides, and animal wastes into streams; stream channelization; dams; removal of native vegetation from riparian zones; introductions of non-native species.

5. Pugnose Shiner, *Notropis anogenus* (State Endangered)

The pugnose shiner was originally described from specimens collected in 1880 (Forbes 1885) from the Fox River in McHenry County (INHS 26948, 26949) and was known to occur elsewhere in Illinois only in a floodplain lake near Havana in Mason County where it was collected in 1909 (INHS 85642) and in glacial lakes in Lake County. Glacial lakes where the species has been found, and years of collection, are Fourth Lake, 1892 (INHS 85199), Channel Lake, 1965 (INHS 4101), Grass Lake, 1968 (INHS 4090), Loon Lake, 1968 (INHS 4138), East Loon Lake, 1984 (INHS 68013) and 1985 (INHS 68452), Deep Lake, 1985 (INHS 68441), and Cross Lake, 1986 (INHS 62616).

The pugnose shiner occurred historically in the Great Lakes, Mississippi River, and Hudson Bay basins from eastern Ontario to North Dakota and south to central Illinois (where the species now is extirpated). The species is rare and becoming less common over much of its range (Page and Burr 1991). It usually is found over sand and mud in clear vegetated lakes and vegetated pools and runs of creeks and rivers. The species lives among

aquatic plants and feeds on small crustaceans that live on the plants and on filamentous algae (Becker 1983). The pugnose shiner is one of the rarest fishes in North America and should remain protected as an endangered species in Illinois.

Since 1990, the pugnose shiner has been observed at only four lakes in Lake and McHenry counties in spite of intensive efforts made to find the species in all previously known localities. Populations appear to be extant only in Deep Lake (SIUC 30126), East Loon Lake (INHS 60554), Cross Lake (INHS 60555, SIUC 30219) and Elizabeth Lake (INHS 28421, SIUC 30131).

Extant Illinois Populations: (1) Glacial lakes in Lake and McHenry counties. Populations may survive only in Deep, East Loon, and Cross lakes in Lake County, and in Elizabeth Lake in McHenry County.

Threats to Survival: Removal of native submerged vegetation; introductions of non-native species and stocking of predators such as northern pike, largemouth bass, and bluegills; habitat degradation resulting from releases of fertilizers, pesticides, and silt into streams and lakes (Herkert 1992).

6. Blacknose Shiner, *Notropis heterolepis* (State Endangered)

The blacknose shiner was once widespread throughout Illinois and probably was common in the prairie swales and natural lakes in the northern two-thirds of the state before these habitats were drained (Smith 1979). However, the species has disappeared from most of the state and persists in only a few localities in northern Illinois. All recent records, those since 1970, are from Lake and McHenry counties in extreme northeastern Illinois.

The blacknose shiner occupies the Atlantic, Great Lakes, Hudson Bay, and Mississippi River basins of southern Canada and south to Ohio, Illinois, south-central Missouri, and Kansas. It remains common in some parts of its range (e.g., Ontario, Michigan, and Wisconsin), but is disappearing from many southern localities (Smith 1979, Pflieger 1997, Trautman 1981). It lives in clear, vegetated glacial lakes and sand-bottomed streams.

Based on collections since 1990, the species is extant in McHenry County in Nippersink Creek and Elizabeth Lake. It was collected in Nippersink Creek, northeast of Richmond, 28 April 1992 (INHS 28533), and in Elizabeth Lake, northeast of Richmond, 11 May 1993 (INHS 30667). In Lake County, the species persists in Wooster Lake, Cedar Lake, Loon Lake, East Loon Lake, Bangs Lake, Cross Lake, and Deep Lake. It was collected in Wooster Lake, south of Fox Lake, 14 May 1990 (INHS 60565) and 21 September 1997 (SIUC 30134); Cedar Lake, May 1990 (INHS 60559), 1 June 1992 (SIUC 19753), 14 September 1997 (SIUC 30130), and 2 May 1998 (INHS 45684); Loon Lake, southeast of Antioch, 26 June 1998 (INHS 48939) and 18 August 1998 (INHS 48152); East Loon Lake, north of Lake Villa, 2 May 1998 (INHS 45712); Bangs Lake, 1 July 1998 (INHS 48725); Cross Lake, 26 June 1998 (INHS 48948) and 2 July 1998 (INHS 47211); Deep Lake, east of Lake Villa, 21 September 1997 (SIUC 30128) and 2 July 1998 (INHS 48241).

