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**THE DISTRIBUTION AND RELATIVE ABUNDANCE OF  
LITHASIA PINGUIS (LEA), PLEUROBEMA PLENUM (LEA),  
VILLOSA TRABALIS (CONRAD), AND EPIOBLASMA SAMPSONI (LEA)**

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**ABSTRACT**

Field studies in 1981 showed that *Lithasia pinguis* (Lea) should not be placed on the federal List of Endangered Species because, although it is threatened in the Duck River, it is abundant in the Collins River and its tributaries. *Epioblasma sampsoni* (Lea) is apparently extinct and, regrettably, should probably be removed from that list. *Villosa trabalis* (Conrad) is properly listed as endangered. It is very rare and occurs only in the Cumberland River just below Cumberland Falls and in three tributaries of the Cumberland River in Kentucky. *Pleurobema plenum* (Lea), also endangered, has been reduced to three small populations, one in the Clinch River, another in the lower Tennessee River, and a third in the Green and Barren Rivers near their confluence in Kentucky.

The Green River, which 25 years ago may have been the richest mussel stream in North America, has been severely damaged by planned development. Mussel abundance has been reduced by about 90% and diversity by about 50%. It is urged that efforts be made to restore the middle portion of the Green River to its natural (pre-1958) condition. This can be approximated simply by stopping the practice of allowing cold, turbid water to pass through low outlets in the high dam at Green River Lake and instead by allowing only water from near the lake surface to be discharged.

During the summer and fall of 1981, ECOSEARCH, INC., carried out an investigation for the U.S. Fish and Wildlife Service to determine the present distribution and abundance of *Lithasia pinguis* (Lea, 1852) (Pleuroceridae), *Pleurobema plenum* (Lea, 1840), *Villosa trabalis* (Conrad, 1834), and *Epioblasma sampsoni* (Lea, 1861) (all Unionidae). *Lithasia pinguis* has been proposed for listing on the federal List of Endangered Species and the other species are already included on that list. The information was to be assembled from all possible sources, including field work.

A detailed report (Clarke, 1981) on the results of the work, including tabulations of the number of living and dead specimens of each species observed at each site, and ecological notes, is on file with the U.S. Fish and Wildlife Service, Twin Cities, Minnesota. The major findings, however, are given below. For obvious reasons, specific localities where endangered species still occur are not precisely defined.

**RESULTS**

***Lithasia pinguis*.** Published records for this species include the type locality (Lebanon, Wilson County, Tennessee), the Duck River at Manchester, Coffee County, Tennessee

(Goodrich, 1934), Caney Fork River and its branches (Goodrich, 1940; Burch, 1982), and the Duck River above Manchester, Tennessee and the Collins River below McMinnville, Tennessee (U.S. Department of the Interior, 1977). Published records from the headwaters of the Holston River and the Coosa River (U.S.D.I., *loc. cit.*) are believed to be incorrect. It is believed to be absent from Caney Fork River and it is clear that the Duck River population is endangered by Columbia Dam (Davis, 1974).

A thorough search at 16 localities in the Duck River and its tributaries near and above Manchester revealed only one sparse population of *L. pinguis*. That occurs in a short stretch of the Duck River at Manchester below Big Falls and above the mouth of the polluted Little Duck River. Streams above Manchester are either too slow-moving or too small to support *L. pinguis*, although they do contain a species of *Mudalia* (?) which resembles *L. pinguis*. A similar search of the nearby Collins River and its tributaries showed that *L. pinguis* is very abundant in the main river from above its mouth (which is backed up from the impounded Caney Fork River), throughout its free-flowing course for about 30 miles (48.3 km) upstream to a point 1.1 mi. (1.77 km) ESE of Mount Olive, Grundy Co.; in its major tributary, Big Hickory Creek, upstream for a similar distance (to 1.7 mi. (2.74 km) SSW of

Viola, Warren Co.); and in its smaller downstream tributaries (Little Hickory Creek, Barren Fork Collins River, and Hills Creek).

***Pleurobema plenum***. Reliable records of this rather cryptic species show that it was once widely distributed in the Ohio, Tennessee, and Green rivers and in some of their largest tributaries (Lea, 1840; Ortmann, 1919, 1926; Williams, 1969; Stansbery, 1971; and Ahlstedt, 1980).

Our survey covered 26 localities in the Green and Barren rivers in Hart, Barren, and Warren counties, Kentucky. Empty shells of *P. plenum* occurred at eight sites in the Green River and at two in the Barren, but only one living specimen was found. That occurred in the Green River near Glenmore, Warren County. Shortly thereafter reliable information was received which shows that two other small living populations of *P. plenum* also exist, one in the Clinch River below Kyles Ford, Hancock Co., Tennessee and the other in the lower Tennessee River near Savannah, Hardin Co., Tennessee.

