A STUDY OF FRESHWATER MUSSELS IN TRIBUTARIES OF THE LOWER OHIO AND WABASH RIVERS

Prepared for:

ILLINOIS DEPARTMENT OF CONSERVATION
DIVISION OF NATURAL HERITAGE
Springfield, Illinois

Prepared by:

HUNTER/ESE, INC.
St. Louis, Missouri

Hunter/ESE No. 98-533-0300

December 1989

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TABLE OF CONTENTS

Section		Page
1.0	INTRODUCTION	1
2.0	METHODS	3
	2.1 LITERATURE REVIEW AND MUSEUM CONSULTATION	3
	2.2 FIELD RECONNAISSANCE	3
	2.3 MUSSEL SAMPLING	3
3.0	RESULTS AND DISCUSSION	4
	3.1 WABASH DRAINAGE	4
	3.1.1 Big Creek	6
	3.1.2 Mill Creek	10
	3.1.3 Bonpas Creek	10
	3.2 OHIO RIVER DRAINAGE	18
	3.2.1 Saline River	18
	3.2.2 Big, Big Grande Pierre, Lusk Creeks	36
4.0	SUMMARY	46
5.0	LITERATURE CITED	63

LIST OF TABLES
(Page 1 of 2)

Table		Page
3-1	Mussels Historically Collected in the Lower Wabash River	5
3-2	Summary of Habitat Characteristics in Big Creek (Wabash Drainage), 1989	7
3-3	Freshwater Mussels Collected in Big Creek, Clark County, Illinois	9
3-4	Summary of Habitat Characteristics of Mill Creek, 1989	11
3-5	Freshwater Mussels Collected in Mill Creek, Clark County, Illinois	12
3-6	Status and Age Distribution of Freshwater Mussels in Mill Creek, 1989	13
3-7	Summary of Habitat Characteristics in Bonpas Creek, 1989	16
3-8	Freshwater Mussels Collected in Bonpas Creek, Wabash and Edwards Counties, Illinois	17
3-9	Status and Age Distribution of Freshwater Mussels in Bonpas Creek, 1989	19
3-10	Species Historically Occurring in the Saline River Basin	21
3-11	Summary of Habitat Characteristics in North Fork Saline River, 1989	23
3-12	Freshwater Mussels Collected in North Fork Saline River, Saline and Gallatin Counties, Illinois	24
3-13	Status and Age Distribution of Freshwater Mussels in North Fork Saline River, 1989	26
3-14	Summary of Habitat Characteristics in Middle Fork Saline River, 1989	28
3-15	Freshwater Mussels Collected in Middle Fork Saline River, Saline County, Illinios	29
3-16	Summary of Habitat Characteristics in South Fork Saline River, 1989	30

LIST OF TABLES
(Page 2 of 2)

Table		Page
3-17	Freshwater Mussels Collected in South Fork Saline River, Saline County, Illinois	31
3-18	Summary of Habitat Characteristics in Saline River (Main Stem), 1989	33
3-19	Freshwater Mussels Collected in Saline River Main Stem, Gallatin and Hardin Counties, Illinois	34
3-20	Status and Age Distribution of Freshwater Mussels in Saline River (Main Stem), 1989	35
3-21	Summary of Habitat Characteristics in Big Creek (Ohio Drainage), 1989	38
3-22	Freshwater Mussels Collected in Big Creek, Hardin County, Illinois	39
3-23	Summary of Habitat Characteristics in Big Grande Pierre Creek, 1989	40
3-24	Freshwater Mussels Collected in Big Grande Pierre Creek, Pope County, Illinois	42
3-25	Status and Age Distribution of Freshwater Mussels in Big Grande Pierre Creek, 1989	43
3-26	Summary of Habitat Characteristics in Lusk Creek, 1989	44
3-27	Freshwater Mussels Collected in Lusk Creek, Pope County, Illinois	45
3-28	Status and Age Distribution of Freshwater Mussels in Lusk Creek, 1989	47
4-1	Summary of Mussels Collected in Eastern and Southern Illinois, 1989	48

LIST OF FIGURES

Figure		Page
1-1	Location of Study Creeks in Eastern and Southern Illinois	2
3-1	Mussel Sampling Sites on Big and Mill Creek, 1989	8
3-2	Mussel Sampling Sites on Bonpas Creek, 1989	14
3-3	Mussel Sampling Sites in Saline River Basin, 1989	20
3-4	Mussel Sampling Sites on Big, Big Grand Pierre, and Lusk Creeks, 1989	37
4-1	Distribution of *Actionaias l. carinata* and *Fusconaia flava* in the Study Area	49
4-2	Distribution of *Amblema plicata* in the Study Area	50
4-3	Distribution of *Anodonta grandis* in the Study Area	51
4-4	Distribution of *Anodonta imbecilis*, *Anodonta suborbiculata* and *Strophitus u. undulatus* in the Study Area	52
4-5	Distribution of *Arcidens confragosus*, *Megalonaias nervosa* and *Tritogonia verrucosa* in the Study Area	53
4-6	Distribution of *Lampsilis r. luteola* in the Study Area	54
4-7	Distribution of *Lampsilis teres* and *Lampsilis ventricosa* in the Study Area	55
4-8	Distribution of *Lasmigona complanata* in the Study Area	56
4-9	Distribution of *Leptodea fragilis* in the Study Area	57
4-10	Distribution of *Ligumia recta* and *Ligumia subrostrata* in the Study Area	58
4-11	Distribution of *Potamilus alatus* and *Potamilus ohiensis* in the Study Area	59
4-12	Distribution of *Quadrula pustulosa* and *Quadrula quadrula* in the Study Area	60
4-13	Distribution of *Toxolasma parvus* and *Toxolasma texasensis* in the Study Area	61
4-14	Distribution of *Truncilla truncata* and *Uniomerus tetralasmus* in the Study Area	62

1.0 INTRODUCTION

The Illinois Department of Conservation (IDOC), Division of Natural Heritage, is currently in the process of conducting a statewide inventory of freshwater mussels. Useful information obtained through a statewide survey may include:

1. Identifying changes in water quality and habitat quality through comparison of present populations to historical data;
2. Determining the status of Federally endangered species occurring in the State of Illinois; and
3. Developing a data base useful to agencies in determining potential impacts of proposed development or alteration of streams on mussel populations.

Mussel inventories in the southern portion of Illinois have been conducted primarily in the Wabash River (Goodrich and Van der Schalie, 1944; Krumholz *et al.*, 1970; Clark, 1976) and Ohio River (Williams and Schuster, 1982). Parmalee (1967) discusses 46 species found in the Wabash and Ohio River drainages. Recent studies in Southern Illinois funded by IDOC include inventories of the Embarras River, Little Wabash River, and a survey of the Wabash River for *Potamilus capax*. Many of the other streams in southern Illinois have not been inventoried to date.

Hunter/ESE sampled freshwater mussels in three Wabash River Tributaries (Big Creek, Mill Creek, Bonpas Creek), the Saline River Basin (a tributary of the Ohio River), and three small Ohio River tributaries (Big Creek, Lusk Creek, Big Grande Pierre Creek) during the summer and fall of 1989 (Figure 1-1). The purpose of this unionid mollusk survey of the study streams was to document:

- Species composition,
- Relative abundance,
- Diversity,
- Size class structure,
- Distribution, and
- Habitat associations.

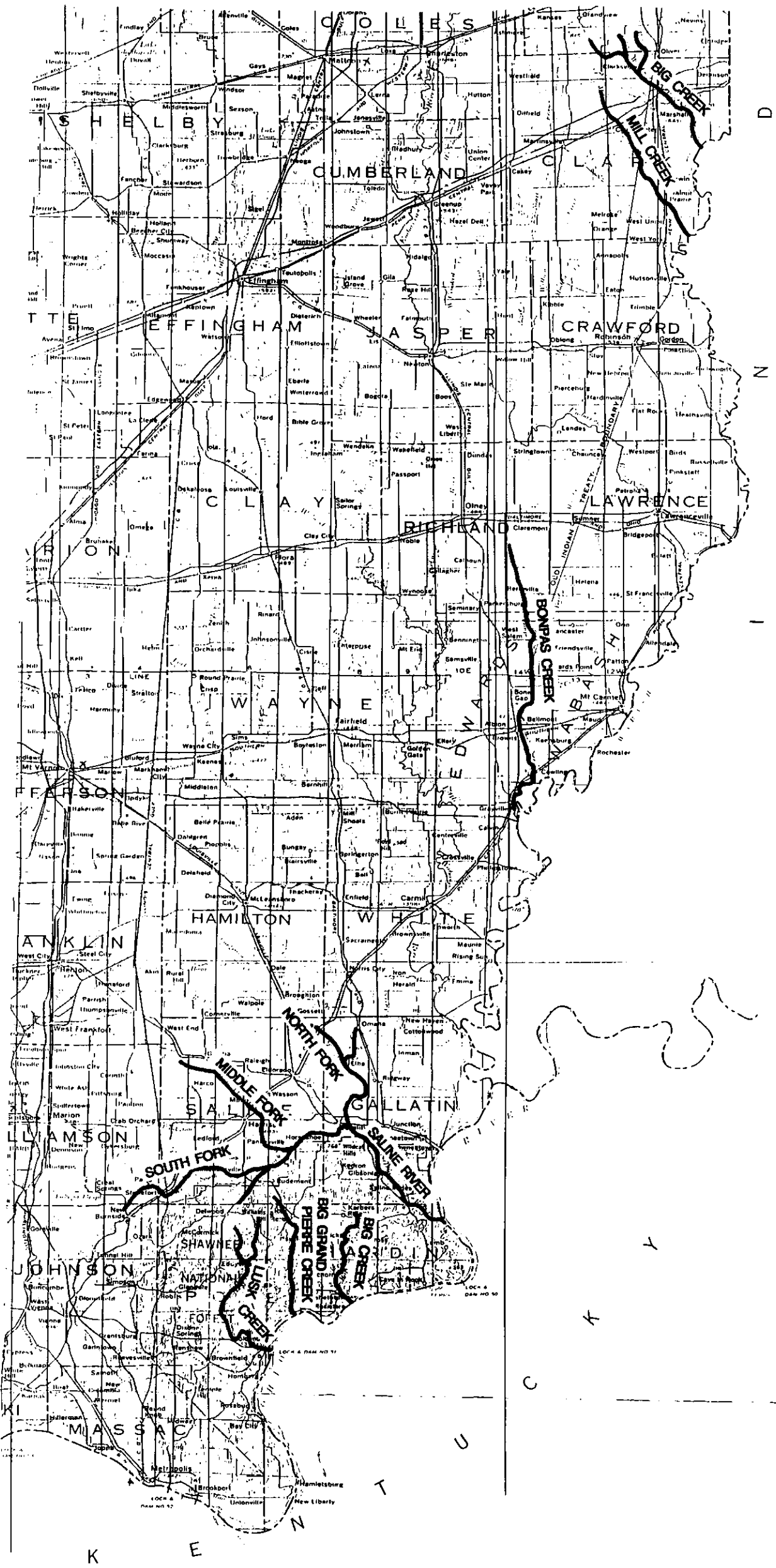

Figure 1-1
LOCATION OF STUDY CREEKS IN EASTERN AND SOUTHERN ILLINOIS

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2.0 METHODS

2.1 LITERATURE REVIEW AND MUSEUM CONSULTATION

Prior to field sampling, literature on southern Illinois mussel inventories was reviewed. In addition, the Illinois Natural History Survey was visited to obtain data on collections in or near the study streams. Museum specimens of rare species potentially occurring in the project area were reviewed. Dr. David Stansbery (Ohio State University) was also contacted with respect to prior collections in the study streams. Any specimens of questionable identification were sent to Dr. Stansbery for verification.

2.2 FIELD RECONNAISSANCE

Topographic maps (United States Geological Survey) of study streams were reviewed for potential sampling locations. Several sites on each stream were selected for field reconnaissance based on potential habitat, position in the water shed, and access. Potential sites were visited by Hunter/ESE and IDOC. Two to six stations were selected for sampling on each stream.

2.3 MUSSEL SAMPLING

Three persons searched each of the sampling stations by pollywogging, diving, and visually searching. A visual search and pollywogging were the primary means of collection. Diving was used in areas too deep for wading (i.e., Saline River and Station 1 of Lusk Creek). Three hours of sampling effort were expended (3 persons for 1 hour each) at each location. If a mussel bed was located, effort was concentrated in the area of the bed. If no bed was located, as much area as could be thoroughly searched in 3 hours was covered.

After 3 hours of effort, all mussels collected were sorted according to species. The number of each species collected, relative age of individuals, status of shell (living, recently dead, fossil), method of collection, and habitat type (riffle, pool, stream bank, etc.) were recorded.

During the field effort notes were recorded describing the location of the area, and chemical and physical characteristics of each site. Dissolved oxygen and

temperature were measured using either a YSI dissolved oxygen meter (Model 51B, 54A, or 57) or a Hydrolab Surveyor II. All meters were calibrated and checked for accuracy using a Winkler titration and a NBS-certified thermometer. Pre- and post-calibration checks indicated all meters functioned accurately during field surveys.

Current velocity was measured using a pygmy Gurley meter. Water clarity was measured using a Secchi disk. Width and depth of the stream, length of area sampled, substrate, aquatic vegetation, and land use were qualitatively estimated. However, all observations were recorded by the same individual to ensure data comparability.

3.0 RESULTS AND DISCUSSION

3.1 WABASH DRAINAGE

The Wabash River has historically supported a diverse mussel fauna (Goodrich and Van der Schalie, 1944; Krumholz *et al.*, 1970; Clark, 1976). Clark (1976) extensively reviewed the literature on Wabash River mussel collections. His review identified 67 species historically collected in the lower Wabash (however, several of these species are now considered synonymous). Of these mussels, 30 were collected by Krumholz *et al* (1970) and Clark (1976) in the Wabash between Terre Haute and the Ohio River (Table 3-1). Although the present survey did not include the Wabash River, species composition of tributary streams was similar.

Illinois tributaries of the Wabash River vary in size and stream quality. Of the two major tributaries, the Little Wabash is designated as partial support/minor use impairment throughout most of its basin. The Embarras is designated as full aquatic life use support throughout most of the basin (IEPA, 1988). Mussel surveys of both of these systems are currently being conducted by Illinois Natural History Survey (INHS). Wabash tributaries surveyed by Hunter/ESE in 1989 include Big Creek, Mill Creek, and Bonpas Creek. Big Creek is designated as a full aquatic life use support creek. Mill Creek and Bonpas Creek are designated partial support/minor use impairment (IEPA, 1988). Smith (1971) rated Mill Creek and Big Creek good with respect to fish fauna and

Table 3-1. Mussels Historically Collected in the Lower Wabash River

Species	Krumholz *et al*	Clark
Actinonaias l. carinata	X	X
Alasmidonta marginata		X
Amblema plicata	X	X
Anodonta grandis	X	
Anodontoides ferrussacianus		X
Cyprogenia irrorata	X	
Elliptio crassidens		X
Fusconaia ebena	X	X
Fusconaia flava	X	X
Lampsilis anodontoides	X	X
Lampsilis ventricosa	X	X
Lasmigona complanata	X	X
Lasmigona compressa		X
Lasmigona costata	X	
Leptodea fragilis	X	X
Megalonaias nervosa	X	X
Obliquaria reflexa	X	X
Obovaria olivaria	X	X
Plethobasus cyphyus		X
Pleurobema cordatum		X
Potamilus alatus	X	X
Potamilus capax		X
Potamilus ohiensis	X	X
Quadrula metanevra	X	X
Quadrula nodulata		X
Quadrula pustulosa	X	X
Quadrula quadrula	X	X
Strophitus u. undulatus		X
Tritogonia verrucosa	X	X
Truncilla donaciformes		X
Truncilla truncata	X	X

Sources: Krumholz *et al*, 1970.
Clark, 1976.
Hunter/ESE, 1989.

implicated oil fields as a pollution source in the area. Bonpas Creek rated fair with respect to fish fauna, primarily due to habitat limitations in the watershed and oil field pollution (Smith, 1971). No previous mussel surveys were identified in Big, Mill or Bonpas creeks.

3.1.1 Big Creek

Big Creek is located in Clark County, Illinois (Figure 3-1). The stream flows through an agricultural area and drains into the Wabash about 4 miles upstream of Darwin, Illinois. Habitat throughout the creek consists of alternating riffles and pools. Water clarity is excellent with the stream bottom visible in most areas. Conductivity throughout the stream (>500 µohms/cm) indicates a moderate amount of dissolved solids in the stream (Table 3-2).

Six stations were sampled on Big Creek: one station on the west fork (Station 6), two on the east fork (Stations 4 and 5), and three stations downstream of the two forks (Stations 1 through 3) (Figure 3-1). The area of the creek sampled ranged from 80,000 square feet to 150,000 square feet. Water clarity and depth enabled biologists to visually search the stream for a considerable distance, in addition to searching through substrates for burrowed clams.

Substrates throughout Big Creek consisted of primarily loose sand and gravel. Some areas contained minor amounts of clay. A portion of the stream bottom at Station 3 was bedrock. Neither loose substrate or bedrock are good mussel substrates. Mussels cannot burrow in bedrock. Conversely, mussels can burrow in sand but such substrate is not stable and animals are easily dislodged and transported downstream. Shifty sand is not conducive to bed formation.

No mussels were collected in Big Creek (Table 3-3). In addition, no evidence of mussels (old shells) or *Corbicula fluminea* were found in the area. Although the area provides habitat for several unusual fish species [i.e., blacknose dace, redbelly dace, greenside darter, bigeye shiner (Smith 1971)], conditions are not suitable for unionid mollusks.

Table 3-2. Summary of Habitat Characteristics in Big Creek (Wabash Drainage), 1989

	Stations					
	1	2	3	4	5	6
Habitat	pool	riffle/ pool	riffle/ pool	riffle/ pool	riffle/ pool	riffle pool
Substrate	sand with gravel/clay	sand with gravel/clay	sand with gravel	sand with gravel/rubble	sand with gravel/rubble	sand with gravel/rubble
Water clarity (mm)	bottom	bottom	bottom	bottom	bottom	bottom
Temperature (°C)	20.0	19.0	18.8	16.5	16	17.5
Dissolved Oxygen (ppm)	7.8	8.4	8.8	9.0	9.4	9.5
Conductivity (μohms/cm)	557.0	555.0	555.0	560.0	559.0	558.0
Approximate area sampled (ft^2)	150,000	150,000	112,500	100,000	80,000	100,000

Source: Hunter/ESE, 1989.