The blacknose shiner may survive in additional lakes and associated streams in Lake and McHenry counties, but it seems unlikely that it survives elsewhere in Illinois. The decline of this species has been among the most dramatic of any species in Illinois, and the present distribution is a small fraction of the original range of the species. The blacknose shiner should remain protected as an endangered species in Illinois.

Extant Illinois Populations: (1) Nippersink Creek and Elizabeth Lake in McHenry County, (2) Glacial lakes in Lake County, including Wooster Lake, Cedar Lake, Loon Lake, East Loon Lake, Bangs Lake, Cross Lake, and Deep Lake.

Threats to Survival: Removal of native submerged vegetation; introductions of non-native species and stocking of predators such as largemouth bass and bluegills; habitat degradation resulting from channelization, dams, and release of fertilizers, pesticides, and silt into streams and lakes.

7. Taillight Shiner, *Notropis maculatus* (State Endangered)

The taillight shiner has been found in Illinois only in a wetland (= Mud Creek) in Massac County (Burr, et al. 1988). It was first found in Mud Creek, south of Unionville on 15 July 1987 (SIUC 15282), and again at the same locality on 31 July 1987 (SIUC 15356) and 19 July 1988 (INHS 64206). All subsequent attempts to observe the species have been unsuccessful.

Illinois is on the northern edge of the species' range, which extends from southern Illinois to the Gulf Coast and in coastal drainages from North Carolina to Texas. Elsewhere the species is generally uncommon. It usually is found near vegetation in swamps, ponds, and backwater pools of small to large rivers. Additional efforts should be made to confirm the status of the species in Illinois. For now, it should remain protected as an endangered species, following the recommendation of Herkert (1994).

Extant Illinois Populations: (1) Mud Creek, south of Unionville, Massac County – status uncertain.

Threats to Survival: Degradation from agricultural practices that result in large releases of silt, fertilizers, pesticides, and animal wastes into streams.

8. Weed Shiner, *Notropis texanus* (State Endangered)

The weed shiner once occurred widely in Illinois and was found in the Rock, Illinois, and Wabash River drainages (Forbes and Richardson 1909, Smith 1979). It appears to have been fairly common in sandy tributaries of the Illinois River in Morgan and Mason counties. However, the only Illinois records for the species since 1990 are from the Kankakee River system in Kankakee County, and tributaries of the Rock River in a small area of Bureau and Whiteside counties. The weed shiner has been found since 1990 in the Rock River system only in County Ditch No. 1 (Coon Creek), north of Tampico, Whiteside County, 23 May 1990 (INHS 58554); Coon Creek, Whiteside County, 23 May 1990 (INHS 58593); Fairfield Union Special Ditch, west of New Bedford, Bureau County, 24 July 1991 (INHS 27883) and 18 August 1999 (INHS 90411); Fairfield Ditch No. 1, north-northwest of Mineral, Bureau County, 29 July 1991 (INHS 27882) and 18 August

1999 (INHS 90066); and Fairfield Ditch No. 1, southeast of Yorktown, Bureau County, 23 May 1990 (INHS 58602) and 15 July 1999 (INHS 51994).

In the Kankakee River drainage, weed shiners have been collected since 1990 in a tributary of Little Beaver Creek, south-southwest of Hopkins Park, 11 July 1991 (INHS 61084); Little Beaver Creek, south of Hopkins Park, Kankakee County, 11 July 1991 (INHS 61088); a small unnamed tributary of the Kankakee River, east-southeast of Momence, Kankakee County, 17 August 1999 (INHS 52831); and a backwater of the Kankakee River near River Isle, Kankakee County, 25 July 2000 (INHS 56820).

The weed shiner is found in clear water near submerged vegetation in sandy runs and pools of creeks and small to medium rivers. In Illinois and other northern states, the species also may be found in large rivers and the lower reaches of their tributaries. The species ranges from Michigan, Wisconsin, and Minnesota south to the Gulf of Mexico. It is common in the southern part of its range but is rare in Illinois and other northern states (Smith 1979, Becker 1983, Page and Burr 1991, Lyons et al. 2000).