***Villosa trabalis***. The historical distribution of this species spanned more than 100 miles of the Cumberland River, at least from near Burkesville, Cumberland County, Kentucky upstream to Cumberland Falls, McCreary/Whitley counties, Kentucky and included several of its major tributaries from the Obey River in Tennessee to the Rockcastle River in Kentucky (Neel and Allen, 1964; Stansbery, 1971). The Cumberland River was impounded throughout this whole region in about 1950 and several of its tributaries have now been poisoned by acid mine waste or are also impounded.

Shortly after reaching the Cumberland River region I learned that the Kentucky Nature Preserves Commission (KNPC) had recently surveyed much of the area for freshwater invertebrates and that several records for *V. trabalis* were already available. I also examined the specimens on which these records were based, now at the Ohio State University Museum of Zoology, and verified the identifications. It was, therefore, decided to concentrate our efforts in those areas that had not been recently searched. Our field work covered 16 areas and resulted in the discovery of some range extensions and in confirming the presence of *V. trabalis* in Buck Creek, and Rockcastle River, and Little South Fork River. These streams, together with the Cumberland River just below Cumberland Falls (Stansbery, 1970), apparently support the only populations of *V. trabalis* that now exist.

***Epioblasma sampsoni***. Historically, this species occurred in the Ohio River from near Cincinnati to near the mouth of the Wabash River, in the lower Wabash River from near New Harmony, Indiana to the Ohio River, and in the White River, Indiana, presumably near its mouth at the Wabash River (information from specimen-associated data in the major museums of the U.S.). *E. sampsoni* is reported to have occurred only on bars of gravel or sand and never on mud (Sampson in Lea, 1861). Several workers, including the writer, have feared that, as in the Ohio River, impoundments and other habitat disruptions in the lower Wabash and White rivers might have caused the species to become extinct. This opinion was supported by the work of Stansbery (1970, 1971)

and by two recent surveys of the mussels of the lower Wabash (Mayer, 1974; Clark, 1976) during which *E. sampsoni* was not found.

In the fall of 1981 water levels in the Wabash River remained very high and it was impossible to search that large river thoroughly. The combined experience of many local commercial mussel fishermen and dealers, located at numerous localities along the river from near its mouth to Lafayette, Indiana, was therefore utilized. A photograph of *E. sampsoni* was given to each informant and an attractive reward was offered for any information that would lead to the location of a living specimen. A month later the region was revisited and most of the informants were questioned again. On both occasions all informants declared that nothing resembling *E. sampsoni* had been seen in the Wabash River for decades. Only Mr. Virgil Carroll, an elderly mussel dealer in Mount Carmel, Illinois, remembered seeing any specimens of any species of *Epioblasma* (which he called "buzzard head"). These were taken in the lower Wabash River about 40 years ago. His experience has convinced him that they, and in addition the squaw foot (*Strophitus undulatus*) and the rabbit's foot (*Quadrula cylindrica*), are now extirpated from the river.

## CONCLUSIONS

The available information indicates that although *Lithasia pinguis* in the Duck River is in jeopardy, as a species it is not endangered throughout its range and it should not be included on the federal List of Endangered Species. In addition, and most regrettably, *Epioblasma sampsoni* should be removed from that list because, as far as can be determined, it is extinct.

*Villosa trabalis* is very rare throughout its range and it is certainly endangered. Careful searches in the streams where it is known to occur usually reveal no living specimens, although one or two of its empty shells are occasionally found. The most productive locality, in Buck Creek, yielded only two living specimens after 2 ½ hours of searching, under excellent conditions, by two experienced collectors. It is recommended that the Rockcastle River, Buck Creek, and Little South Fork Cumberland River all be classified as Wild and Scenic Rivers and that they be protected from pollution and impoundment so that this species, and other rare species that occur there (e.g., *Pegias fabula*), will continue to survive.

The status of *Pleurobema plenum* in the Green River, and of the Green River itself, requires special attention. The Green River has been impounded by a series of six lock and dam structures from its mouth to Mammoth Cave National Park, a distance of about 200 river miles (322 km). A major tributary, the Barren River, has also been impounded from its mouth upstream to Bowling Green, a distance of 40 miles (64.4 km). In 1965 Green River Dam 4, located just below the mouth of the Barren River, was destroyed from impact with a large floating tree. This caused the water levels to decline

upstream from that dam, in both the Green and Barren rivers, to the next lock and dam structure and those reaches to resume a pre-impoundment, free-flowing condition. That is the only region within the Green River System where *P. plenum* now survives.