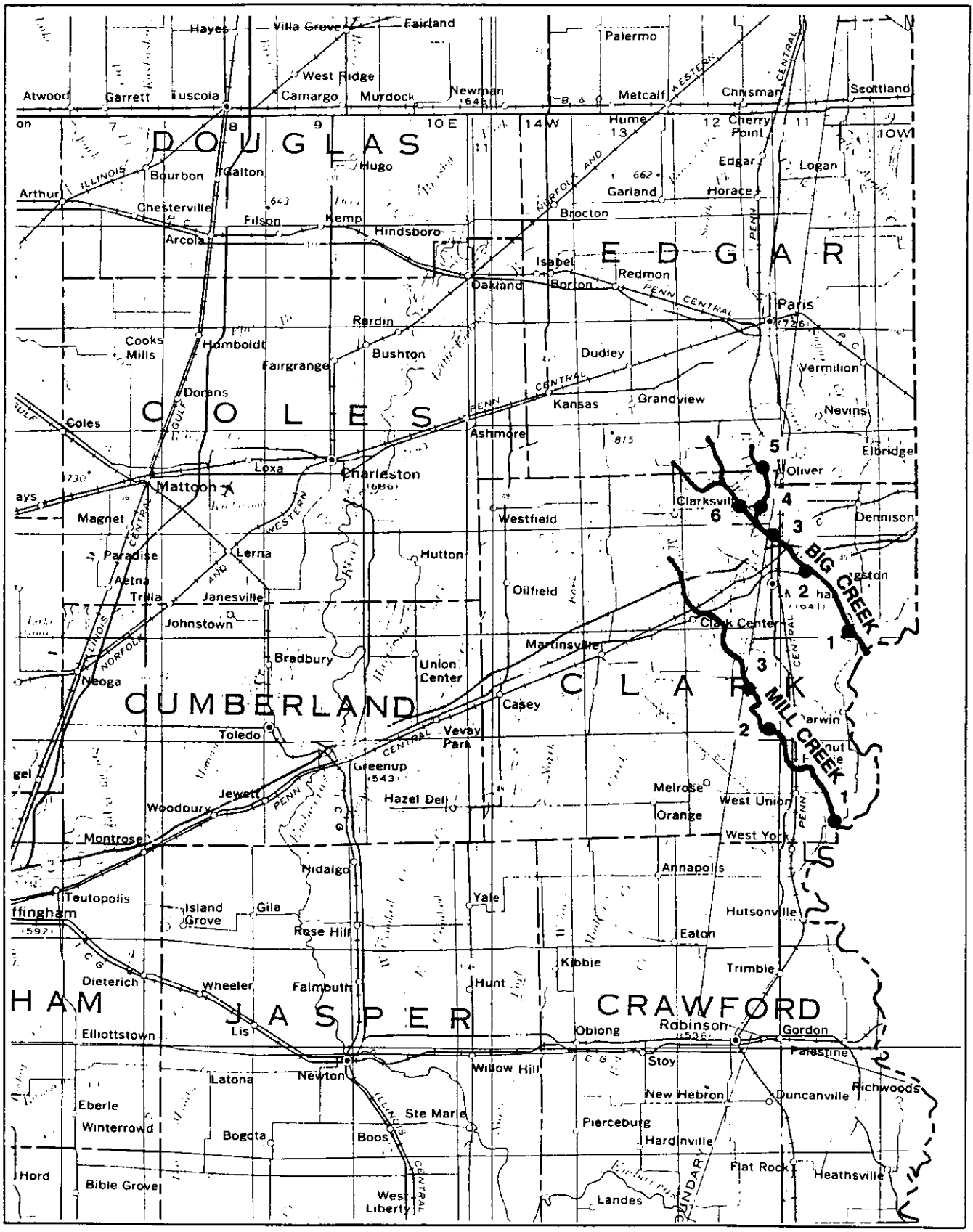

Figure 3-1
MUSSEL SAMPLING SITES ON BIG CREEK AND MILL CREEK, 1989

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Table 3-3. Freshwater Mussels Collected in Big Creek, Clark County, Illinois

Species	Stations					
	1	2	3	4	5	6
	No mussels collected					
Total	0	0	0	0	0	0
Species	0	0	0	0	0	0

Source: Hunter/ESE, 1989.

3.1.2 Mill Creek

Mill Creek is located in Clark County (see Figure 3-1). The creek flows into the Wabash River near York, Illinois. Three areas of the creek were sampled. Habitat in Mill Creek was similar to Big Creek with alternating riffles and pools. Water was fairly clear with the bottom being visible in most areas. Average depth in sampled areas was less than 1 foot and width was about 30 feet. Substrate was predominately sand with some clay and pebbles (Table 3-4).

Only 13 unionid mussels were collected in Mill Creek (Table 3-5). Nine mussels of five species were collected at the station farthest downstream (Station 1) and four mussels of three species were collected at Station 2.

The substrate in Mill Creek lacks the stability necessary for colonization of unionid mollusks. Mussels, as expected, were sparse and scattered throughout the sampled area. Species collected were those typically found in smaller creeks or softer substrates (*Leptodea fragilis*, *Toxolasma parva*, *Lampsilis ventricosa*, *Lampsilis t. teres*). *Q. pustulosa* is more frequently collected in mussel beds or areas with more stable substrates. The one *Q. pustulosa* collected was a shell and may have washed into the creek from the nearby Wabash River. (One week prior to sampling 5 inches of rain fell in the area. Creeks had been backed up by the Wabash and had only recently resumed flowing.)

Only two species were collected live: *Lampsilis ventricosa* and *Toxolasma parvus*. The remaining species were collected only as shells. Although mussels were sparse in Mill Creek, some reproduction was evident. The *Lampsilis teres* shell was from a juvenile. Over half of the *L. ventricosa* and half of the *L. fragilis* were subadult (Table 3-6).

3.1.3 Bonpas Creek

Bonpas Creek flows through Richland, Edwards, and Wabash Counties into the Wabash River in Grayville, Illinois (Figure 3-2). Water quality in Bonpas Creek is fair, with oil fields and erosion from farm fields being the major source of pollution (Smith, 1971). IEPA (1988) designates Bonpas Creek as a partial support of aquatic life stream with minor use impairment. Habitat in Bonpas

Table 3-4. Summary of Habitat Characteristics in Mill Creek, 1989

	Stations					
	1		2		3	
	A	B	A	B	A	B
Habitat	pool	riffle	riffle	pool	riffle	pool
Substrate	sand with clay	sand	sand with pebble	sand with pebble	sand with pebble	sand with pebble
Water clarity (mm)	bottom	bottom	bottom	bottom	bottom	bottom
Temperature (°C)	25.8		27.1		26.3	
Dissolved Oxygen (ppm)	9.6		9.6		8.4	
pH	7.8		7.8		7.7	
Conductivity (μohms/cm)	415.0		381.0		406.0	
Approximate area sampled (ft^2)	60,000	30,000	30,000	120,000	92,400	105,600

Source: Hunter/ESE, 1989.

Table 3-5. Freshwater Mussels Collected in Mill Creek, Clark County, Illinois

Species	Stations 1	2	3	Total
Lampsilis t. teres	2	--	--	2
Lampsilis ventricosa	3	2	--	5
Leptodea fragilis	1	1	--	2
Quadrula pustulosa	1	--	--	1
Toxolasma parvus	2	1	--	3
Total	9	4	0	13
Species	4	3	0	5

Source: Hunter/ESE, 1989.

Table 3-6. Status and Age Distribution of Freshwater Mussels in Mill Creek, 1989

Species	Status			Age Distribution		
	Live	Shells	Live (%)	Juvenile	Subadult	Adult
Lampsilis teres	0	2	0.00	1	--	1
Lampsilis ventricosa	4	1	80.00	--	3	2
Leptodea fragilis	0	2	0.00	--	1	1
Quadrula pustulosa	0	1	0.00	--	--	1
Toxolasma parvus	1	2	33.33	--	--	3
Total	5	8	38.46	1	4	8

Source: Hunter/ESE, 1989.

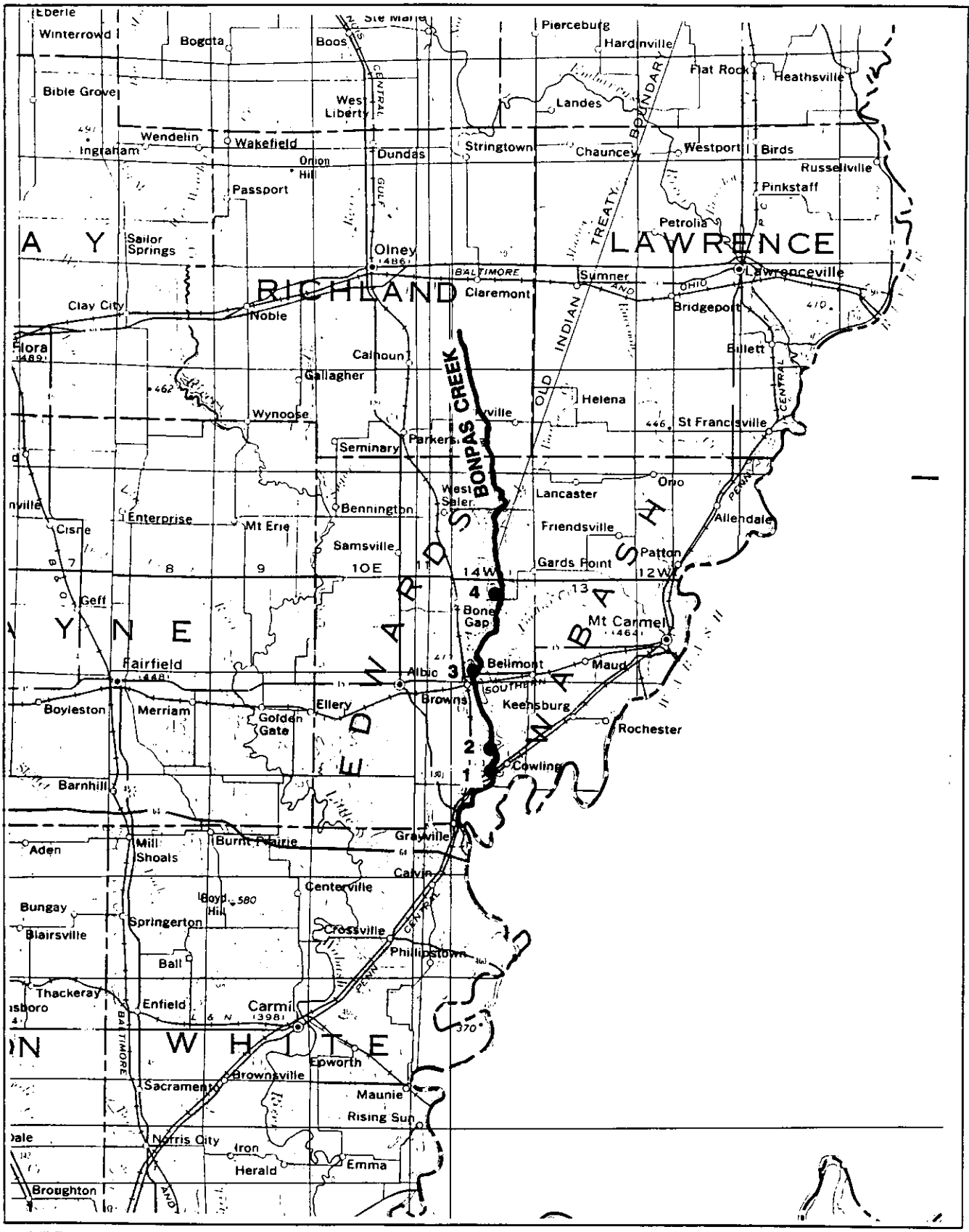

Figure 3-2
MUSSEL SAMPLING SITES ON BONPAS CREEK, 1989

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Creek was primarily flowing pool with little riffle development (Table 3-7). Substrate in most areas was silt over bedrock or clay. In some areas, however, a mix of sand, gravel, clay, and silt existed in the stream bottom, creating a more stable substrate. In these areas, mussels were abundant.

A total of 147 mussels of 16 species were collected at four locations in Bonpas Creek (Table 3-8). The number of mussels and number of species collected was lowest in upstream areas and increased downstream. Station 4, located in the upper watershed where stream width averaged 15 feet and depth only 1 foot, yielded only a few species (*Anodonta grandis*, *Ligumia subrostrata*, and *Toxolasma texasensis*). *L. subrostrata* and *T. texasensis* are typically collected in mud bottoms in the shallows of lakes and streams (Parmalee, 1967). *L. subrostrata* is fairly widely distributed in Illinois. *T. texasensis*, however, has only been collected from a few locations in southern Illinois including North Fork Saline River, Big Muddy River and Crab Orchard Lake (Parmalee, 1967), and in the Saline River and Eagle Creek, a tributary of the Saline River (INHS, 1987).

At Station 3, stream width and depth increased to 50 feet and 2 feet, respectively. The number of species collected increased to six, but still included species primarily associated with small streams and ponds (*A. grandis*, *L. r. luteola*, *L. t. teres*), softer substrates (*L. fragilis*, *P. alatus*), or a wide variety of habitats (*Quadrula quadrula*).

Station 2 was similar in width and depth to Station 3. Trash in the creek was more prevalent at this point and an old oil pipeline was exposed. Although stream quality declined in this portion of the river (abundant trash, conductivity over 600 µohms/cm) mussels were scattered throughout the sampled area, with 29 mussels of 7 species collected. A few species collected (*A. plicata*, *M. nervosa*, *T. verrucosa*), typically associated with beds in medium to larger rivers, suggests this area of stream is more stable than upstream areas.

Bonpas Creek at Station 1 (just upstream of the Highway 1 bridge) showed some signs of riffle development. Pool areas were deeper (up to 4 feet) with shallower "run" habitat existing between gravel bars. Substrate in the run area

Table 3-7. Summary of Habitat Characteristics in Bonpas Creek, 1989

	Stations			
	1	2	3	4
Habitat	flowing pool	flowing pool	flowing pool	flowing pool
Substrate	gravel/clay silt/bedrock	silt over clay gravel/clay	clay/silt	sand/clay/ gravel/silt
Water clarity (mm)	355.0	100.0	155.0	230.0
Temperature (°C)	16.3	17.0	18.2	16.9
Dissolved Oxygen (ppm)	7.6	7.4	6.2	6.8
Conductivity (μohms/cm)	620.0	680.0	315.0	330.0
Approximate area sampled (ft^2)	25,000	25,000	50,000	30,000

Source: Hunter/ESE, 1989.

Table 3-8. Freshwater Mussels Collected in Bonpas Creek, Wabash and Edwards Counties, Illinois

Species	Stations 1	2	3	4	Total
Amblema plicata	16	5	--	--	21
Anodonta grandis	--	--	7	2	9
Arcidens confragosus	3	--	--	--	3
Fusconaia flava	1	--	--	--	1
Lampsilis r. luteola	--	--	1	--	1
Lampsilis t. teres	1	--	1	--	2
Lasmigona complanata	14	5	--	--	19
Leptodea fragilis	3	5	1	--	9
Ligumia subrostrata	--	--	--	2	2
Megalonaias nervosa	1	3	--	--	4
Potamilus alatus	3	1	1	--	5
Quadrula pustulosa	1	--	--	--	1
Quadrula quadrula	21	9	8	--	38
Toxolasma texasensis	--	--	--	6	6
Tritogonia verrucosa	23	1	--	--	24
Truncilla truncata	2	--	--	--	2
Total	89	29	19	10	147
Species	12	7	6	3	16

Source: Hunter/ESE, 1989.

consisted of gravel, silt, and clay. Mussels were scattered throughout the area. In addition, a concentration, or mussel bed, was identified in the run. Eighty-nine mussels of 12 species were collected. Dominant species included *T. verrucosa*, *Q. quadrula*, *A. plicata*, and *L. complanata*.

Although not a clean stream with riffle/pool habitat, Bonpas Creek appears to support a good mussel population. Despite the abundant trash in the creek bottom, presence of oil (Stations 2 and 4), and high conductivity, all stations sampled yielded some mussels. A few species (*L. r. luteola*, *L. subrostrata*, *T. truncata*) were represented only by shells, but overall 81 percent of the mussels collected were live (Table 3-9). In addition, young individuals of two species (*A. confragosus* and *T. verrucosa*) were collected indicating some reproduction. Although water quality is not good, species considered intolerant (*T. verrucosa*, *M. nervosa*) were present in the creek.

In contrast to other Wabash drainage streams sampled, substrates in Bonpas Creek were more stable. Apparently water quality was not poor enough to limit unionid mollusks, while stable substrates in Bonpas Creek were more conducive to mussel colonization than the shifty silt and sand in Big and Mill Creeks.

3.2 OHIO RIVER DRAINAGE

3.2.1 Saline River

The Saline River, located in Hardin, Gallatin, Saline, and Hamilton Counties flows into the Ohio River near Ohio River Mile 867 (Figure 3-3). Water quality in the Saline Basin is poor due to strip mine wastes, siltation, channelization, and oil field pollution (Smith, 1971). Although habitat is minimal and water quality poor throughout much of the Saline Basin, prior studies indicate some unionid mollusks live in the basin (Table 3-10). Illinois Natural History Survey identified two species (*Q. pustulosa* and *T. texasensis*) in the Saline River and four species (*A. grandis*, *A. imbecillis*, *T. texasensis*, and *Uniomerus tetralasmus*) in Eagle Creek, a tributary of the Saline River. *U. tetralasmus* is currently listed as a threatened species in Illinois (IDOC, 1989). Several species were collected by INHS (1988) from ponds and reservoirs in the basin (*A. grandis*, *A. suborbiculata*, *L. subrostrata*, *L. complanata*, *P. ohiensis*,

Table 3-9. Status and Age Distribution of Freshwater Mussels in Bonpas Creek, 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Amblema plicata	16	5	76.19	--	--	16
Anodonta grandis	6	3	66.67	--	--	6
Arcidens confragosus	3	0	100.00	--	1	2
Fusconaia flava	1	0	100.00	--	--	1
Lampsilis r. luteola	0	1	0.00	--	--	--
Lampsilis t. teres	1	1	50.00	--	--	1
Lasmigona complanata	16	3	84.21	--	--	16
Leptodea fragilis	6	3	66.67	--	--	6
Ligumia subrostrata	0	2	00.0	--	--	--
Megalonaias nervosa	3	1	75.00	--	--	3
Potamilus alatus	4	1	80.00	--	--	4
Quadrula pustulosa	1	0	100.00	--	--	1
Quadrula quadrula	34	4	89.47	--	--	34
Toxolasma texasensis	5	1	83.33	--	--	5
Tritogonia verrucosa	23	1	95.83	--	7	16
Truncilla truncata	0	2	0.00	--	--	--
Total	119	28	81.52	--	8	111

* Live mussels.

Source: Hunter/ESE, 1989.

Figure 3-3
MUSSEL SAMPLING SITES IN SALINE RIVER BASIN, 1989

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Table 3-10. Species Historically Occurring in the Saline River Basin

Anodonta grandis
Anodonta imbecilis
Anodonta suborbiculata
Lasmigona complanata
Ligumia subrostrata
Potamilus ohiensis
Quadrula pustulosa
Quadrula quadrula
Toxolasma texasensis
Uniomerus tetralasmus
Villosa lienosa

Sources: INHS, 1987-1988.
Parmalee, 1967.

Q. quadrula) Parmalee (1967) listed the Saline River as part of the range of *Q. quadrula*, *T. texasensis* and *V. lienosa* in Illinois.