The few streams in which the weed shiner persists in Illinois are restricted to the Kankakee River system and a small area in southern Whiteside and northwestern Bureau County. The populations in the Kankakee system are more widespread but still appear vulnerable to extirpation. Of particular concern, recent efforts to find the species in Little Beaver Creek, where it was found in 1982 and 1991, were unsuccessful. Although the weed shiner still may occur in Little Beaver Creek, this stream and others are in an area of intensive agriculture and are highly vulnerable to degradation.

Given the historical distribution of the weed shiner in Illinois, it appears to be in serious decline and should remain protected as an endangered species. Protecting specific areas of habitat for this species, including Coon Creek/County Ditch No. 1 in Whiteside County and Kankakee River in Kankakee County, seems highly desirable.

Extant Illinois Populations: (1) Tributaries of the Rock River in a small area in southern Whiteside and northwestern Bureau County, (2) Tributaries and backwaters of the Kankakee River in Kankakee County.

Threats to Survival: Siltation, pesticides, and fertilizers from agriculture; removal of water from streams for irrigating fields; removal of native vegetation from riparian zones; introductions of non-native species.

9. Northern Madtom, *Noturus stigmosus* (State Endangered)

The only valid Illinois records for the northern madtom are based on collections made in the Wabash River at Vincennes, Knox County, Indiana (Lawrence County, Illinois) in 1888 (USNM 161721); the Vermilion River, east of Westville, Vermilion County, August 1962 (INHS 12057); and the Ohio River near Joppa, Massac County, 11 October 1997 (SIUC 29386) (Burr and Stewart 1998). The record given by Smith (1979) for the Wabash River near Rochester, Wabash County, was based on a misidentification of the morphologically similar mountain madtom, *Noturus eleutherus* (Thomas 2000).

The northern madtom occupies Lake Erie and Ohio River basins from Pennsylvania to western Kentucky, and Mississippi River tributaries in western Tennessee and northern Mississippi. It lives near woody debris in mixed sand and rock riffles and runs in small to large rivers. The species is uncommon throughout most of its range.

Recent efforts to find the northern madtom in the Vermilion and Wabash rivers, including seining expeditions in Vermilion, Clark, Wabash, and Lawrence counties in 1994, 1997, 1998, and 1999, were unsuccessful. If the species persists in the Vermilion and Wabash rivers, it is extremely rare (Thomas 2000). The northern madtom should remain protected as an endangered species in Illinois.

Extant Illinois Populations: (1) Ohio River near Joppa, Massac County.

Threats to Survival: Dams; stream channelization; introductions of non-native species; habitat degradation resulting from agricultural practices that result in large releases of silt, fertilizers, pesticides, and animal wastes into streams; removal of native vegetation from riparian zones.

10. Harlequin Darter, *Etheostoma histrio* (State Endangered)

The harlequin darter was observed at five localities in the Embarras River in Cumberland County (INHS 16735, 16767, 16853, 16800, 17074) and Jasper County (INHS 9617, 9657) in the 1960s (Smith 1979), and in Coles County in the 1980s (INHS 88477). However, many recent efforts to find the harlequin darter at these localities have been unsuccessful, and the species appears to be extirpated from the Embarras River. The last observation was on 25 October 1983 when one specimen was found just below the Lake Charleston dam, southeast of Charleston, Coles County (INHS 88477).

Smith (1979) postulated that an unvouchered record published by Forbes and Richardson (1909) for the banded darter, *Etheostoma zonale*, in the Wabash River, White County, actually was based on a collection of the harlequin darter. The persistence of the harlequin darter in the Wabash River has been documented by collections made in White and Wabash counties (Burr et al. 1996), and the species also was found recently (8 October 1997) in the Ohio River near Wabash Island at the mouth of the Wabash River, Gallatin County (SIUC 29947). The species was collected or observed in the Wabash River, northwest of Mount Carmel, Wabash County, 29 July 1995 (SIUC 24444); northeast of Maunie, White County, 30 October 1995 (SIUC 24861); east of Maunie, White County, 26 September 1996 (INHS 39006); near Rochester, Wabash County, 22 September 1997 (INHS 42311); near Maunie, White County, 18 September 1998 (SIUC 33497) and 2 October 1999 (INHS staff; no specimens vouchered).

The harlequin darter lives in rocky riffles or among woody debris in sandy and gravelly runs of small to large rivers from central Illinois to the Gulf Coast. Most populations are in streams on the Former Mississippi Embayment. The species is locally common.