Above Mammoth Cave National Park the Green River has also been severely altered. That is especially tragic because during the late 1950's that reach contained probably the most diverse mussel fauna—about 50 species—of any river in North America (Stansbery, 1965 and pers. comm.). In 1958 and 1959 the reach from Greensburg, Green County to Mammoth Cave was heavily impacted by oil brine pollution and whole mussel communities were killed (Williams, 1969). By 1968 many species had begun to repopulate that part of the river but in June 1969 a large dam upstream, at what is now Green River Lake, was completed. The immediate effect of that dam on the mussel fauna is unknown, but in the summer of 1981 fishermen at Munfordville, Cave City, and Park City complained that although many species of fishes previously occurred in the river, for about the past ten years fishing had been very poor and only carp, catfish, and suckers could be caught.

In July 1981 we noticed that the river at Munfordville, and above the town, was unusually cold and that a thick layer of silt covered all submerged objects. A visit to Green River Lake Dam soon revealed the reason. Cold, turbid water was being released from below the thermocline through a low outlet in the dam. Enquiries to the Corps of Engineers, the agency which operates the dam, revealed that a program was underway, in coordination with the State of Kentucky, to manage that part of the Green River as a trout stream by maintaining the temperature at  $65 \pm 5^\circ\text{F}$  each year from May to October.

During our survey only 24 species of mussels were found alive in the Green and Barren rivers above Green River Dam 4. Fourteen additional species occurred only as empty shells. All of these are listed below (Table 1). To facilitate comparisons with the survey by Williams (1969), the Green River divisions used by him are used here, viz. Area 1 includes the first riffle just inside the eastern boundary of Mammoth Cave National Park and extends upstream to Green River Lake, and Area 2 extends from below that riffle downstream to Green River Dam 4. The region below Dam 4 was not sufficiently sampled during our survey to make comparisons useful. The total numbers of living specimens which we observed were: Area 1, 249; Area 2, 53; Area B (Barren River), 40.

Species found only as occasional empty shells are (in Areas 1 and 2 only): *Pleurobema coccineum*, *Pleurobema pyramidatum* and *Obovaria retusa*; (in Areas 1 and B only): *Plethobasus cyphus*; (in Area 1 only): *Quadrula metanevra*, *Cyprogenia irrorata*, *Obovaria subrotunda*, *Villosa lienosa*, *Villosa ortmanni*, *Lampsilis anodontoides*, and *Epioblasma triquetra*; (in Area 2 only): *Anodonta grandis*.

If a diverse and thriving mussel fauna, including *P. plenum*, is to survive in the Green River, a healthy and free-flowing riverine environment must be maintained. If Dam 4 is

**Table 1.** Living freshwater mussels observed in the Green River system in 1981.  
(Numbers of specimens expressed as % of total for each area.)

	AREA		
	1	2	B
<i>Actinonaias carinata</i>	71.1	7.5	0
<i>Tritogonia verrucosa</i>	7.2	5.7	5.0
<i>Amblyema plicata</i>	6.8	3.8	22.5
<i>Proptera alata</i>	3.2	9.4	0
<i>Ligumia recta</i>	2.0	1.9	0
<i>Lampsilis ovata</i>	1.6	3.8	0
<i>Ptychobranthus fasciolaris</i>	1.2	17.0	7.5
<i>Cyclonaias tuberculata</i>	1.2	0	7.5
<i>Megalonaias gigantea</i>	1.2	0	2.5
<i>Fusconaia flava</i>	0.8	1.9	0
<i>Lampsilis r. siliquoides</i>	0.8	1.9	0
<i>Elliptio dilatata</i>	0.8	0	0
<i>Elliptio crassidens</i>	0.4	13.2	0
<i>Lasmigona costata</i>	0.4	3.8	15.0
<i>Quadrula pustulosa</i>	0.4	3.8	0
<i>Truncilla truncata</i>	0.4	1.9	0
<i>Leptodea fragilis</i>	0.4	0	0
<i>Plagiola lineolata</i>	0	9.4	2.5
<i>Quadrula nodulata</i>	0	3.8	17.5
<i>Pleurobema cordatum</i>	0	3.8	2.5
<i>Obliquaria reflexa</i>	0	3.8	0
<i>Pleurobema plenum</i>	0	1.9	0
<i>Alasmidonta viridis</i>	0	1.9	0
<i>Quadrula quadrula</i>	0	0	17.5

rebuilt, and no upstream improvements are made, all natural riverine habitats in the river below its headwaters will have been destroyed. It is recommended, therefore, that the plan to convert the middle part of the Green River to a trout stream be abandoned and that the river below Green River Lake Dam and above Mammoth Cave be allowed to return to its original condition prior to 1958. The dam has the functional flexibility to allow warm, plankton-rich water to be discharged from near its top rather than cold, turbid, and plankton-poor water to escape from near its bottom. Such a change would be of great benefit to local fishermen and to the whole aquatic biological community, including the nearly extinct species *Villosa ortmanni* (Walker, 1925), which is endemic to the Green River system.