The North Fork, Middle Fork, South Fork, and Saline River main stem were sampled for mussels during this survey (see Figure 3-3).

North Fork

The North Fork is channelized for most of its length. In addition, oil fields and runoff from agriculture are major sources of pollution. The IEPA designates the stream as a partial support of aquatic life stream with minor use impairment (IEPA, 1988). Five stations were sampled on the North Fork, one in Saline County, and four in Gallatin County (see Figure 3-3).

Habitat in the North Fork is limited due to channelization. Some riffle/pool development, however, was evident in the upper part of the watershed (Station 4 on North Fork and Station 5 on Cane Creek). Habitat in the lower three stations was limited to flowing pool. Substrate throughout the stream was fairly stable, consisting of gravel, rubble, sand, silt, and clay. Water was fairly turbid at all stations except Station 4, limiting the sampling effort to groping through substrate. Conductivity was near 400 µohms/cm, indicating a moderate amount of pollution in the stream (Table 3-11).

Though channelized and somewhat polluted, mussels were collected at all five sampling stations (Table 3-12). A total of 248 mussels of 17 species was collected. Mussels were most abundant at Station 2, and diversity was highest at Station 4. *Quadrula quadrula* was the most prevalent species (95 individuals), being collected at all stations. *A. plicata*, though less abundant, was equally ubiquitous.

Species more prevalent in the downstream stations, where conditions are more stable, included *A. plicata*, *M. nervosa*, and *Q. quadrula*. Species more prevalent in the upstream stations were those typically associated with a variety of conditions (*A. grandis*, *L. t teres*, *L. subrostrata*, *T. parvus*, *T. texasensis*). One species collected in the North Fork, *Uniomerus tetralasmus*,

Table 3-11. Summary of Habitat Characteristics in North Fork Saline River, 1989

	Stations				
	1	2	3	4	5
Habitat	flowing pool*	flowing pool*	flowing pool*	riffle/ pool*	riffle/ pool*
Substrate	gravel, rubble, sand, clay	gravel, rubble, silt, clay	gravel, rubble, sand, clay	gravel, sand, silt	gravel, clay
Water clarity (mm)	130.0	130.0	110.0	315.0	175.0
Temperature (°C)	21.0	21.0	20.0	24.9	18.2
Dissolved Oxygen (ppm)	6.7	5.8	6.0	8.6	8.2
Conductivity (μohms/cm)	395.0	410.0	410.0	415.0	355.0
Approximate area sampled (ft^2)	9,000	30,000	15,000	125,000	90,000

* Channelized.

Source: Hunter/ESE, 1989.

Table 3-12. Freshwater Mussels Collected in North Fork Saline River, Saline and Gallatin Counties, Illinois

Species	Stations 1	2	3	4	5	Total
Amblema plicata	11	3	2	1	5	22
Anodonta grandis	--	8	--	7	2	17
Lampsilis r. luteola	1	--	--	1	--	2
Lampsilis t. teres	1	--	9	21	2	33
Lampsilis ventricosa	--	1	--	--	--	1
Lasmigona complanata	--	9	2	3	3	17
Leptodea fragilis	--	--	4	--	1	5
Ligumia recta	--	--	--	--	1	1
Ligumia subrostrata	--	--	--	14	--	14
Megalonaias nervosa	2	2	--	--	1	5
Potamilus alatus	--	6	--	--	1	7
Potamilus ohiensis	--	--	--	14	--	14
Quadrula quadrula	3	66	17	4	5	95
Toxolasma parvus	--	--	--	9	--	9
Toxolasma texasensis	--	--	--	1	--	1
Truncilla truncata	--	--	3	--	--	3
Uniomerus tetralasmus	--	--	--	2	--	2
Total	18	95	37	77	21	248
Species	5	7	6	11	9	17

Source: Hunter/ESE, 1989.

is listed as threatened in Illinois. This species is widely distributed but uncommon in Illinois (Parmalee, 1967). INHS (1987) collected *U. tetralasmus* in Eagle Creek, but this appears to be the first record in the North Fork.

Many of the mussels collected in North Fork (over 50 percent) were collected as shells, particularly in the upstream stations (Table 3-13). Several species (*L. r. luteola*, *L. recta*, *L. subrostrata*, *M. nervosa*, *P. ohiensis*, *T. texasensis*) were represented only as shells. Some reproduction is evident in the stream as young individuals of three species (*L. complanata*, *P. alatus*, *Q. quadrula*) were collected.

Although channelized and polluted by agriculture and oil fields, the North Fork supports a fairly good mussel population. The upper watershed shows signs of recovery from channelization with some riffle/pool development. A number of mussel species, including one threatened species (*Uniomerus tetralasmus*) were collected in the upper watershed. However, like most small streams, fluctuating conditions prevent formation of mussel beds in the area. Many of the mussels collected in the upstream stations (4 and 5) were shells, probably washed down from farther upstream during high water. Habitat at the lower three stations was limited to a shallow flowing pool. However, stable substrates enabled mussels to inhabit the area. Though the mussel fauna of the North Fork is not extremely diverse, the number of mussels and species present indicate some recovery from channelization.

Middle Fork

The Middle Fork flows primarily through Saline County (see Figure 3-3). The Middle Fork, like the North Fork, suffers from channelization and agricultural runoff. In addition, surface mining and Harrisburg's wastewater treatment plant contribute to its water quality problems. As a result, the majority of Middle Fork has been designated as a partial support stream with minor use impairment (IEPA, 1988).

Four stations were sampled for mussels on the Middle Fork. All stations indicated some recovery from channelization, with some development of riffles

Table 3-13. Status and Age Distribution of Freshwater Mussels in North Fork Saline River, 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Amblema plicata	3	19	13.64	--	--	3
Anodonta grandis	9	8	52.94	--	--	9
Lampsilis r. luteola	0	2	0.00	--	--	--
Lampsilis t. teres	5	28	15.15	--	--	5
Lampsilis ventricosa	1	0	100.00	--	--	1
Lasmigona complanata	8	9	47.06	--	1	7
Leptodea fragilis	1	4	20.00	--	--	1
Ligumia recta	0	1	0.00	--	--	--
Ligumia subrostrata	0	14	0.00	--	--	--
Megalonaias nervosa	0	5	0.00	--	--	--
Potamilus alatus	2	5	28.57	--	1	1
Potamilus ohiensis	0	14	0.00	--	--	--
Quadrula quadrula	86	9	90.53	--	1	85
Toxolasma parvus	2	7	22.22	--	--	2
Toxolasma texasensis	0	1	0.00	--	--	--
Truncilla truncata	1	2	33.33	--	--	1
Uniomerus tetralasmus	1	1	50.00	--	--	1
Total	119	129	47.98	--	3	116

* Live mussels.

Source: Hunter/ESE, 1989.

and pools. However, water quality and substrate appear to limit unionids in this part of the Saline River Basin. Conductivity in the upper portion of the stream was over 500 µohms/cm, while conductivity at Station 1, below Harrisburg, was in excess of 2,000 µohms/cm (Table 3-14). Substrate throughout the stream was a hard clay covered in riffle areas by shifty sand and gravel.

Only one unionid mussel was collected in the Middle Fork, a *U. tetralasmus* (Table 3-15). This individual was a shell collected at Station 2. Other signs of mollusk life in the stream included a few very old unionid shell fragments and an abundance of *Corbicula fluminea* in sandy areas.

South Fork

The South Fork flows through Williamson and Saline Counties (see Figure 3-3). The primary source of pollution in the South Fork is surface mining. The lower 9 miles of South Fork are non-supportive of aquatic life (IEPA, 1988).

Only two stations were sampled on the South Fork; one in the upper watershed above Palzo (a major mining area) and one just above the confluence with Middle Fork (see Figure 3-3). The downstream station was devoid of signs of animal life. Water color was orange and garbage littered the bottom. Some periphyton was present in shallow areas and water clarity was good. Even with improvements in water quality it is doubtful this area would support mussels. Substrates were a hard clay with some shifty silt, sand, and pebble (Table 3-16). The upper area of the South Fork showed signs of life, however, no mussels were collected in the area (Table 3-17). Habitat consisted of flowing pool with some riffle development. Substrate was primarily hard clay with silt and sand. Although no unionids were collected, a few *Corbicula fluminea* shells were in the area.

Saline River Main Stem

The Saline River, downstream of the confluence of the South and Middle Forks, is designated a partial support stream with minor impairment (IEPA, 1988). This area of the Saline River suffers from channelization, as well as agricultural and mining runoff and wastewater imput.

Table 3-14. Summary of Habitat Characteristics in Middle Fork Saline River, 1989

	Stations			
	1	2	3	4
Habitat	riffle/ pool*	riffle/ pool*	riffle/ pool*	riffle/ pool*
Substrate	sand/gravel over clay	sand over clay	pebble/sand over clay	hard clay with sand
Water clarity (mm)	bottom	bottom	530.0	bottom
Temperature (°C)	24.0	25.0	20.0	18.2
Dissolved Oxygen (ppm)	12.8	9.4	7.9	8.0
Conductivity (μohms/cm)	2150.0	--	--	560.0
Approximate area sampled (ft^2)	200,000	50,000	100,000	100,000

* Channelized.

Source: Hunter/ESE, 1989.

Table 3-15. Freshwater Mussels Collected in Middle Fork Saline River, Saline County, Illinois

Species	Stations 1	2	3	4	Total
Uniomerus tetralasmus	--	1	--	--	1
Total	0	1	0	0	1
Species	--	1	--	--	1

Source: Hunter/ESE, 1989.

Table 3-16. Summary of Habitat Characteristics in South Fork Saline River, 1989

	Stations	
	1	2
Habitat	pool	flowing pool
Substrate	hard clay, minor silt/ pebble/sand	silt/sand/clay
Water clarity (mm)	bottom	315.0
Temperature (°C)	25.0	17.8
Dissolved Oxygen (ppm)	8.4	6.4
Approximate area sampled (ft^2)	50,000	26,130

Source: Hunter/ESE, 1989.

Table 3-17. Freshwater Mussels Collected in South Fork Saline River, Saline County, Illinois

Species	Stations 1	Stations 2	Total
	No mussels collected		
Total	0	0	0
Species	0	0	0

Source: Hunter/ESE, 1989.

Five stations on the lower Saline River and one station on Eagle Creek were sampled for mussels. Habitat in the lower Saline River was limited to flowing pool. SCUBA was utilized to sample these stations as depth prevented adequate sampling by pollywogging. Substrate in most areas was silt and clay, with some sand and gravel in deeper channel areas (Table 3-18). Water quality in the lower Saline was poor with high conductivity and low dissolved oxygen; most likely a result of mining runoff and wastewater input. Water quality in Eagle Creek (Station 3) was also poor. Algal mats and anaerobic pockets in sediments implicate wastewater input. Conductivity was extremely high (2,300 µohms/cm) in the area. Substrate was mainly bedrock with pockets of gravel, silt, and clay. *Corbicula fluminea* were numerous throughout the creek.

Despite poor water quality and habitat, a few mussels were collected at all but Station 6. Water quality was particularly poor at Station 6. Conductivity was near 2,000 µohms/cm and dead fish littered the area. A few mussels were found scattered at each of the other locations. Species collected were those that are typically found in a variety of habitats (*A. plicata*, *Q. quadrula*) and species typical of softer substrates (*A. grandis*, *A. suborbiculata*, *L. t. teres*, *L. fragilis*, *P. ohiensis*, *T. texasensis*) (see Table 3-19). Most individuals were live, however only shells of *A. plicata* and *L. fragilis* were collected. Only one subadult, a *P. ohiensis*, was collected. The remainder of individuals were adult (Table 3-20).

Overall, water quality and habitat quality prevent unionid mollusks from inhabiting most of the Saline River Basin. The North Fork supports the best population of mussels due to stable substrate and slightly less polluted waters. Conversely, the South Fork is devoid of most life except in the upper reaches. The Middle Fork and Saline main stem yielded a few scattered individuals, however, substrate and water quality limit the colonization to only the hardiest of individuals.

Table 3-18. Summary of Habitat Characteristics in Saline River (Main Stem), 1989

	Stations					
	1	2	3*	4	5	6
Habitat	pool	pool	riffle/ pool	flowing pool	flowing pool	pool (channelized)
Substrate	silt/clay	silt/clay shoreline gravel/ pebble/ bedrock channel	bedrock, gravel, silt, clay	gravel, clay silt	silt over clay	silt, sand, clay
Water clarity (mm)	--	330.0	bottom	145.0	200.0	360.0
Temperature (°C)	24.0	24.5	20.0	22.2	20.1	22.0
Dissolved Oxygen (ppm)	2.4	2.0	5.5	4.5	6.4	—
Conductivity (μohms/cm)	462.0	1050.0	2300.0	1110.0	610.0	1950.0
Approximate area sampled (ft^2)	25,000	25,000	50,000	15,000	15,000	30,000

* Eagle Creek.

Source: Hunter/ESE, 1989.

Table 3-19. Freshwater Mussels Collected in Saline River Main Stem, Gallatin and Hardin Counties, Illinois

Species	Stations 1	2	3	4	5	6	Total
Amblema plicata	--	--	--	--	1	--	1
Anodonta grandis	2	1	2	1	1	--	7
Anodonta suborbiculata	1	--	--	--	--	--	1
Lampsilis t. teres	--	1	--	--	1	--	2
Leptodea fragilis	--	--	1	--	--	--	1
Potamilus ohiensis	1	--	--	3	1	--	5
Quadrula quadrula	--	--	1	--	--	--	1
Toxolasma texasensis	--	1	--	--	--	--	1
Total	4	3	4	4	4	0	19
Species	3	3	3	2	4	0	8

Source: Hunter/ESE, 1989.

Table 3-20. Status and Age Distribution of Freshwater Mussels in Saline River (Main Stem), 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Amblema plicata	0	1	0.00	--	--	--
Anodonta grandis	2	5	28.57	--	--	2
Anodonta suborbiculata	1	0	100.00	--	--	1
Lampsilis t. teres	2	0	100.00	--	--	2
Leptodea fragilis	0	1	0.00	--	--	--
Potamilus ohiensis	5	0	100.00	--	1	4
Quadrula quadrula	1	0	100.00	--	--	1
Toxolasma texasensis	1	0	100.00	--	--	1
Total	12	7	63.16	--	1	11

* Live mussels.

Source: Hunter/ESE, 1989.

3.2.2 Big, Big Grande Pierre, Lusk Creeks

Big Creek, Big Grande Pierre Creek, and Lusk Creek flow through Shawnee National Forest. In contrast to the other study streams, these streams are rated as Class A by the IEPA/IDOC Biological Stream Characterization process (IEPA, 1988). The creeks are characterized by clear water, rock bottom, gravel riffles, and cold springs (Smith, 1971).

Big Creek

Big Creek flows through Hardin County and into the Ohio River near Ohio River Mile 889.5 (Figure 3-4). The lower portion of Big Creek is pooled due to the Ohio River. Substrate in this area is silt and clay. Water is fairly clear (Secchi disk depth 525). Dissolved oxygen, however, was low at the time of sampling (Table 3-21). The upper watershed is a clear free-flowing stream with alternating riffles and pools. Substrate consists of gravel, pebble, and sand.

Only a few mussels were collected in Big Creek (Table 3-22). The lower portion (Station 1) was sampled by diving in deep areas and pollywogging near the shoreline. Only four *A. grandis* were collected. All were live adults. Similarly, collection efforts by INHS (1987) just upstream of the Hunter/ESE collection area and prior to construction of the Highway 146 bridge, yielded only a few individuals. Species collected by INHS included *A. plicata*, *A. grandis*, *A. imbecilis*, and *T. parvus*.

Upstream, habitat changed to alternating pools and riffles. However, substrate was relatively loose sand/gravel which may have limited mussel colonization. No mussels or shells were collected. Only one *Corbicula fluminea* shell was collected in the area.

Big Grande Pierre Creek

Big Grande Pierre Creek flows through Pope County and into the Ohio River near Ohio River Mile 898. Habitat in the lower portion of the creek was shallow pool with a rubble, gravel, and bedrock substrate (Table 3-23). In the upstream stations, habitat consisted of riffle and pools with a variety of substrate types.

Figure 3-4
MUSSEL SAMPLING SITES ON BIG, BIG GRANDE PIERRE AND LUSK CREEKS, 1989

HUNTER / ESE
ENVIRONMENTAL SERVICES, INC.

Table 3-21. Summary of Habitat Characteristics in Big Creek (Ohio Drainage), 1989

	Stations	
	1	2
Habitat	pool	riffle/pool
Substrate	silt/clay	gravel/pebble/sand
Water clarity (mm)	525.0	bottom
Temperature (°C)	25.1	22.0
Dissolved Oxygen (ppm)	3.2	5.6
Conductivity (μohms/cm)	388.0	--
Approximate area sampled (ft^2)	100,000	40,000

Source: Hunter/ESE, 1989.

Table 3-22. Freshwater Mussels Collected in Big Creek, Hardin County, Illinois

Species	Stations 1	Stations 2	Total
Anodonta grandis	4	--	4
Total	4	--	4
Species	1	0	1

Source: Hunter/ESE, 1989.

Table 3-23. Summary of Habitat Characteristics in Big Grande Pierre Creek, 1989

	Stations		
	1	2	3
Habitat	shallow pool	riffle/ pool	riffle/ pool
Substrate	rubble/ gravel/ bedrock	gravel/ pebble/sand silt/clay	rubble/ gravel/ sand over hard clay
Water clarity (mm)	bottom	bottom	bottom
Temperature (°C)	23.0	22.0	21.5
Dissolved Oxygen (ppm)	6.2	6.5	6.5
Approximate area sampled (ft^2)	100,000	125,000	23,000

Source: Hunter/ESE, 1989.

Mussels in Big Grande Pierre Creek were scattered throughout the sampled areas. A total of 88 mussels of nine species were collected. For a small stream, Big Grande Pierre supports a good mussel fauna. Mussels in low order streams such as Big Grande Pierre Creek are typically not abundant due to fluctuating water level, temperature, and low stream productivity.

Species collected throughout the creek, as expected in a small stream, were those tolerant of a wide variety of conditions (Table 3-24). One exception is *A. l. carinata*, which is more typically collected in medium or larger rivers where conditions are more stable (Parmalee, 1967). Deeper pools and springs may render some areas stable enough to support a mussel bed. A few concentrations of mussels were found at Station 3. Scattered individuals collected throughout the stream could have resulted from high flow dislodging mussels from more stable upstream areas or areas with shifty substrates (i.e., loose sand and gravel).

Most of the individuals (83.5 percent) collected in Big Grande Pierre Creek were live. Only a few individuals were subadult. No juveniles were collected (Table 3-25). However, due to their shape and size, juveniles are very difficult to collect, particularly in sand and gravel substrates.

Lusk Creek

Lusk Creek flows through Pope County and into the Ohio River near Ohio River Mile 902.5. The lower end of the creek near the Ohio is a wide pooled area. The area receives intensive recreation, as one bank is a marina and the other a campground. Substrate near shore is silt and clay (Table 3-26). Mussels collected at Station 1 reflect the available habitat (Table 3-27). Most of the individuals collected were *A. grandis*, a typical inhabitant of shallow, soft substrate areas. Other species collected (*L. t. teres*, *L. fragilis*, *P. alatus*, *P. ohiensis*, *Q. quadrula*) are also common inhabitants of softer substrates.