The long-term presence of the harlequin darter in a fairly large segment of the Wabash River in Wabash and White counties suggests that a sizeable population exists. However, suitable habitat, which consists of clean rocky riffles or current-swept woody debris, ap-

pears to be scarce, and the species may not occur in areas other than those identified above. The harlequin darter should remain protected as an endangered species in Illinois.

Extant Illinois Populations: (1) Wabash River, Wabash and White counties, (2) Ohio River, Gallatin County.

Threats to Survival: Dams; stream channelization; introductions of non-native species; habitat degradation resulting from agricultural practices that result in large releases of silt, fertilizers, pesticides, and animal wastes into streams; removal of native vegetation from riparian zones.

RESULTS – CRUSTACEANS

11. Amphipod, *Crangonyx antennatus* (State Endangered)

The presumed presence of *Crangonyx antennatus* in Illinois was based on two collections made in 1975 and 1976 in Cave Springs Cave in Hardin County (INHS 2179, 2181). These collections recently were re-identified by Dr. John R. Holsinger of Old Dominion University as *Crangonyx packardi*. According to Zhang (1997), *Crangonyx packardi* occurs throughout the Shawnee Hills in southern Illinois and in Twin Culverts Cave in Pike County (INHS 6617). The presence of *Crangonyx antennatus* in Illinois was based on misidentified specimens. The species with which it was confused, *Crangonyx packardi,* is discussed below.

Extant Illinois Populations: None.

12. Packard's Amphipod, *Crangonyx packardi* (State Endangered)

Crangonyx packardi has been considered a complex of species in need of taxonomic revision (Holsinger 1972). As noted by Zhang (1997), "Earlier references to literally all *Crangonyx* from caves in the Interior Low Plateaus region were this species. However, it is obvious from the present study that several species were once called '*packardi*.'" In his revision of *Crangonyx*, Zhang (1997) identified specimens of *Crangonyx packardi* from several counties (Hardin, Johnson, Saline, and Union) in the Shawnee Hills in southern Illinois, and in Twin Culverts Cave in Pike County (INHS 6617). The species has been found recently (19 April 1997) at Bell Spring in Johnson County (INHS 6548) and, although difficult to collect, almost certainly persists in several caves in the Shawnee Hills. The new information suggests that the species is not endangered in Illinois.

Extant Illinois Populations: (1) Springs and caves in the Shawnee Hills in southern Illinois, (2) Twin Culverts Cave in Pike County.

13. Amphipod, *Crangonyx anomalus* (State Endangered)

Crangonyx anomalus is known in Illinois only from two collections, made in 1974 and 1992, in springs in Pope County (INHS 3458, 6441). One spring drains into Lusk Creek, and the other into Simmons Creek and then into Big Grand Pierre Creek. A return visit to the 1974 site (Lusk Creek), northwest of Golconda in an area known as Reddick Hollow, failed to produce any specimens. However, the area contains terrain difficult to adequately sample, and it is likely that the species, albeit rare, is still there.

This species is easily distinguished by the strongly expanded posterior margins of the pereopod bases. It is fairly common in springs and spring-fed streams in southwestern Ohio and eastern Kentucky; however, it is known to occur in Illinois only in Pope County and in Indiana at only one locality (Zhang 1997). Its restricted occurrence in Illinois and Indiana is difficult to explain.

Crangonyx anomalus was considered to be endangered because it was known in Illinois only from the locality near Golconda. Expanding its known range to a second site suggests that the species is more widespread than previously realized in southeastern Illinois. However, only three specimens have been collected in the state and until more sites can be explored for the species, it should still be considered as endangered in the state.

Extant Illinois Populations: (1) Spring near Gowins, Simmons Creek drainage, Pope County; (and probably extant in one or more springs near Golconda, Lusk Creek drainage, Pope County).

Threats to Survival: No immediate anthropogenic threats are evident. However, the species appears to persist in Illinois in small, highly disjunct populations and may be vulnerable to agricultural chemicals or other pollutants (Herkert 1992).