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### LITERATURE CITED

- Ahlstedt, S. A., 1980. *Endangered and Threatened Wildlife of Kentucky, North Carolina, South Carolina, and Tennessee* [section on Unionidae, pp. 70-107] Warren Parker and Laura Dixon, eds., North Carolina Agricultural Extension Service, Raleigh.
- Burch, J. B. 1982. *Freshwater Snails (Mollusca: Gastropoda) of North America*. United States Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. EPA-600/3-82-026. Pp. i-iv + 1-294, 775 figs.
- Clark, C. F. 1976. The Freshwater Naiades of the Lower End of the Wabash River, Mt. Carmel, Illinois to the South. *Sterkiana*, No. 61:1-14.
- Clarke, A. H. 1981. *Determination of the Precise Geographical Areas Occupied by Four Endangered Species of Freshwater Mollusks*. Final Report from ECOSEARCH, INC., to the United States Fish and Wildlife Service, Federal Building, Room 668, Fort Snelling, Twin Cities, Minnesota 55111. Contract Co. 14-16-003-81-019, 207 pp., 6 maps.
- Conrad, T. A. 1834. *New Fresh Water Shells of the United States, with Lithographic Illustrations, and a Monograph of the Genus Anculotus of Say and a Synopsis of the American Naiades*. Philadelphia: Judah Dobson, p. 27, plate 3, fig. 5.
- Davis, G. M. 1974. *Report on the Rare and Endangered Status of a Selected Number of Freshwater Gastropods from South-eastern U.S.A.* Report to U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 51 pp., 25 maps.
- Goodrich, C. 1934. Studies of the Family Pleuroceridae-1. *Occasional Papers of the Museum of Zoology, University of Michigan* No. 286:8-11.
- Goodrich, C. 1940. The Pleuroceridae of the Ohio River Drainage System. *Occasional Papers of the Museum of Zoology, University of Michigan* No. 417:1-21.
- Lea, I. 1840. Descriptions of New Fresh Water and Land Shells. *Proceedings of the American Philosophical Society, Philadelphia* 1:286.
- Lea, I. 1852. Description of a New Genus (*Basistoma*) of the Family Melaniana, together with some New Species of American Melaniae. *Transactions of the American Philosophical Society* 100 (n.s.):301, plate 30, Fig. 11.
- Lea, I. 1861. Description of Eleven New Species of the genus *Unio* from United States. *Proceedings of the Academy of Natural Sciences, Philadelphia* 13:392.
- Lea, I. 1862. *Observations on the Genus Unio* 9:15 [This is a reprint from Lea's 1862 paper in *Journal of the Academy of Natural Sciences, Philadelphia* 5 (n.s.):193].
- Lea, I. 1880. Descriptions of New Fresh Water and Land Shells. *Proceedings of the American Philosophical Society, Philadelphia* 1:286.
- Mayer, E. R. 1974. Unionid Mussels of the Wabash, White, and East Fork of the White Rivers, Indiana. *Virginia Journal of Science* 25(1):20-25.
- Neel, J. K. and W. R. Allen. 1964. The Mussel Fauna of the Upper Cumberland Basin Before Its Impoundment. *Malacologia* 1(3):446-449.
- Ortmann, A. E. 1919. A Monograph of the Naiades of Pennsylvania, Part 3. *Memoirs of the Carnegie Museum* 8(1):74-75.
- Ortmann, A. E. 1926. The Naiades of the Green River Drainage in Kentucky. *Annals of the Carnegie Museum* 17:167-188.
- Stansbery, D. H. 1965. The Naiad Fauna of the Green River at Munfordville, Kentucky. *Annual Reports of the American Malacological Union for 1965*, pp. 13-14.
- Stansbery, D. H. 1970. Eastern Freshwater Mollusks, (1) The Mississippi and St. Lawrence River Systems. (pp. 9-21) (in) Clarke, A. H. (editor), *Papers on the Rare and Endangered Mollusks of North America*. *Malacologia* 10:1-56.
- Stansbery, D. H. 1971. Rare and Endangered Freshwater Mollusks in Eastern United States. *Proceedings of a Symposium on Rare and Endangered Mollusks (Naiads) of the U.S.* (S. E. Jorgenson and R. W. Sharp, editors.) U.S. Department of the Interior, Fish and Wildlife Service, Region 3, p. 14.
- United States Department of the Interior. 1977. *Endangered and Threatened Wildlife and Plants*. Federal Register 42(8):2510.
- Williams, J. C. 1969. *Mussel Fishery Investigation, Tennessee, Ohio, and Green Rivers, Final Report*. Kentucky Department of Fish and Wildlife Resources, pp. i-v + 1-107.