Upstream, habitat consists of alternating riffles and pools. Substrates at Station 2 were either hard rubble and clay or loose sand; difficult for mussels

Table 3-24. Freshwater Mussels Collected in Big Grande Pierre Creek, Pope County, Illinois

Species	Stations 1	2	3	Total
Actinonaias l. carinata	--	2	--	2
Amblema plicata	1	1	--	2
Anodonta grandis	--	8	1	9
Lampsilis r. luteola	10	8	22	40
Lampsilis ventricosa	4	2	2	8
Leptodea fragilis	--	1	--	1
Potamilus alatus	3	3	11	17
Quadrula quadrula	--	1	--	1
Strophitus undulatus	--	4	4	8
Total	18	30	40	88
Species	4	9	5	9

Source: Hunter/ESE, 1989.

Table 3-25. Status and Age Distribution of Freshwater Mussels in Big Grande Pierre Creek, 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Actionaias l. carinata	2	0	100.00	--	--	2
Amblema plicata	2	0	100.00	--	--	2
Anodonta grandis	9	0	100.00	--	1	8
Lampsilis r. luteola	33	7	82.50	--	--	33
Lampsilis ventricosa	3	5	37.50	--	--	3
Leptodea fragilis	0	1	0.00	--	--	--
Potamilus alatus	12	5	70.59	--	--	12
Quadrula quadrula	0	1	0.00	--	--	--
Strophitus undulatus	6	2	75.00	--	3	3
Total	67	21	83.75	--	4	63

* Live mussels.

Source: Hunter/ESE, 1989.

Table 3-26. Summary of Habitat Characteristics in Lusk Creek, 1989

	Stations			
	1	2	3	4
Habitat	pool	riffle/ pool	riffle/ pool	riffle/ pool
Substrate	silt/clay	hard rubble/ clay/ loose sand	rubble/ gravel/ sand	rubble/ gravel/ sand/ bedrock
Water clarity (mm)	355.0	bottom	bottom	bottom
Temperature (°C)	27.0	24.0	24.0	24.5
Dissolved Oxygen (ppm)	6.7	4.0	7.5	6.9
Approximate area sampled (ft^2)	6,000	15,000	79,200	79,200

Source: Hunter/ESE, 1989.

Table 3-27. Freshwater Mussels Collected in Lusk Creek, Pope County, Illinois

Species	Stations 1	2	3	4	Total
Anodonta grandis	50	2	2	--	54
Anodonta imbecilis	--	--	--	8	8
Lampsilis r. luteola	--	1	30	8	39
Lampsilis t. teres	1	--	--	--	1
Leptodea fragilis	2	--	--	--	2
Potamilus alatus	1	--	--	--	1
Potamilus ohiensis	1	--	--	--	1
Quadrula quadrula	4	--	--	--	4
Strophitus undulatus	--	--	1	6	7
Total	59	3	33	22	117
Species	6	2	3	3	9

Source: Hunter/ESE, 1989.

to inhabit. Consequently, only a few individuals were collected (*A. grandis and L. r. luteola*).

Habitat at Stations 3 and 4 was more conducive to mussels and more individuals were collected. Substrates at Stations 3 and 4 consisted of rubble, gravel, and sand with some bedrock areas at Station 4. Species collected were *A. grandis*, *A. imbecillis*, *L. r. luteola*, and *Strophitus u. undulatus*. Typical of a low order stream, individuals were scattered throughout the samplyed area.

Most of the mussels collected in Lusk Creek were live. Only a few species were represented as shells (*L. t. teres*, *L. fragilis*, and *P. ohiensis*) (Table 3-28). Most individuals were adults, but subadults were collected of *A. grandis*, *L. r. luteola* and *S. u. undulatus*, indicative of a reproducing population.

Two areas of Lusk Creek were sampled by INHS in 1986. Results were similar to the present survey with *L. r. luteola* being the dominant taxa collected upstream. Additional species collected by INHS include *T. parvus* (not found in the present survey), *S. u. undulatus*, and *L. fragilis*.

4.0 SUMMARY

Three Wabash River drainage creeks, the Saline River Basin, and three Ohio River drainage creeks were sampled for freshwater mussels in July, August, and September 1989. A total of 637 mussels of 25 species were collected (Table 4-1). Figures 4-1 through 4-14 indicate the distribution of species in the study area. One species, *Uniomerus tetralasmus*, is listed as threatened in Illinois. One live and one shell were collected in the North Fork Saline River and one shell was collected in the Middle Fork.

Water quality, habitat quality, and stream size appeared to determine the abundance and species of mussels collected. Of the three Wabash drainage streams, Big Creek appeared to have the best water quality, but shifty substrate limited mussel colonization. In contrast, 147 mussels of 16 species were collected in Bonpas Creek where water quality was fair but substrate was stable.

Table 3-28. Status and Age Distribution of Freshwater Mussels in Lusk Creek, 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Anodonta grandis	48	6	88.89	--	3	45
Anodonta imbecilis	8	0	100.00	--	--	8
Lampsilis r. luteola	38	1	97.44	--	1	37
Lampsilis t. teres	0	1	0.00	--	--	--
Leptodea fragilis	0	2	0.00	--	--	--
Potamilus alatus	1	0	100.00	--	--	1
Potamilus ohiensis	0	1	0.00	--	--	--
Quadrula quadrula	4	0	100.00	--	--	4
Strophitus undulatus	7	0	100.00	--	3	4
Total	106	11	90.60	--	7	99

* Live mussels.

Source: Hunter/ESE, 1989.

Table 4-1. Summary of Mussels Collected in Eastern and Southern Illinois, 1989

Species	Wabash Drainage			Ohio Drainage							Total
	Big Creek	Mill Creek	Bonpas Creek	North Fork	Middle Fork	South Fork	Saline River	Big Creek	Big Grande Creek	Lusk Creek	
Actinonaias l. carinata	--	--	--	--	--	--	--	--	2	--	2
Amblema plicata	--	--	21	22	--	--	1	--	2	--	46
Anodonta grandis	--	--	9	17	--	--	7	4	9	54	100
Anodonta imbecilis	--	--	--	--	--	--	--	--	--	8	8
Anodonta suborbiculata	--	--	--	--	--	--	1	--	--	--	1
Arcidens confragosus	--	--	3	--	--	--	--	--	--	--	3
Fusconaia flava	--	--	1	--	--	--	--	--	--	--	1
Lampsilis r. luteola	--	--	1	2	--	--	--	--	40	39	82
Lampsilis t. teres	--	2	2	33	--	--	2	--	--	1	40
Lampsilis ventricosa	--	5	--	1	--	--	--	--	8	--	14
Lasmigona complanata	--	--	19	17	--	--	--	--	--	--	36
Leptodea fragilis	--	2	9	5	--	--	1	--	1	2	20
Ligumia recta	--	--	--	1	--	--	--	--	--	--	1
Ligumia subrostrata	--	--	2	14	--	--	--	--	--	--	16
Megalonaias nervosa	--	--	4	5	--	--	--	--	--	--	9
Potamilus alatus	--	--	5	7	--	--	--	--	17	1	30
Potamilus ohiensis	--	--	--	14	--	--	5	--	--	1	20
Quadrula pustulosa	--	1	1	--	--	--	--	--	--	--	2
Quadrula quadrula	--	--	38	95	--	--	1	--	1	4	139
Strophitus u. undulatus	--	--	--	--	--	--	--	--	8	7	15
Toxolasma parvus	--	3	--	9	--	--	--	--	--	--	12
Toxolasma texasensis	--	--	6	1	--	--	1	--	--	--	8
Tritogonia verrucosa	--	--	24	--	--	--	--	--	--	--	24
Truncilla truncata	--	--	2	3	--	--	--	--	--	--	5
Uniomerus tetralasma	--	--	--	2	1	--	--	--	--	--	3
Total	0	13	147	248	1	0	19	4	88	117	637
Number of species	0	5	16	17	1	0	8	1	9	9	25

Source: Hunter/ESE, 1989.

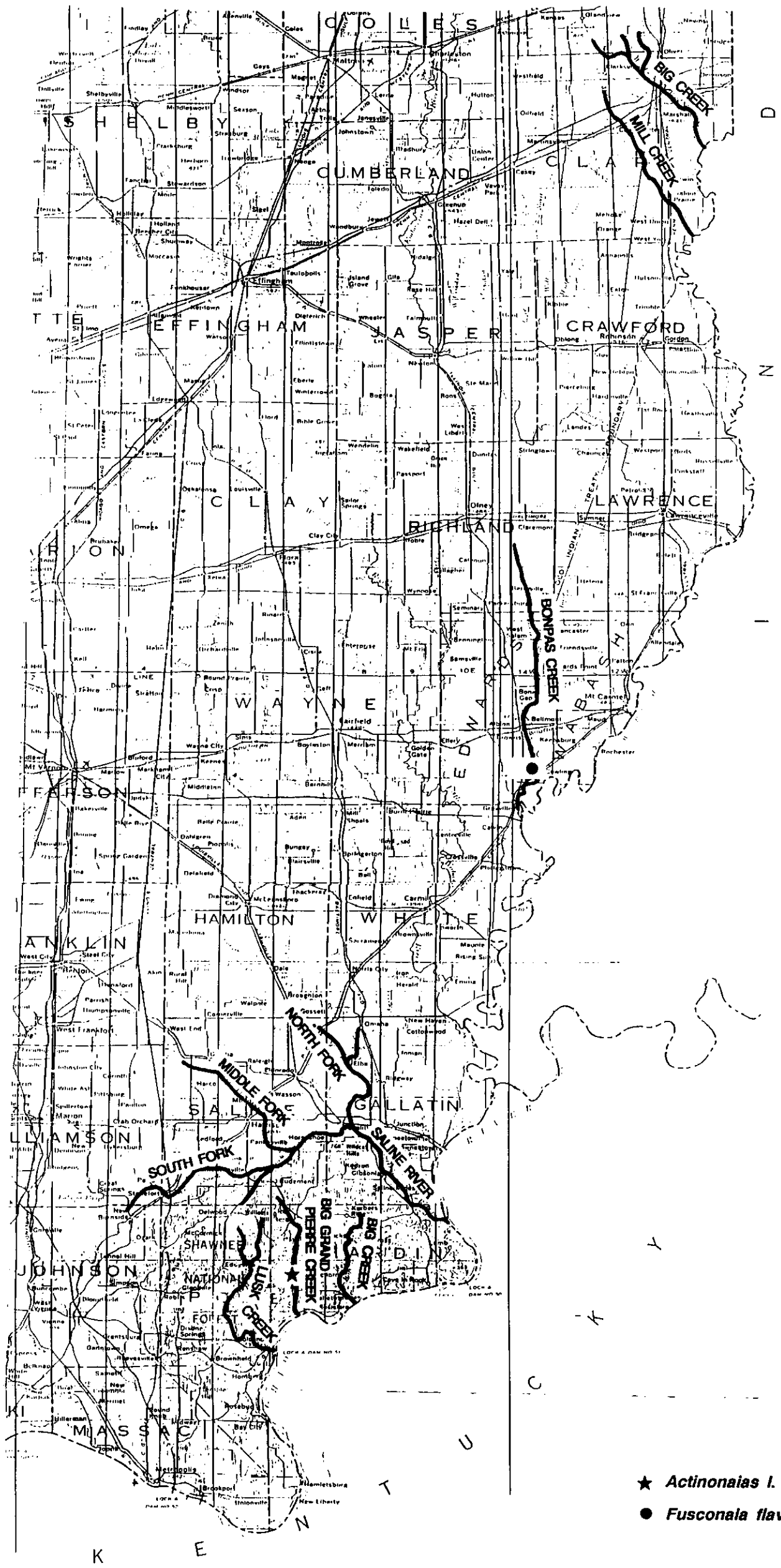

Figure 4-1
DISTRIBUTION OF *Actinonaias l. carinata* AND *Fusconaia flava* IN THE STUDY AREA

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

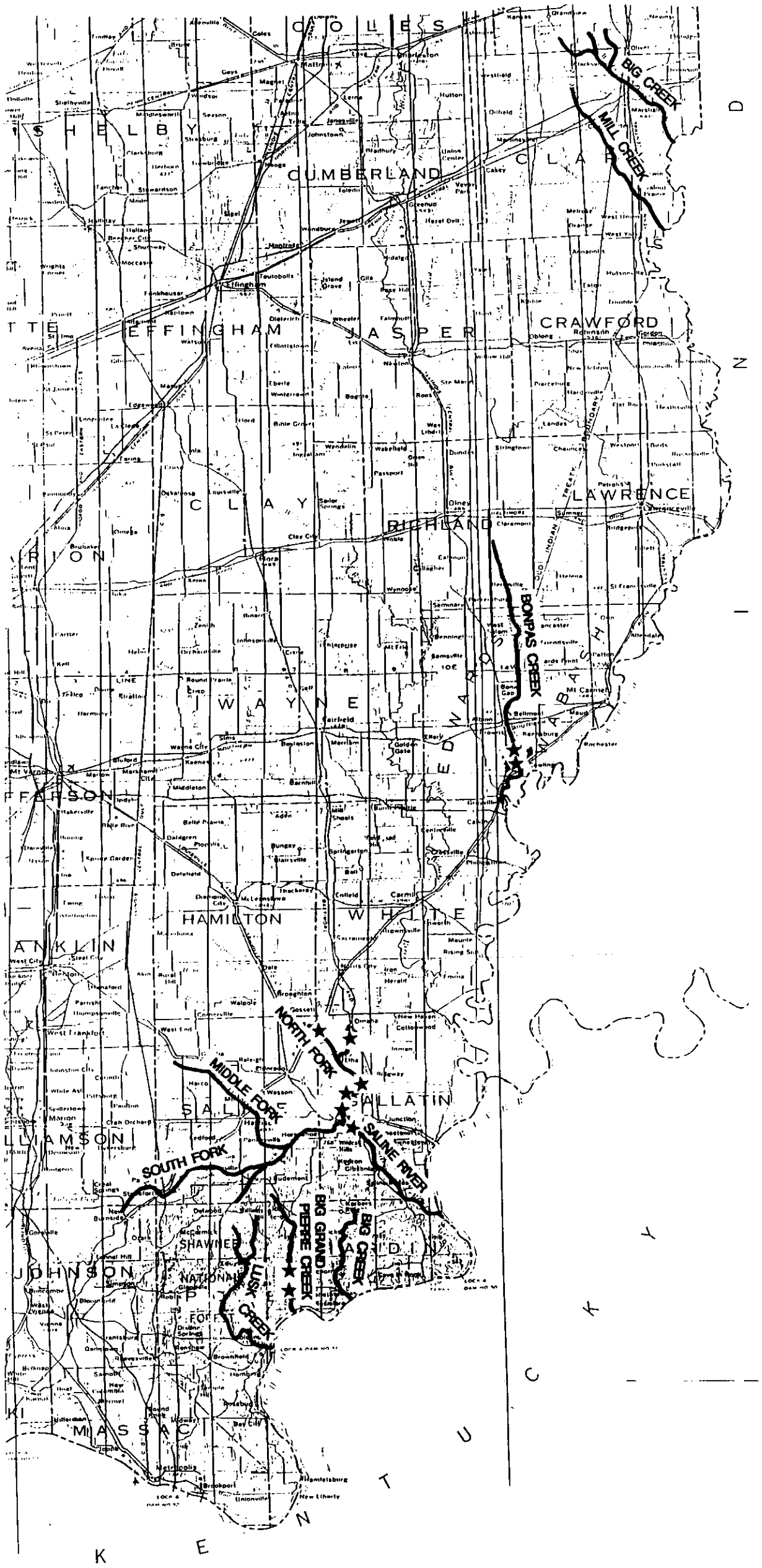

Figure 4-2
DISTRIBUTION OF *Amblema plicata* IN THE STUDY AREA

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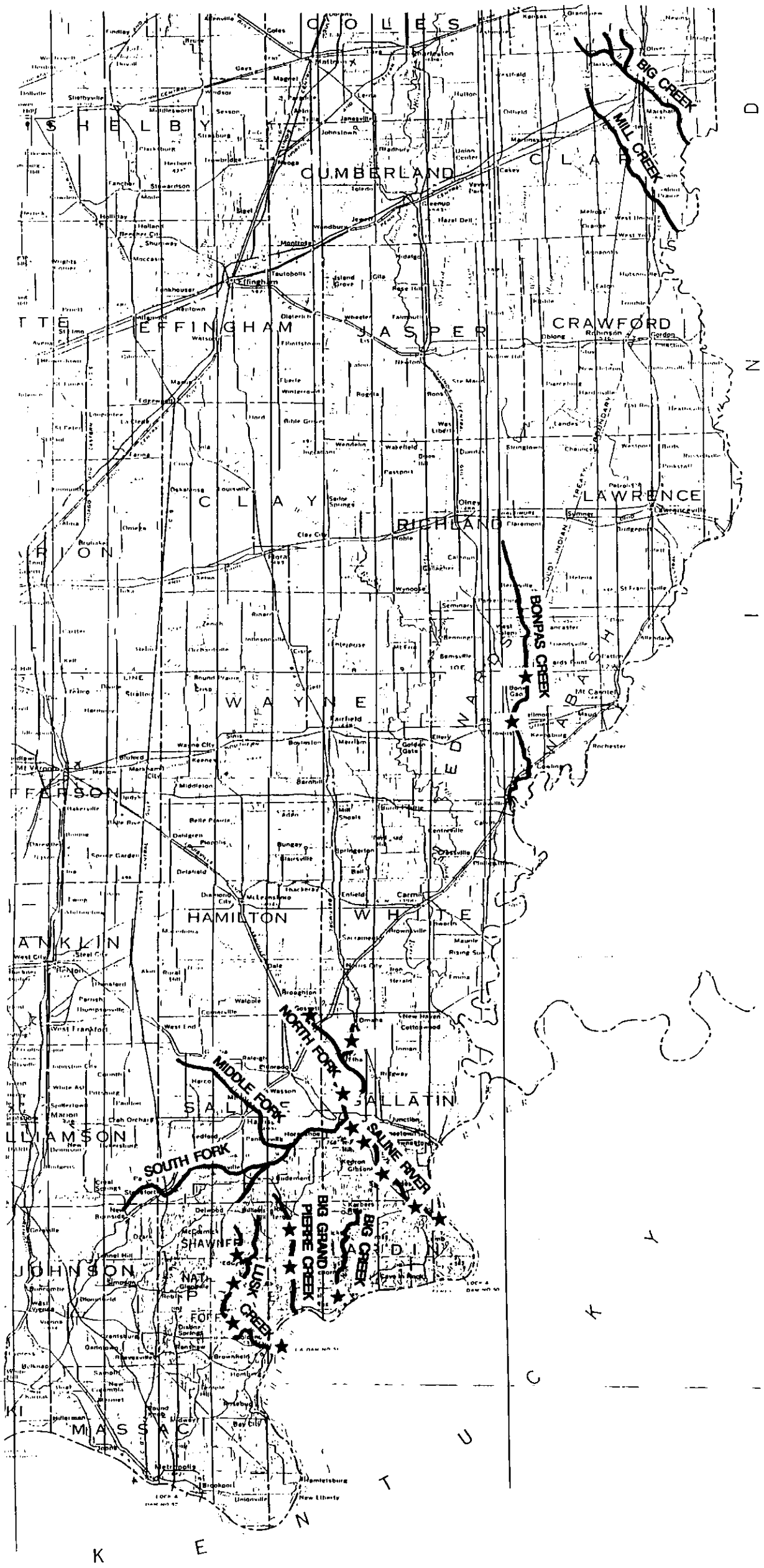