14. Amphipod, *Gammarus bousfieldi* (State Threatened)

Gammarus bousfieldi is listed as a Threatened Species in Illinois based on specimens collected from the Ohio River (INHS 2189, 3065, 3068, 3074, 3515, 3531). However, a recent comparison by one of us (LMP) of specimens collected from the Illinois portion of the Ohio River with type-specimens of *Gammarus bousfieldi* at the U.S. National Museum indicates that the Ohio River records are based on misidentified specimens of *Gammarus fasciatus*. *Gammarus fasciatus* is native in Illinois only to the Lake Michigan basin and perhaps to the upper Illinois River drainage, and apparently was introduced into the Ohio River around 1973 (Beckett et al. 1998). The introduced population in the Ohio River was referred to taxonomically as *Gammarus bousfieldi* by the Illinois Endangered Species Protection Board (1994, 1999) but is *G. fasciatus*, as noted by Beckett et al. (1998). *Gammarus bousfieldi* is endemic to two small tributaries of the Ohio River in north-central Kentucky (Cole and Minckley 1961; Holsinger 1972). *Gammarus bousfieldi* is not found in Illinois.

The introduction of *G. fasciatus* into the Ohio River is thought to have occurred after, and therefore not to have caused, the disappearance of the native amphipod, *Crangonyx pseudogracilis* (Beckett et al. 1998). *Crangonyx pseudogracilis* disappeared around 1973 following dramatic changes in the physical characteristics of the river caused by the construction of dams. Paradoxically, *Gammarus fasciatus* has not been found in the Ohio River of Illinois since 1981. Several recent attempts, including visits to all known localities in 1999 and 2000 failed to verify the presence of the species. The Ohio River localities where *G. fasciatus* was found are heavily populated by the zebra mussel, *Dreissena polymorpha*. The huge populations of the zebra mussel now in the Ohio River may have depleted the food supply for *G. fasciatus*. The only amphipod recently found (26 April 2000) in the Illinois portion of the Ohio River was *Hyalella azteca*.

The status of *Gammarus fasciatus* in Lake Michigan and the upper Illinois River should be investigated. The recent introduction of a Eurasian amphipod, *Echinogammarus ischnus*, into the Great Lakes has led to the extirpation of *Gammarus fasciatus* from portions of the Lake Erie and Lake Ontario drainages (Dermott et al. 1998) and may cause the extirpation of *G. fasciatus* in Lake Michigan.

Extant Illinois Populations: None.

15. Flat-tailed Groundwater Isopod, *Caecidotea spatulata* (State Endangered)

Caecidotea spatulata was described by Mackin and Hubricht (1940) from a collection made near Dupo in 1937 in St. Clair County (USNM 76270). Fleming (1972) and Peck & Lewis (1978) reported collections from Carroll and DeWitt counties, but Lewis & Bowman (1981) subsequently reidentified these as *Caecidotea kendeighi*. Recent attempts by J. J. Lewis and by us to find *C. spatulata* near the type-locality in St. Clair County have been unsuccessful. In April 2000, Lewis visited 33 sites in St. Clair and Monroe counties, Illinois, and one site in St. Louis Co., Missouri, in an unsuccessful effort to find *C. spatulata* (Lewis 2000).

Caecidotea spatulata has been confirmed at only one locality in Illinois and four localities in three counties in Missouri. Because the species is difficult to observe and collect in its underground habitats, it may be more widespread than these observations suggest. Given the extensive development now occurring in St. Clair County, the species is still considered to be state endangered. Lewis (2000) made the same recommendation.

Extant Illinois Populations: Status unknown.

Threats to Survival: Extensive modification of the landscape as a result of mining operations near the type-locality in St. Clair County, the only known locality for the species in Illinois.

16. Colmar Isopod, *Caecidotea lesliei* (State Endangered)

Caecidotea lesliei was described in 1981 (Lewis and Bowman 1981) from 10 specimens collected from the outflow of a field tile, south of Colmar, McDonough County in 1941 and now housed at the U.S. National Museum (USNM 108578, 172788). The species was not seen again until 1 May 2001 (almost exactly 60 years later!) when four individuals were collected from the same tile outlet (INHS 8624). The species is not known to occur anywhere other than at the type-locality, making it one of the rarest and least geographically distributed species in the world.

Nothing appears to be special about the locality where *Caecidotea lesliei* is found. The surrounding landscape consists almost exclusively of farm fields on low hills that originally were covered with prairie grasses. This species apparently lives in groundwater flowing through unconsolidated glacial drift (White 1991). The flow from the tile drains into the LaMoine River system, which is not known to have other endemic species. Due to its occurrence at a single location, the species is considered endangered in the state.

Extant Illinois Populations: (1) Subterranean aquifer, south of Colmar, McDonough County.

Threats to Survival: Although the species has persisted at this site through decades of farming activities, it is prudent to protect the site from pollution of the groundwater from agricultural fertilizers and pesticides (Herkert 1992).

17. Shrimp Crayfish, *Orconectes lancifer* (State Endangered)

The only known Illinois population of the shrimp crayfish occupies Horseshoe Lake in Alexander County, where it was observed as recently as 1 October 1999 (INHS 7312). A very old record (mid-1800s) exists for Cairo, Illinois (Faxon 1914), but the species appears to be gone from that area. Given the continued degradation of Horseshoe Lake, the species remains endangered in the state.

The shrimp crayfish is an inhabitant of the Gulf Coastal Plain and extends north in the Former Mississippi Embayment to extreme southern Illinois. The species is common in some areas of the southern U.S. but is rare in the northern part of its range (Page 1985, Pflieger 1996). It lives in deep water of oxbows, bayous, and large streams (Black 1972, Page 1985, Pflieger 1996). Horseshoe Lake is an old oxbow of the Mississippi River supporting stands of bald cypress and many Coastal Plain species that are rare in Illinois. Protection of the lake should be an extremely high priority of the Illinois Department of Natural Resources; unfortunately, the lake is managed for fishing and hunting interests with little regard for rare and endangered species that live there.

Extant Illinois Populations: (1) Horseshoe Lake, Alexander County.

Threats to Survival: Degradation of Horseshoe Lake, including removal of native shoreline vegetation, introduction of non-native species, and discharges of silt, fertilizers, and pesticides from farms in the drainage basin.

DISCUSSION

All 10 species of fishes investigated are considered to be endangered in Illinois. All are in danger of extirpation because of human-caused habitat degradation. Localities for surviving populations are identified for eight of the species: river chub, bigeye chub, pallid shiner, pugnose shiner, blacknose shiner, weed shiner, northern madtom, and harlequin darter. Recent records of the northern brook lamprey in Illinois are lacking; however, it is a difficult species to locate and is present in the Kankakee River upstream of Illinois. In our opinion, it is likely to persist in the Illinois portion of the Kankakee River. The taillight shiner has not been found in Illinois since 1988, and additional efforts should be made to confirm the status of the species. In our opinion, a small population is likely to persist in Illinois, and the species should remain protected as an endangered species.

Of the seven species of crustaceans studied, four are considered to be endangered. The only known locality in the world for the Colmar isopod is a field tile south of Colmar in McDonough County. This species has persisted through the transition from native prairie to croplands and appears to be in no particular jeopardy. However, because only one population is known, the species should be considered as endangered. Similarly, the only known Illinois population of the shrimp crayfish occupies Horseshoe Lake in Alexander

County and is endangered. Horseshoe Lake should be managed as habitat for the shrimp crayfish and other rare species.

Crangonyx anomalus is more widespread than previously realized in southeastern Illinois. However, only three specimens have been collected in the state, and *C. anomalus* should continue to be considered an endangered species.

Recent collections of *Caecidotea spatulata* are lacking, and it has been confirmed at only one locality in Illinois. Elsewhere it is known historically only from four localities in Missouri. The species is extremely rare throughout its range and, given the encroachment of mining operations on the only known locality for the species in Illinois, it remains state endangered.

As now understood taxonomically, *Crangonyx packardi* is known from several caves and springs in the Shawnee Hills (Zhang 1997). The species is in no immediate danger of extirpation and not considered endangered. The putative presence in Illinois of *Crangonxy antennatus* and *Gammarus bousfieldi* were based on misidentified specimens and neither are residents of the state.

This new information on the distribution of some of Illinois' most endangered aquatic organisms should result in improved habitat management and other protection measures. For some species, special attention should be given to the limited areas in which they occur. For example, Horseshoe Lake should be managed to benefit the shrimp crayfish and other rare species (Page et al. 1992). The area just south of Colmar, which harbors the only known population of the Colmar isopod, should be considered for acquisition and protection. All of these species will benefit from efforts that stop or reduce habitat degradation. The negative impacts of agricultural toxicants, siltation, and other forms of pollution have been increased by the removal of native vegetation from riparian zones and destruction of wetlands, which would otherwise function as filters and reduce the amounts of chemicals and silt reaching streams. Re-establishment of native riparian vegetation would increase the likelihood of survival of many of these species.

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