Figure 4-3
DISTRIBUTION OF *Anodonta grandis* IN THE STUDY AREA

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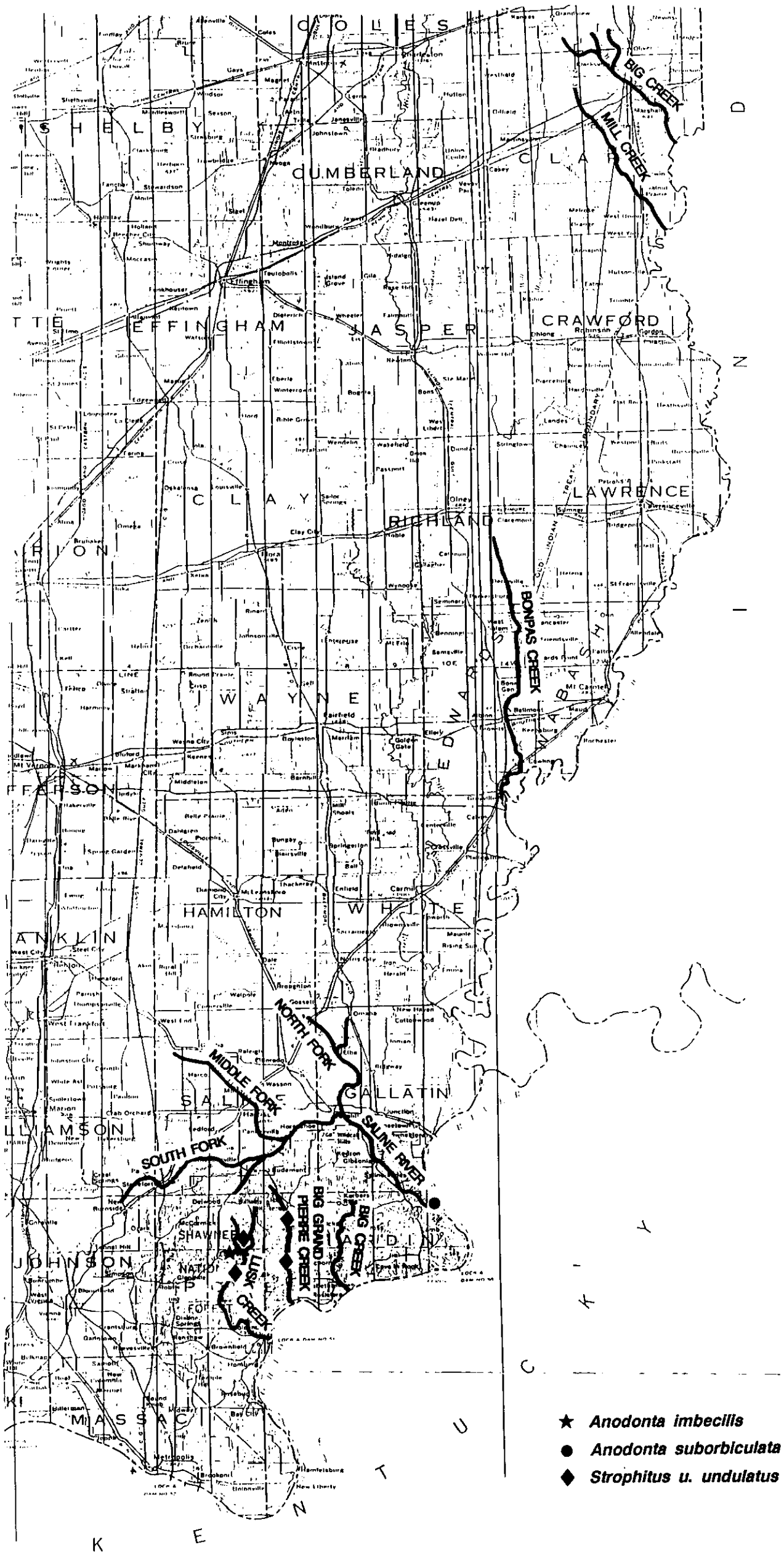

Figure 4-4
DISTRIBUTION OF *Anodonta imbecilis*, *Anodonta suborbiculata* AND *Strophitus u. undulatus* IN THE STUDY AREA

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ENVIRONMENTAL SERVICES, INC.

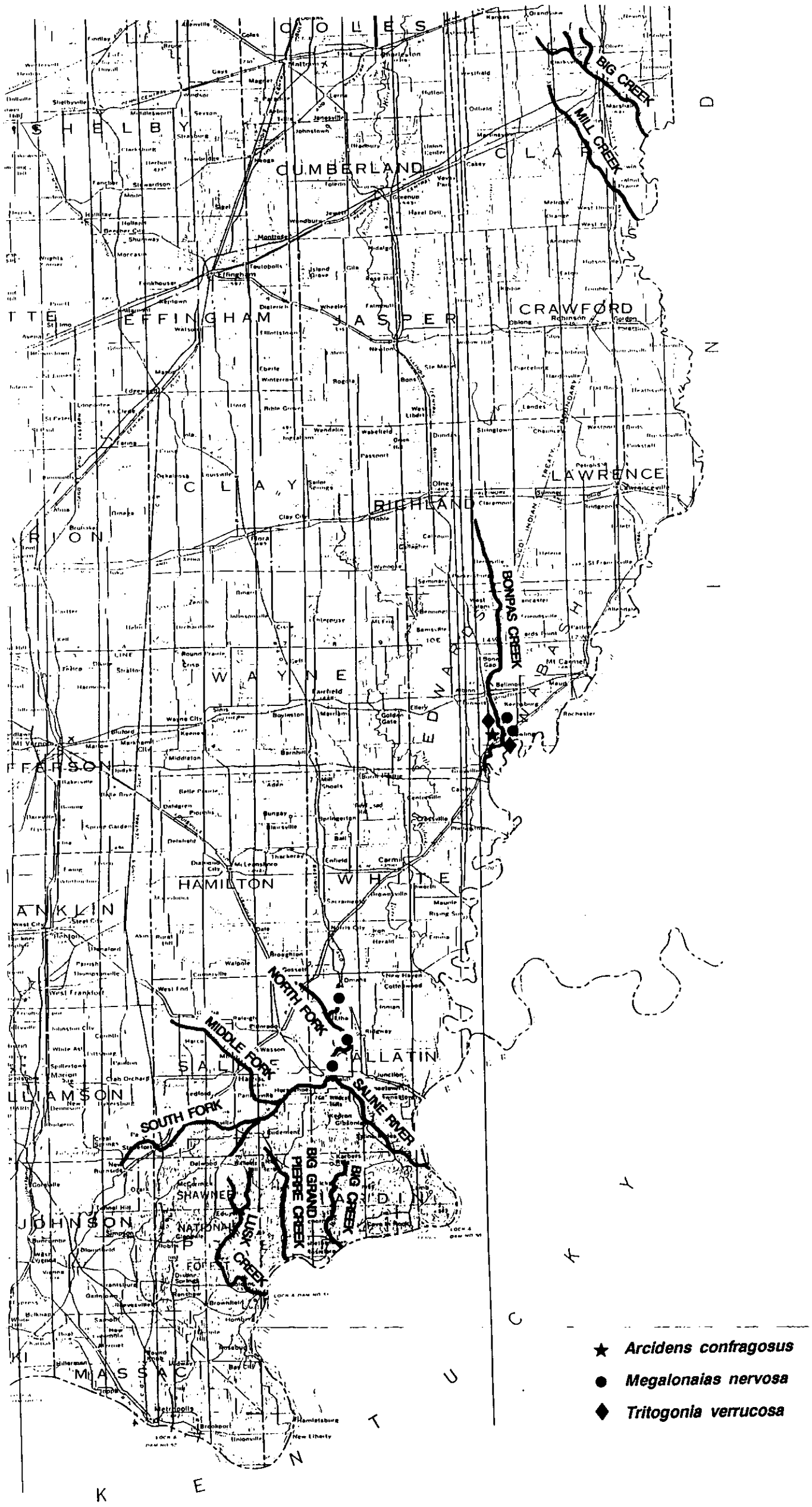

Figure 4-5
***DISTRIBUTION OF Arcidens confragosus, Megalonaias nervosa* AND *Tritogonia verrucosa* IN THE STUDY AREA**

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

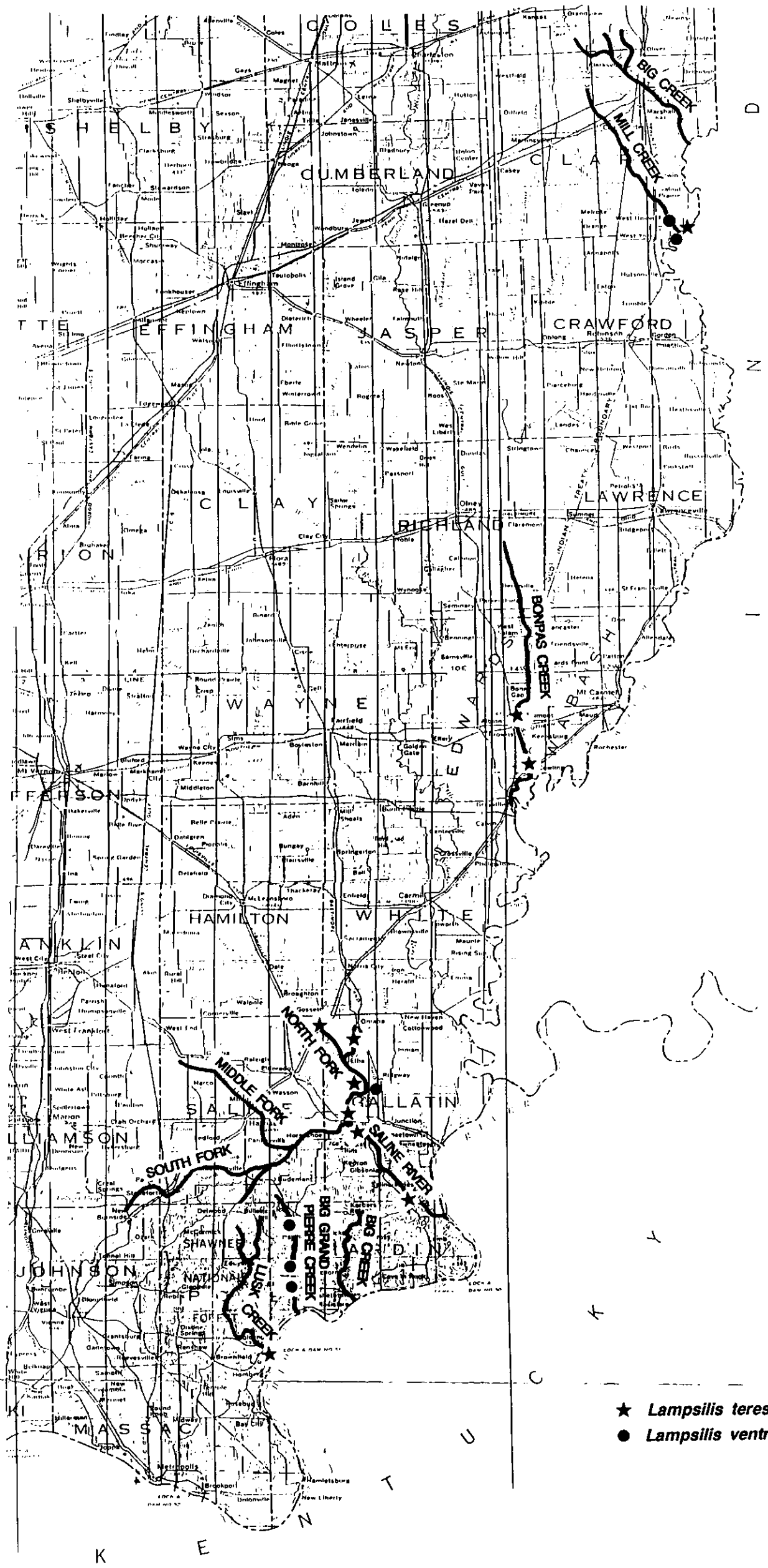

Figure 4-7
DISTRIBUTION OF *Lampsilis teres* AND *Lampsilis ventricosa* IN THE STUDY AREA

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ENVIRONMENTAL SERVICES, INC.

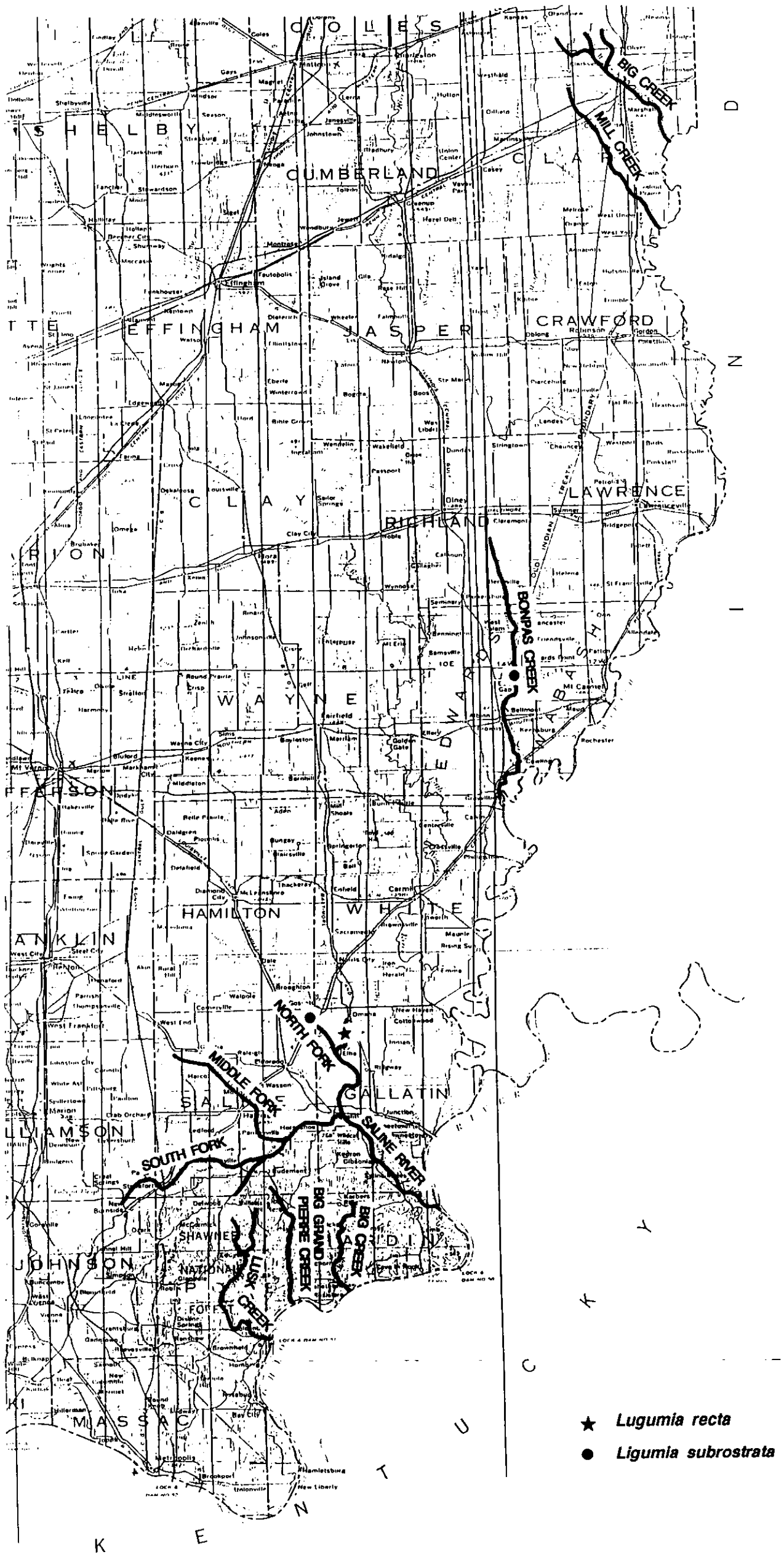

Figure 4-10
DISTRIBUTION OF *Ligumia recta* AND *Ligumia subrostrata* IN THE STUDY AREA

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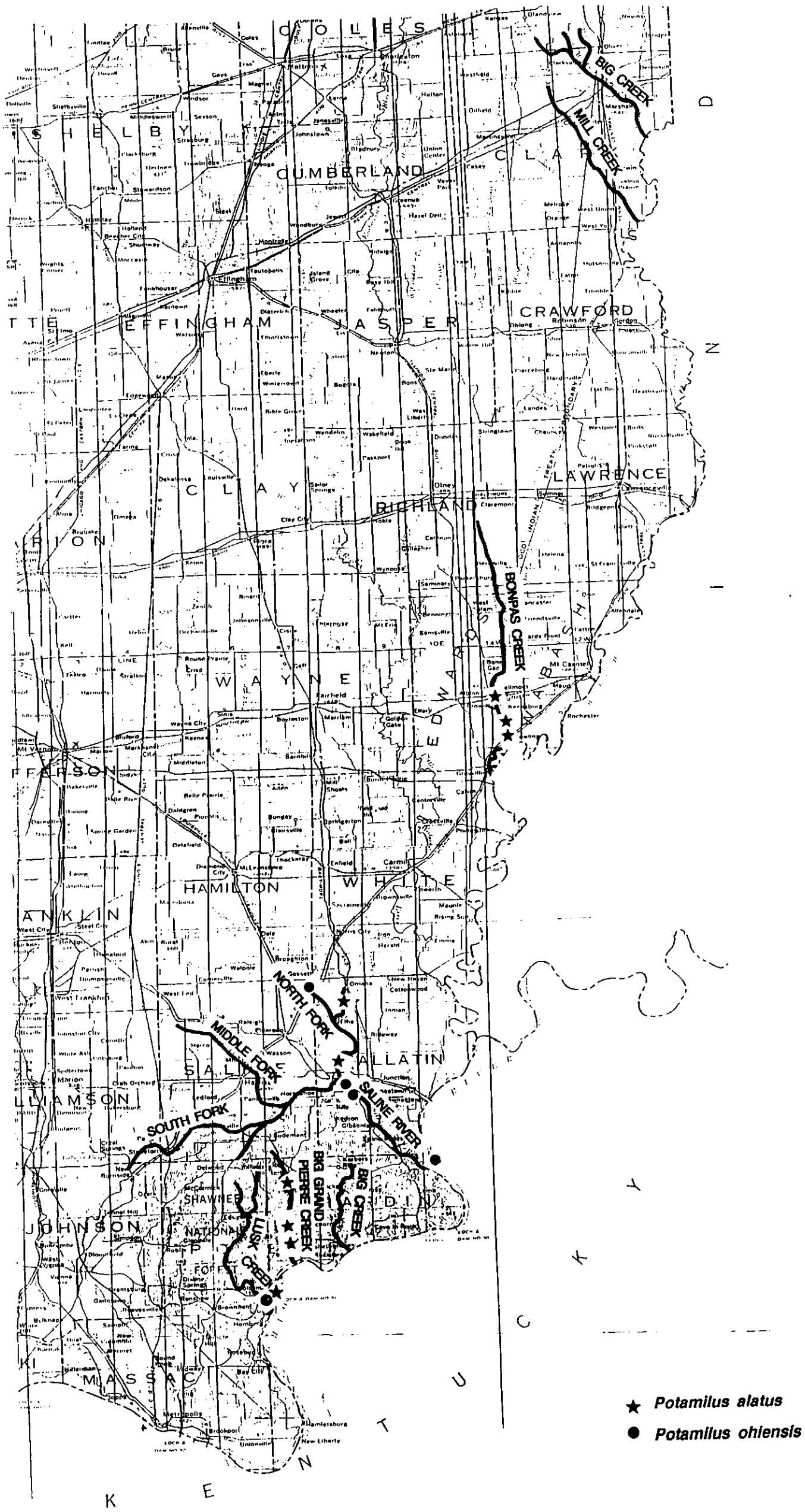

Figure 4-11
DISTRIBUTION OF *Potamilus alatus* AND *Potamilus ohiensis* IN THE STUDY AREA

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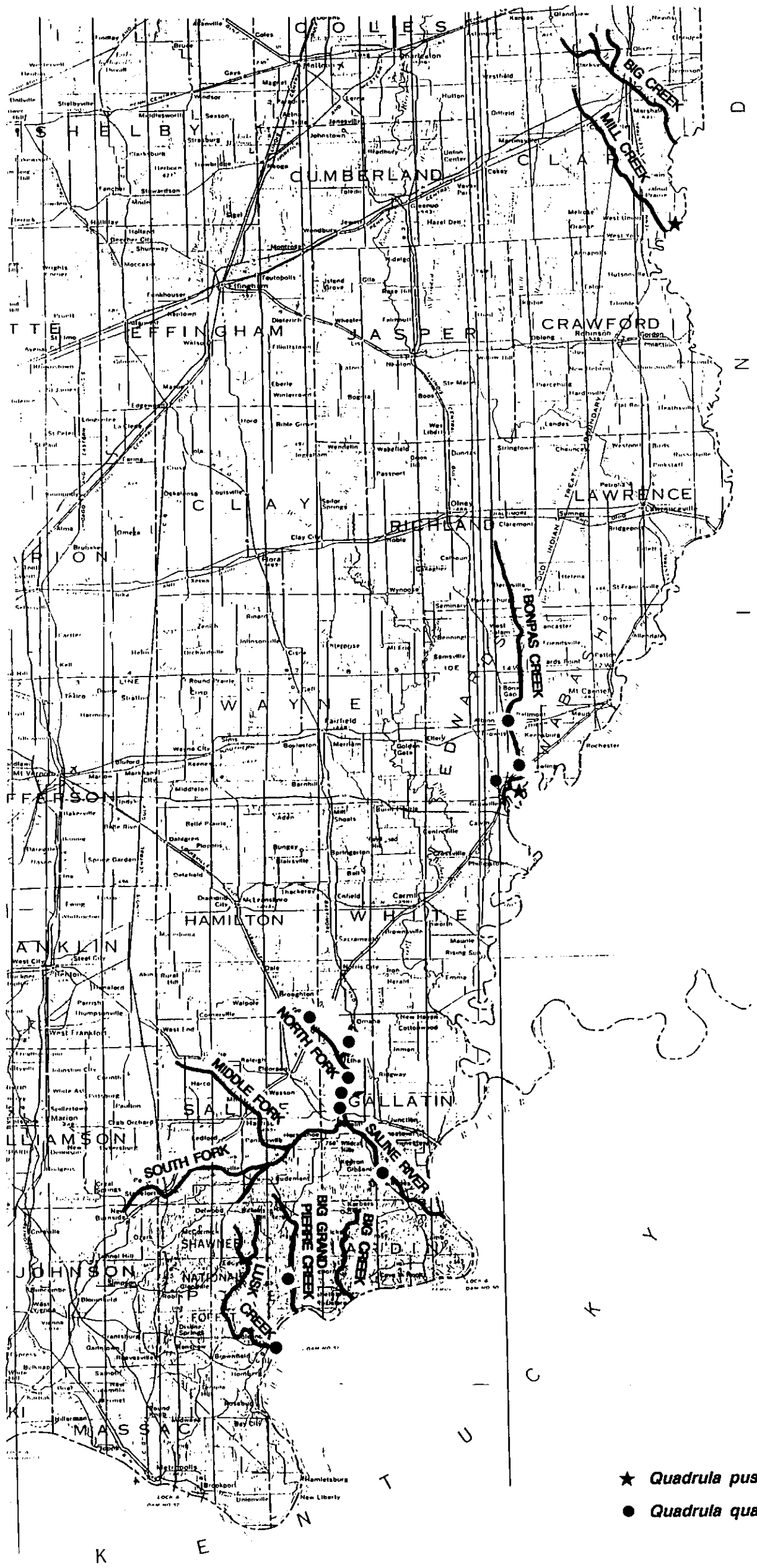

Figure 4-12
DISTRIBUTION OF *Quadrula pustulosa* AND *Quadrula quadrula* IN THE STUDY AREA

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

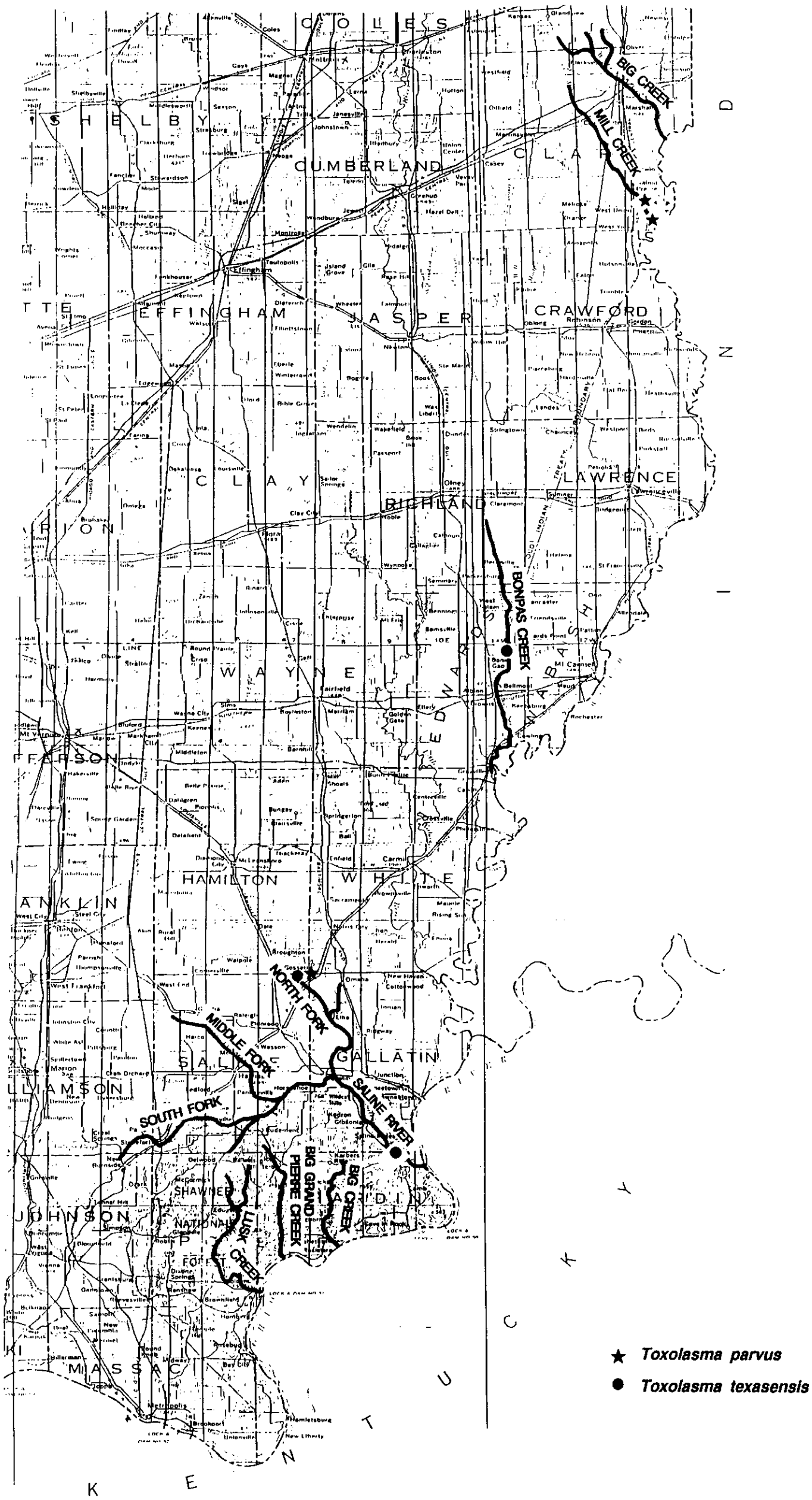

Figure 4-13
DISTRIBUTION OF *Toxolasma parvus* AND *Toxolasma texasensis* IN THE STUDY AREA

HUNTER/ESE
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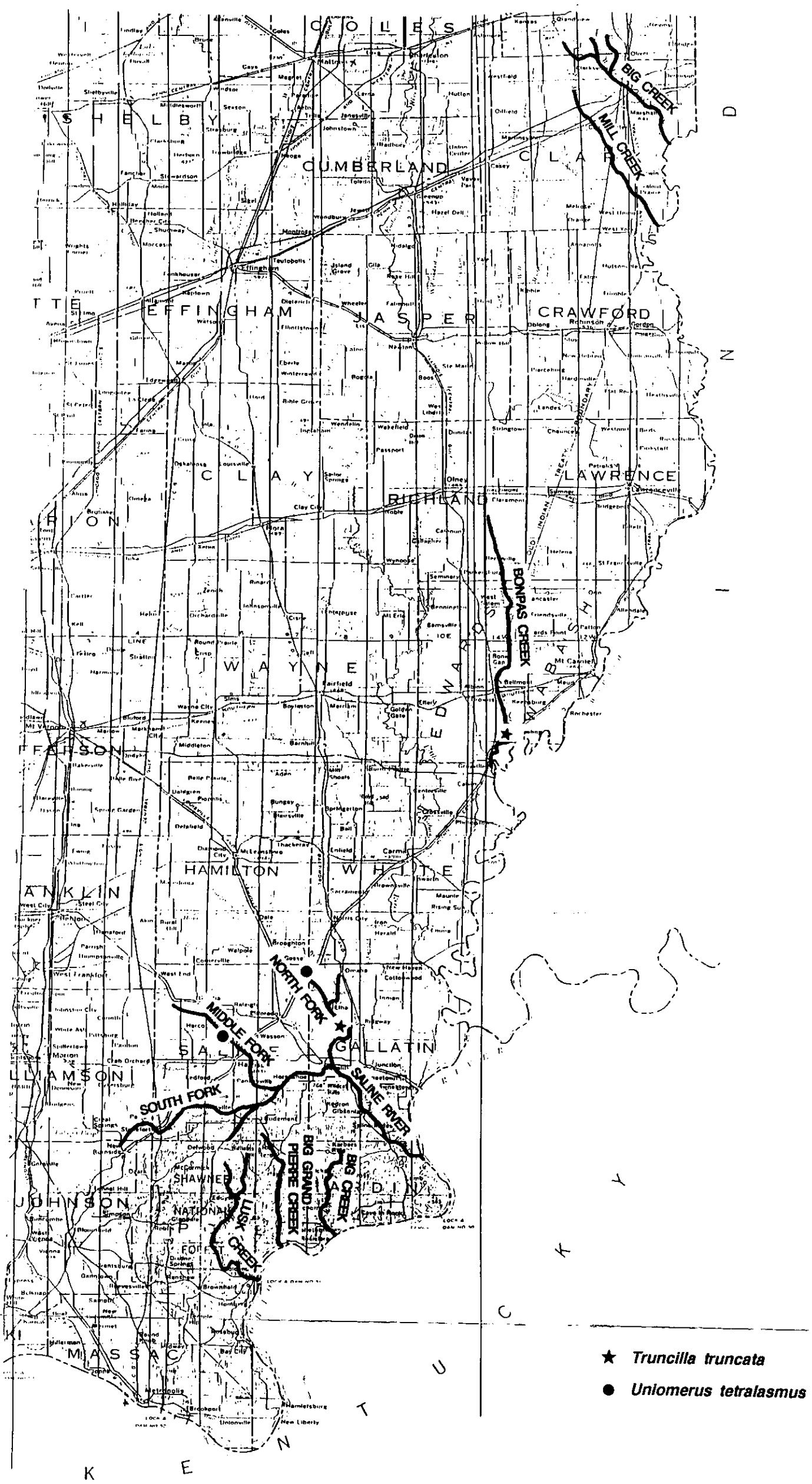

Figure 4-14
DISTRIBUTION OF *Truncilla truncata* AND *Uniomerus tetralasmus* IN THE STUDY AREA

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

Mussels in the Saline River Basin were limited by stream alteration, pollution (oil fields, agriculture runoff, strip mine runoff, sewage effluent), and substrate. Water quality and substrate were most suitable for mussels in the North Fork where 248 mussels of 17 species, including *U. tetralasmus*, were collected. No mussels were collected in the South Fork and only one shell was collected in the Middle Fork. A few individuals were scattered in the main stem.

Big, Big Grande Pierre, and Lusk Creeks were the best streams in terms of water quality. However, low order streams such as these typically lack the stability in flow, depth, and substrate necessary for a stable mussel population. Nevertheless, numerous mussels were collected in both Big Grande Pierre Creek and Lusk Creek. Only four mussels were collected in Big Creek which lacked suitable substrate.

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APPENDIX A

Description of Sample Areas

Description of Sample Areas (Page 1 of 3)

Creek	County	Station	Description	USGS Quad
Big Creek	Clark	1	T11N, R11W, Sec 35 county road bridge	Hutton
		2	T11N, R11W, Sec 17 US Hwy 40 bridge	Marshall
		3	T12N, R12W, Sec 36 Illinois Hwy 1 bridge	Marshall
		4	T12N, R12W, Sec 36 county road bridge	Marshall
	Clark, Edgar	5	T12N, R12W, Sec 24 county road bridge	Marshall
	Clark	6	T12N, R12W, Sec 34 + 35 county road bridge	Marshall
Mill Creek	Clark	1	T9N, R11W, Sec 28 + 33 gravel road bridge	West Union
		2	T10N, R12W, Sec 36 county road bridge	Snyder
		3	T10N, R12W, Sec 23 county road bridge	Snyder
Bonpas Creek	Edwards, Wabash	1	T2S, R14W, Sec 34 + 35 Illinois Hwy 1 bridge	Grayville
		2	T2S, R14W, Sec 26 county road bridge	Grayville
		3	T1S, R14W, Sec 33 Illinois Hwy 15 bridge	Bone Gap
		4	T1N, R14W, Sec 22 + 23 county road bridge	Berryville
North Fork	Gallatin	1	T9S, R8E, Sec 16 Illinois Hwy 13 bridge	Equality
		2	T8S, R8E, Sec 27 + 34 county road bridge	Ridgeway

Description of Sample Areas (Page 2 of 3)

Creek	County	Station	Description	USGS Quad
North Fork	Gallatin	3	T8S, R8E, Sec 23 county road bridge	Ridgeway
	Saline	4	T7S, R7E, Sec 25 US Hwy 45 bridge	Broughton
	Gallatin	5	T7S, R8E, Sec 34 county road bridge	Ridgeway
Middle Fork	Saline	1	T9S, R6E, Sec 11 US Hwy 45 bridge	Galatia
		2	T9S, R6E, Sec 3 + 4 Illinois Hwy 34 bridge	Galatia
		3	T8S, R6E, Sec 19 + 30 gravel road bridge	Galatia
		4	T8S, R5E, Sec 15 + 16 county road bridge	Harco
South Fork	Saline	1	T10S, R7E, Sec 6 county road bridge	Rudement
		2	T10S, R4E, Sec 6 county road bridge	Crab Orchard
Saline River Main Stem	Gallatin	1	T11S, R10E, Sec 8 near Saline Landing	Saline Mines
		2	T11S, R9E, Sec 34 SE¼ near bend in river	Saline Mines
Eagle Creek	Gallatin	3	T10S, R9E, Sec 18 Illinois Hwy 1 bridge	Equality
Saline River	Gallatin	4	T9S, R8E, Sec 26 0.5 mile upstream of Illinois Hwy 1 bridge	Equality
		5	T9S, R8E, Sec 21 downstream of North Fork confluence	Equality

Description of Sample Areas (Page 3 of 3)

Creek	County	Station	Description	USGS Quad
Big Creek	Hardin	1	T12S, R8E, Sec 27 downstream of Illinois Hwy 146 bridge	Rosiclare
		2	T12S, R8E, Sec 4 county road bridge	Rosiclare
Big Grande Pierre	Pope	1	T12S, R7E, Sec 22 Illinois Hwy 146 bridge	Shelterville
		2	T12S, R7E, Sec 9 county road bridge	Shelterville
		3	T11S, R7E, Sec 15 county road bridge	Herod
Lusk	Pope	1	T13S, R7E, Sec 19 Illinois Hwy 146 bridge	Galconda
		2	T13S, R6E, Sec 16 gravel road bridge	Waltersburg
		3	T12S, R6E, Sec 16 county road bridge	Waltersburg
		4	T12S, R6E, Sec 3 gravel road bridge	Eddyville

89-030

A STUDY OF FRESHWATER MUSSELS IN TRIBUTARIES OF THE LOWER OHIO AND WABASH RIVERS

DRAFT

Prepared for:

ILLINOIS DEPARTMENT OF CONSERVATION
DIVISION OF NATURAL HERITAGE
Springfield, Illinois

Prepared by:

HUNTER/ESE, INC.
St. Louis, Missouri

Hunter/ESE No. 98-533-033

December 1989

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

11665 Lilburn Park Road
St. Louis, Missouri 63146-3535
Phone: 314/567-4600
Fax: 314/567-5030

December 15, 1989
98-533

Mr. Glen Kruse
Division of Natural Heritage
Illinois Department of Conservation
Lincoln Tower Plaza
524 South Second Street
Springfield, Illinois 62701-1787

Dear Glen:

Attached is a copy of the report for the "Study of Freshwater Mussels in Tributaries of the Lower Ohio and Wabash Rivers" for your review. Field collection was completed in late September. Bonpas Creek and the North Fork of the Saline River yielded the highest mussel concentrations. Very few mussels were collected from Mill Creek and none were collected from Big Creek; possibly due to the shifty nature of the substrate. Scattered individuals were collected in the remainder of the Saline Basin. Big, Big Grande Pierre, and Lusk Creeks are low order streams (third or less) and, therefore, do not support large mussel populations. However, numerous individuals were found throughout Lusk and Big Grande Pierre Creeks.

If you have any questions or comments, please feel free to contact me. Upon receipt of your comments, a final report will be prepared and 20 copies submitted to your office. We enjoyed working on this project in 1989 and hope similar opportunities arise in the future. Have a Merry Christmas.

Sincerely,

Heidi L. Dunn
Project Manager

/djw

Enclosure

STATE OF ILLINOIS

DEPARTMENT OF CONSERVATION

CONTRACT FOR PROFESSIONAL SERVICES

THIS CONTRACT is made and entered by and between the State of Illinois, Department of Conservation, Office of Resource Management, Division of Natural Heritage (hereinafter called the State), and Hunter/ESE, Inc., hereinafter called "Vendor".

1) Services: The Vendor agrees to provide a report on the status of the freshwater mussels in the Saline River, Big Creek (Clark Co.), Mill Creek, Bonpas Creek, Big Creek (Hardin Co.), Big Grand Pierre Creek, and Lusk Creek as per the proposal dated November 14, 1988.

Phase I - Vendor agrees to:

A. Conduct project preparation

B. Identify historical populations from museum collections

C. Initiate field surveys at specified sampling sites

D. Provide one progress report

Phase I will be completed no later than June 30, 1989. Expenses for Phase I will not exceed $9,995.00

Phase II - Vendor agrees to:

A. Complete field surveys at specified sampling sites

B. Complete identification and cataloging of all specimens collected

C. Provide one progress report

D. Provide one final report which includes distribution maps for all species, a list of species taken by locality, and photographs of all species

Phase II will be completed between July 1, 1989 and December 31, 1989. The maximum cost for Phase II will be $10,000.00.

2) Compensation: The State will pay the Vendor one payment upon satisfactory completion of each Phase of the contract, as follows:

Phase I - $9,995.00

Phase II - $10,000.00

3) Expenses: There shall be no separate reimbursement of Vendor's expenses under this contract.

4) Billing: The Vendor shall submit an invoice voucher to the state upon completion of the services herein described for each Phase.

5) Term: The term of this contract shall be for the period commencing with the signing of this contract and ending December 31, 1989, inclusive. All reports and billings for each project Phase are due to the State on the dates stated in this contract.

6) Appropriation: Obligations of the State will cease immediately without penalty of further payment being required if in any fiscal year the Illinois General Assembly or Federal Funding Source fails to appropriate or otherwise make available sufficient funds for this agreement.

7) Certification: The Vendor certifies that it has not been convicted of bribery or attempting to bribe an officer or employees of the State of Illinois, nor has the Vendor made an admission of guilt of such conduct which is a matter of record, nor has an official, agent, or employee of the Vendor been so convicted nor made such admission of bribery on behalf of the firm and pursuant to the direction or authorization of a responsible official of the firm. The contractor certifies that it has not been barred from bidding on this contract as

a result of a violation of Section 33E-3 or 33E-4 of the Criminal Code of 1961.

8) Termination: This contract may be terminated by either party upon 15 days written notice. Upon termination, the Vendor shall be paid for work satisfactorily completed prior to the date of termination.

9) Work Product: All documents, including reports and all other work products produced by the Vendor under this contract, shall become and remain the property of the State.

10) Laws of Illinois: This contract shall be governed in all respects by the laws of the State of Illinois.

11) Unlawful Discrimination:

A. Vendor agrees not to commit unlawful discrimination in employment in Illinois as that term is used in Article 2 of the Illinois Human Rights Act (Ill. Rev. Stat., 1979, Ch. 68, par. 1-101 et seq.) and further agrees to take affirmative action to ensure that no unlawful discrimination is committed.

B. Vendor agrees to comply with "AN ACT to prohibit discriminations and intimidation on account of race, creed, color, sex, religion, physical or mental handicap unrelated to ability, or national origin in employment under contracts for public buildings or public works", approved July 8, 1933, as amended. The provisions of this Act are made a part of this contract by reference as though set forth in full herein.

12) Subcontractor Disclosure: (consultant Services Only)
Vendors will not utilize the services of a subcontractor to fulfill obligations under this contract.

13) Conflict of Interest: Vendor agrees to comply with the provisions of

the Illinois Purchasing Act. prohibiting conflict of interest (Ill. Rev. Stat., 1979, ch. 127, pars. 132.11-1 through 132.11-5) and all the terms, conditions and provision of those Sections apply to this contract and are made a part of this contract the same as though they were incorporated and included herein.

IN WITNESS WHEREOF, the parties hereto have caused this contract to be executed by their duly authorized representatives.

VENDOR:

BY: _____

ADDRESS: _____

_____

FEIN or SS# _____

DHR NO. _____

DATE: _____

Principal Investigator:

_____

STATE OF ILLINOIS

DEPARTMENT OF CONSERVATION

BY: _____
Mark Frech, Director

DATE: _____

RECOMMENDED BY:

_____
Division of Natural Heritage

TABLE OF CONTENTS

Section		Page
1.0	INTRODUCTION	1
2.0	METHODS	3
	2.1 LITERATURE REVIEW AND MUSEUM CONSULTATION	3
	2.2 FIELD RECONNAISSANCE	3
	2.3 MUSSEL SAMPLING	3
3.0	RESULTS AND DISCUSSION	4
	3.1 WABASH DRAINAGE	4
	3.1.1 Big Creek	6
	3.1.2 Mill Creek	10
	3.1.3 Bonpas Creek	10
	3.2 OHIO RIVER DRAINAGE	18
	3.2.1 Saline River	18
	3.2.2 Big, Big Grande Pierre, Lusk Creeks	36
4.0	SUMMARY	46
5.0	LITERATURE CITED	49

LIST OF TABLES
(Page 1 of 2)

Table		Page
3-1	Mussels Historically Collected in the Lower Wabash River	5
3-2	Summary of Habitat Characteristics in Big Creek (Wabash Drainage), 1989	7
3-3	Freshwater Mussels Collected in Big Creek, Clark County, Illinois	9
3-4	Summary of Habitat Characteristics of Mill Creek, 1989	11
3-5	Freshwater Mussels Collected in Mill Creek, Clark County, Illinois	12
3-6	Status and Age Distribution of Freshwater Mussels in Mill Creek, 1989	13
3-7	Summary of Habitat Characteristics in Bonpas Creek, 1989	16
3-8	Freshwater Mussels Collected in Bonpas Creek, Wabash and Edwards Counties, Illinois	17
3-9	Status and Age Distribution of Freshwater Mussels in Bonpas Creek, 1989	19
3-10	Species Historically Occurring in the Saline River Basin	21
3-11	Summary of Habitat Characteristics in North Fork Saline River, 1989	23
3-12	Freshwater Mussels Collected in North Fork Saline River, Saline and Gallatin Counties, Illinois	24
3-13	Status and Age Distribution of Freshwater Mussels in North Fork Saline River, 1989	26
3-14	Summary of Habitat Characteristics in Middle Fork Saline River, 1989	28
3-15	Freshwater Mussels Collected in Middle Fork Saline River, Saline County, Illinios	29
3-16	Summary of Habitat Characteristics in South Fork Saline River, 1989	30

LIST OF TABLES
(Page 2 of 2)

Table		Page
3-17	Freshwater Mussels Collected in South Fork Saline River, Saline County, Illinois	31
3-18	Summary of Habitat Characteristics in Saline River (Main Stem), 1989	33
3-19	Freshwater Mussels Collected in Saline River Main Stem, Gallatin and Hardin Counties, Illinois	34
3-20	Status and Age Distribution of Freshwater Mussels in Saline River (Main Stem), 1989	35
3-21	Summary of Habitat Characteristics in Big Creek (Ohio Drainage), 1989	38
3-22	Freshwater Mussels Collected in Big Creek, Hardin County, Illinois	39
3-23	Summary of Habitat Characteristics in Big Grande Pierre Creek, 1989	40
3-24	Freshwater Mussels Collected in Big Grande Pierre Creek, Pope County, Illinois	42
3-25	Status and Age Distribution of Freshwater Mussels in Big Grande Pierre Creek, 1989	43
3-26	Summary of Habitat Characteristics in Lusk Creek, 1989	44
3-27	Freshwater Mussels Collected in Lusk Creek, Pope County, Illinois	45
3-28	Status and Age Distribution of Freshwater Mussels in Lusk Creek, 1989	47
4-1	Summary of Mussels Collected in Eastern and Southern Illinois, 1989	48

LIST OF FIGURES

Figure		Page
1-1	Location of Study Creeks in Eastern and Southern Illinois	2
3-1	Mussel Sampling Sites on Big and Mill Creek, 1989	8
3-2	Mussel Sampling Sites on Bonpas Creek, 1989	14
3-3	Mussel Sampling Sites in Saline River Basin, 1989	20
3-4	Mussel Sampling Sites on Big, Big Grand Pierre, and Lusk Creeks, 1989	37

1.0 INTRODUCTION

The Illinois Department of Conservation (IDOC), Division of Natural Heritage, is currently in the process of conducting a statewide inventory of freshwater mussels. Useful information obtained through a statewide survey may include:

1. Identifying changes in water quality and habitat quality through comparison of present populations to historical data;
2. Determining the status of Federally endangered species occurring in the State of Illinois; and
3. Developing a data base useful to agencies in determining potential impacts of proposed development or alteration of streams on mussel populations.

Mussel inventories in the southern portion of Illinois have been conducted primarily in the Wabash River (Goodrich and Van der Schalie, 1944; Krumholz *et al.*, 1970; Clark, 1976) and Ohio River (Williams and Schuster, 1982). Parmalee (1967) discusses 46 species found in the Wabash and Ohio River drainages. Recent studies in Southern Illinois funded by IDOC include inventories of the Embarras River, Little Wabash River, and a survey of the Wabash River for *Potamilus capax*. Many of the other streams in southern Illinois have not been inventoried to date.

Hunter/ESE sampled freshwater mussels in three Wabash River Tributaries (Big Creek, Mill Creek, Bonpas Creek), the Saline River Basin (a tributary of the Ohio River), and three small Ohio River tributaries (Big Creek, Lusk Creek, Big Grande Pierre Creek) during the summer and fall of 1989 (Figure 1-1). The purpose of this study of unionid mollusks in the study streams was to document:

- Species composition,
- Relative abundance,
- Diversity,
- Size class structure,
- Distribution, and
- Habitat associations.

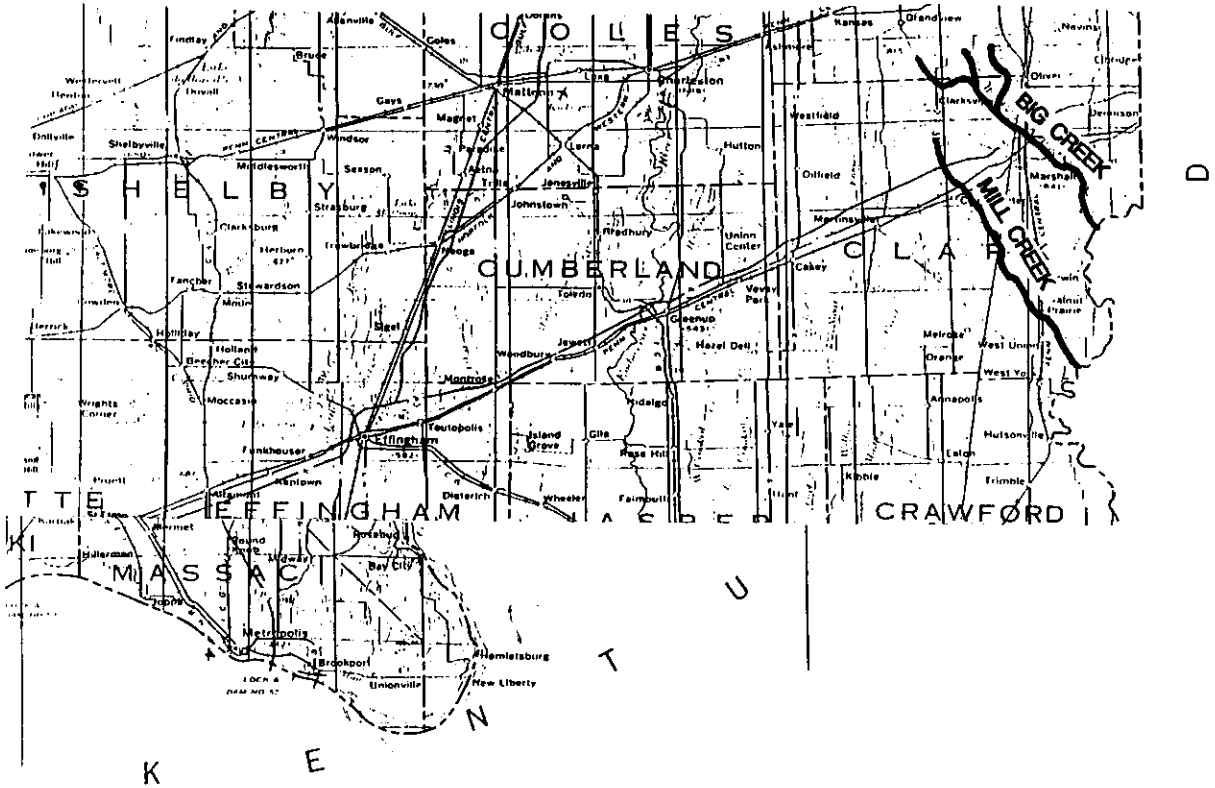

Figure 1-1
LOCATION OF STUDY CREEKS IN EASTERN AND SOUTHERN ILLINOIS

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

2.0 METHODS

2.1 LITERATURE REVIEW AND MUSEUM CONSULTATION

Prior to field sampling, literature on southern Illinois mussel inventories was reviewed. In addition, the Illinois Natural History Survey was visited to obtain data on collections in or near the study streams. Museum specimens of rare species potentially occurring in the project area were reviewed. Dr. David Stansbery (Ohio State University) was also contacted with respect to prior collections in the study streams. Any specimens of questionable identification were sent to Dr. Stansbery for verification.

2.2 FIELD RECONNAISSANCE

Topographic maps (United States Geological Survey) of study streams were reviewed for potential sampling locations. Several sites on each stream were selected for field reconnaissance based on potential habitat, position in the water shed, and access. Potential sites were visited by Hunter/ESE and IDOC. Two to six stations were selected for sampling on each stream.

2.3 MUSSEL SAMPLING

Three persons searched each of the sampling stations by pollywogging, diving, and visually searching. A visual search and pollywogging were the primary means of collection. Diving was used in areas too deep for wading (i.e., Saline River and Station 1 of Lusk Creek). Three hours of sampling effort were expended (3 persons for 1 hour each) at each location. If a mussel bed was located, effort was concentrated in the area of the bed. If no bed was located, as much area as could be thoroughly searched in 3 hours was covered.

After 3 hours of effort, all mussels collected were sorted according to species. The number of each species collected, relative age of individuals, status of shell (living, recently dead, fossil), method of collection, and habitat type (riffle, pool, stream bank, etc.) were recorded.

During the field effort notes were recorded describing the location of the area, and chemical and physical characteristics of each site. Dissolved oxygen and

temperature were measured using either a YSI dissolved oxygen meter (Model 51B, 54A, or 57) or a Hydrolab Surveyor II. All meters were calibrated and checked for accuracy using a Winkler titration and a NBS-certified thermometer. Pre- and post-calibration checks indicated all meters functioned accurately during field surveys.

Current velocity was measured using a pygmy Gurley meter. Water clarity was measured using a Secchi disk. Width and depth of the stream, length of area sampled, substrate, aquatic vegetation, and land use were qualitatively estimated. However, all observations were recorded by the same individual to ensure data comparability.

3.0 RESULTS AND DISCUSSION

3.1 WABASH DRAINAGE

The Wabash River has historically supported a diverse mussel fauna (Goodrich and Van der Schalie, 1944; Krumholz *et al.*, 1970; Clark, 1976). Clark (1976) extensively reviewed the literature on Wabash River mussel collections. His review identified 67 species historically collected in the lower Wabash (however, several of these species are now considered synonymous). Of these mussels, 30 were collected by Krumholz *et al* (1970) and Clark (1976) in the Wabash between Terre Haute and the Ohio River (Table 3-1). Although the present survey did not include the Wabash River, species composition of tributary streams was similar.

Illinois tributaries of the Wabash River vary in size and stream quality. Of the two major tributaries, the Little Wabash is designated as partial support/minor use impairment throughout most of its basin. The Embarras is designated as full aquatic life use support throughout most of the basin (IEPA, 1988). Mussel surveys of both of these systems are currently being conducted by Illinois Natural History Survey (INHS). Wabash tributaries surveyed by Hunter/ESE in 1989 include Big Creek, Mill Creek, and Bonpas Creek. Big Creek is designated as a full aquatic life use support creek. Mill Creek and Bonpas Creek are designated partial support/minor use impairment (IEPA, 1988). Smith (1971) rated Mill Creek and Big Creek good with respect to fish fauna and

Table 3-1. Mussels Historically Collected in the Lower Wabash River

Species	Krumholz *et al*	Clark
Actinonaias l. carinata	X	X
Alasmidonta marginata		X
Amblema plicata	X	X
Anodonta grandis	X	
Anodontoides ferrussacianus		X
Cyprogenia irrorata	X	
Elliptio crassidens		X
Fusconaia ebena	X	X
Fusconaia flava	X	X
Lampsilis anodontoides	X	X
Lampsilis ventricosa	X	X
Lasmigona complanata	X	X
Lasmigona compressa		X
Lasmigona costata	X	
Leptodea fragilis	X	X
Megalonaias nervosa	X	X
Obliquaria reflexa	X	X
Obovaria olivaria	X	X
Plethobasus cyphyus		X
Pleurobema cordatum		X
Potamilus alatus	X	X
Potamilus capax		X
Potamilus ohiensis	X	X
Quadrula metanevra	X	X
Quadrula nodulata		X
Quadrula pustulosa	X	X
Quadrula quadrula	X	X
Strophitus u. undulatus		X
Tritogonia verrucosa	X	X
Truncilla donaciformes		X
Truncilla truncata	X	X

Sources: Krumholz *et al*, 1970.
Clark, 1976.
Hunter/ESE, 1989.

implicated oil fields as a pollution source in the area. Bonpas Creek rated fair with respect to fish fauna, primarily due to habitat limitations in the watershed and oil field pollution (Smith, 1971). No previous mussel surveys were identified in Big, Mill or Bonpas creeks.

3.1.1 Big Creek

Big Creek is located in Clark County, Illinois (Figure 3-1). The stream flows through an agricultural area and drains into the Wabash about 4 miles upstream of Darwin, Illinois. Habitat throughout the creek consists of alternating riffles and pools. Water clarity is excellent with the stream bottom visible in most areas. Conductivity throughout the stream (>500 µohms/cm) indicates a moderate amount of dissolved solids in the stream (Table 3-2).

Six stations were sampled on Big Creek: one station on the west fork (Station 6), two on the east fork (Stations 4 and 5), and three stations downstream of the two forks (Stations 1 through 3) (Figure 3-1). The area of the creek sampled ranged from 80,000 square feet to 150,000 square feet. Water clarity and depth enabled biologists to visually search the stream for a considerable distance, in addition to searching through substrates for burrowed clams.

Substrates throughout Big Creek consisted of primarily loose sand and gravel. Some areas contained minor amounts of clay. A portion of the stream bottom at Station 3 was bedrock. Neither loose substrate or bedrock are good mussel substrates. Mussels cannot burrow in bedrock. Conversely, mussels can burrow in sand but such substrate is not stable and animals are easily dislodged and transported downstream. Shifty sand is not conducive to bed formation.

No mussels were collected in Big Creek (Table 3-3). In addition, no evidence of mussels (old shells) or *Corbicula fluminea* were found in the area. Although the area provides habitat for several unusual fish species (i.e., blacknose dace, redbelly dace, greenside darter, bigeye shiner), conditions are not suitable for unionid mollusks.

Table 3-2. Summary of Habitat Characteristics in Big Creek (Wabash Drainage), 1989

	Stations					
	1	2	3	4	5	6
Habitat	pool	riffle/ pool	riffle/ pool	riffle/ pool	riffle/ pool	riffle pool
Substrate	sand with gravel/clay	sand with gravel/clay	sand with gravel	sand with gravel/rubble	sand with gravel/rubble	sand with gravel/rubble
Water clarity (mm)	bottom	bottom	bottom	bottom	bottom	bottom
Temperature (°C)	20.0	19.0	18.8	16.5	16	17.5
Dissolved Oxygen (ppm)	7.8	8.4	8.8	9.0	9.4	9.5
Conductivity (μohms/cm)	557.0	555.0	555.0	560.0	559.0	558.0
Approximate area sampled (ft^2)	150,000	150,000	112,500	100,000	80,000	100,000

Source: Hunter/ESE, 1989.

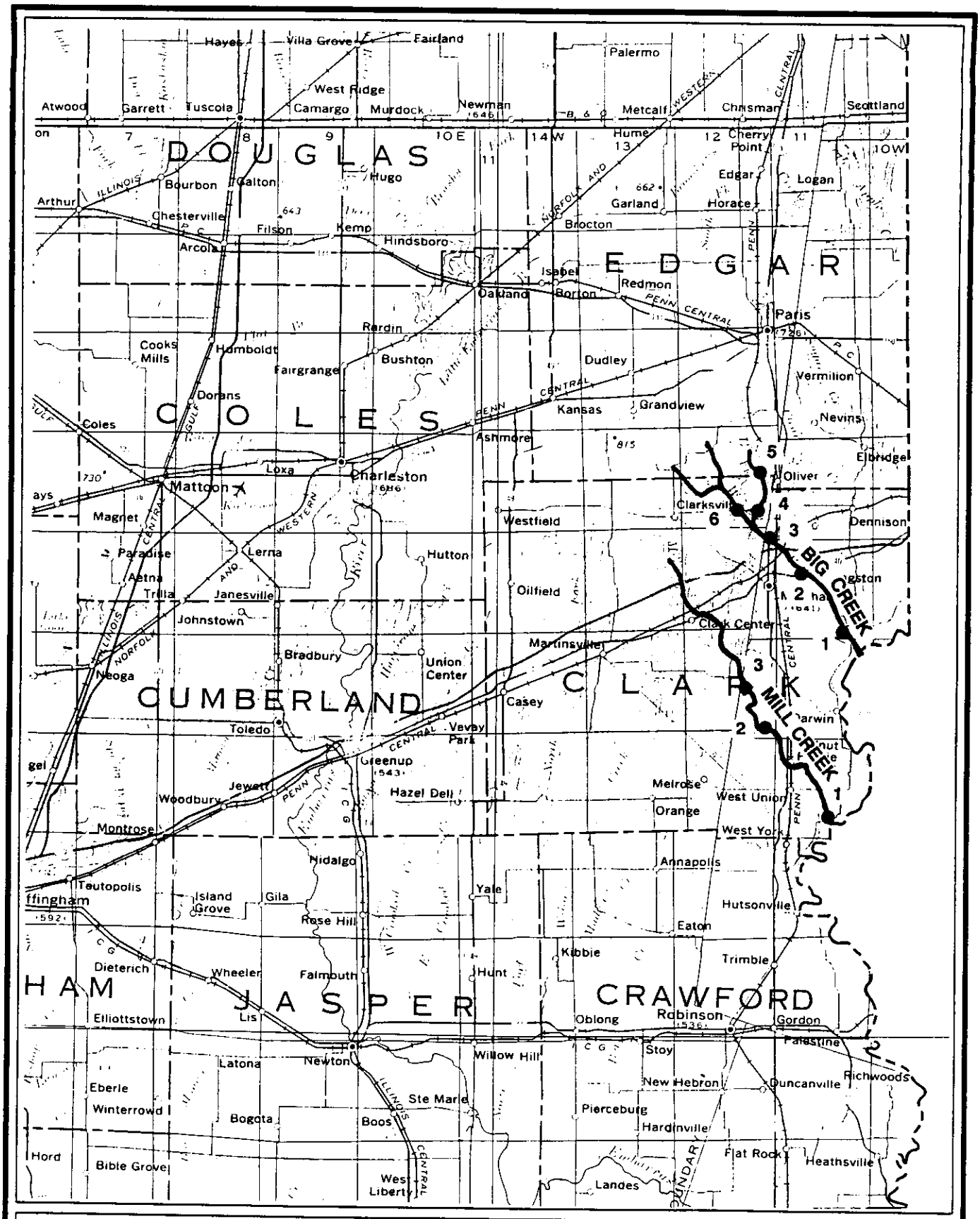

Figure 3-1
MUSSEL SAMPLING SITES ON BIG CREEK AND MILL CREEK, 1989

HUNTER / ESE
ENVIRONMENTAL SERVICES, INC.

Table 3-3. Freshwater Mussels Collected in Big Creek, Clark County, Illinois

Species	Stations 1	2	3	4	5	6
	No mussels collected					
Total	0	0	0	0	0	0
Species	0	0	0	0	0	0

Source: Hunter/ESE, 1989.

3.1.2 Mill Creek

Mill Creek is located in Clark County (see Figure 3-1). The creek flows into the Wabash River near York, Illinois. Three areas of the creek were sampled. Habitat in Mill Creek was similar to Big Creek with alternating riffles and pools. Water was fairly clear with the bottom being visible in most areas. Average depth in sampled areas was less than 1 foot and width was about 30 feet. Substrate was predominately sand with some clay and pebbles (Table 3-4).

Only 13 unionid mussels were collected in Mill Creek (Table 3-5). Nine mussels of five species were collected at the station farthest downstream (Station 1) and four mussels of three species were collected at Station 2.

The substrate in Mill Creek lacks the stability necessary for colonization of unionid mollusks. Mussels, as expected, were sparse and scattered throughout the sampled area. Species collected were those typically found in smaller creeks or softer substrates (*Leptodea fragilis*, *Toxolasma parva*, *Lampsilis ventricosa*, *Lampsilis t. teres*). *Q. pustulosa* is more frequently collected in mussel beds or areas with more stable substrates. The one *Q. pustulosa* collected was a shell and may have washed into the creek from the nearby Wabash River. (One week prior to sampling 5 inches of rain fell in the area. Creeks had been backed up by the Wabash and had only recently resumed flowing.)

Only two species were collected live: *Lampsilis ventricosa* and *Toxolasma parvus*. The remaining species were collected only as shells. Although mussels were sparse in Mill Creek, some reproduction was evident. The *Lampsilis teres* shell was from a juvenile. Over half of the *L. ventricosa* and half of the *L. fragilis* were subadult (Table 3-6).

3.1.3 Bonpas Creek

Bonpas Creek flows through Richland, Edwards, and Wabash Counties into the Wabash River in Grayville, Illinois (Figure 3-2). Water quality in Bonpas Creek is fair, with oil fields and erosion from farm fields being the major source of pollution (Smith, 1971). IEPA (1988) designates Bonpas Creek as a partial support of aquatic life stream with minor use impairment. Habitat in Bonpas

Table 3-4. Summary of Habitat Characteristics in Mill Creek, 1989

	Stations					
	1		2		3	
	A	B	A	B	A	B
Habitat	pool	riffle	riffle	pool	riffle	pool
Substrate	sand with clay	sand	sand with pebble	sand with pebble	sand with pebble	sand with pebble
Water clarity (mm)	bottom	bottom	bottom	bottom	bottom	bottom
Temperature (°C)	25.8		27.1		26.3	
Dissolved Oxygen (ppm)	9.6		9.6		8.4	
pH	7.8		7.8		7.7	
Conductivity (μohms/cm)	415.0		381.0		406.0	
Approximate area sampled (ft^2)	60,000	30,000	30,000	120,000	92,400	105,600

Source: Hunter/ESE, 1989.

Table 3-5. Freshwater Mussels Collected in Mill Creek, Clark County, Illinois

Species	Stations 1	2	3	Total
Lampsilis t. teres	2	--	--	2
Lampsilis ventricosa	3	2	--	5
Leptodea fragilis	1	1	--	2
Quadrula pustulosa	1	--	--	1
Toxolasma parvus	2	1	--	3
Total	9	4	0	13
Species	4	3	0	5

Source: Hunter/ESE, 1989.

Table 3-6. Status and Age Distribution of Freshwater Mussels in Mill Creek, 1989

Species	Status			Age Distribution		
	Live	Shells	Live (%)	Juvenile	Subadult	Adult
Lampsilis teres	0	2	0.00	1	--	1
Lampsilis ventricosa	4	1	80.00	--	3	2
Leptodea fragilis	0	2	0.00	--	1	1
Quadrula pustulosa	0	1	0.00	--	--	1
Toxolasma parvus	1	2	33.33	--	--	3
Total	5	8	38.46	1	4	8

Source: Hunter/ESE, 1989.

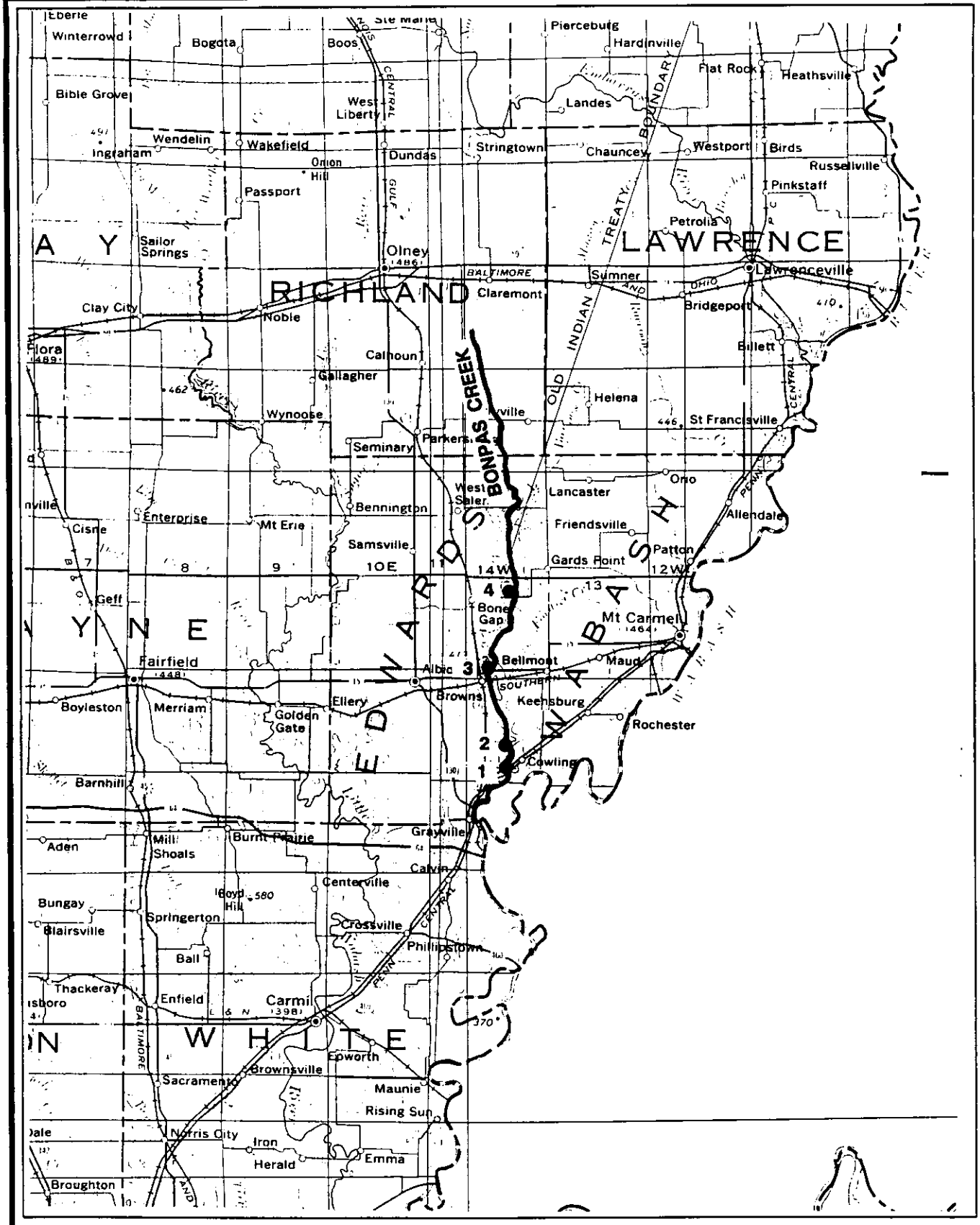

Figure 3-2
MUSSEL SAMPLING SITES ON BONPAS CREEK, 1989

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

Creek was primarily flowing pool with little riffle development (Table 3-7). Substrate in most areas was silt over bedrock or clay. In some areas, however, a mix of sand, gravel, clay, and silt existed in the stream bottom, creating a more stable substrate. In these areas, mussels were abundant.

A total of 147 mussels of 16 species were collected at four locations in Bonpas Creek (Table 3-8). The number of mussels and number of species collected was lowest in upstream areas and increased downstream. Station 4, located in the upper watershed where stream width averaged 15 feet and depth only 1 foot, yielded only a few species (*Anodonta grandis*, *Ligumia subrostrata*, and *Toxolasma texasensis*). *L. subrostrata* and *T. texasensis* are typically collected in mud bottoms in the shallows of lakes and streams (Parmalee, 1967). *L. subrostrata* is fairly widely distributed in Illinois. *T. texasensis*, however, has only been collected from a few locations in southern Illinois including North Fork Saline River, Big Muddy River and Crab Orchard Lake (Parmalee, 1967), and in the Saline River and Eagle Creek, a tributary of the Saline River (INHS, 1987).

At Station 3, stream width and depth increased to 50 feet and 2 feet, respectively. The number of species collected increased to six, but still included species primarily associated with small streams and ponds (*A. grandis*, *L. r. luteola*, *L. t. teres*), softer substrates (*L. fragilis*, *P. alatus*), or a wide variety of habitats (*Quadrula quadrula*).

Station 2 was similar in width and depth to Station 3. Trash in the creek was more prevalent at this point and an old oil pipeline was exposed. Although stream quality declined in this portion of the river (abundant trash, conductivity over 600 µohms/cm) mussels were scattered throughout the sampled area, with 29 mussels of 7 species collected. A few species collected (*A. plicata*, *M. nervosa*, *T. verrucosa*), typically associated with beds in medium to larger rivers, suggests this area of stream is more stable than upstream areas.

Bonpas Creek at Station 1 (just upstream of the Highway 1 bridge) showed some signs of riffle development. Pool areas were deeper (up to 4 feet) with shallower "run" habitat existing between gravel bars. Substrate in the run area

Table 3-7. Summary of Habitat Characteristics in Bonpas Creek, 1989

	Stations			
	1	2	3	4
Habitat	flowing pool	flowing pool	flowing pool	flowing pool
Substrate	gravel/clay silt/bedrock	silt over clay gravel/clay	clay/silt	sand/clay/ gravel/silt
Water clarity (mm)	355.0	100.0	155.0	230.0
Temperature (°C)	16.3	17.0	18.2	16.9
Dissolved Oxygen (ppm)	7.6	7.4	6.2	6.8
Conductivity (μohms/cm)	620.0	680.0	315.0	330.0
Approximate area sampled (ft^2)	25,000	25,000	50,000	30,000

Source: Hunter/ESE, 1989.

Table 3-8. Freshwater Mussels Collected in Bonpas Creek, Wabash and Edwards Counties, Illinois

Species	Stations 1	2	3	4	Total
Ablema plicata	16	5	--	--	21
Anodonta grandis	--	--	7	2	9
Arcidens confragosus	3	--	--	--	3
Fusconaia flava	1	--	--	--	1
Lampsilis r. luteola	--	--	1	--	1
Lampsilis t. teres	1	--	1	--	2
Lasmigona complanata	14	5	--	--	19
Leptodea fragilis	3	5	1	--	9
Ligumia subrostrata	--	--	--	2	2
Megalonaias nervosa	1	3	--	--	4
Potamilus alatus	3	1	1	--	5
Quadrula pustulosa	1	--	--	--	1
Quadrula quadrula	21	9	8	--	38
Toxolasma texasensis	--	--	--	6	6
Tritogonia verrucosa	23	1	--	--	24
Truncilla truncata	2	--	--	--	2
Total	89	29	19	10	147
Species	12	7	6	3	16

Source: Hunter/ESE, 1989.

consisted of gravel, silt, and clay. Mussels were scattered throughout the area. In addition, a concentration, or mussel bed, was identified in the run. Eighty-nine mussels of 12 species were collected. Dominant species included *T. verrucosa*, *Q. quadrula*, *A. plicata*, and *L. complanata*.

Although not a clean stream with riffle/pool habitat, Bonpas Creek appears to support a good mussel population. Despite the abundant trash in the creek bottom, presence of oil (Stations 2 and 4), and high conductivity, all stations sampled yielded some mussels. A few species (*L. r. luteola*, *L. subrostrata*, *T. truncata*) were represented only by shells, but overall 81 percent of the mussels collected were live (Table 3-9). In addition, young individuals of two species (*A. confragosus* and *T. verrucosa*) were collected indicating some reproduction. Although water quality is not good, species considered intolerant (*T. verrucosa*, *M. nervosa*) were present in the creek.

In contrast to other Wabash drainage streams sampled, substrates in Bonpas Creek were more stable. Apparently water quality was not poor enough to limit unionid mollusks, while stable substrates in Bonpas Creek were more conducive to mussel colonization than the shifty silt and sand in Big and Mill Creeks.

3.2 OHIO RIVER DRAINAGE

3.2.1 Saline River

The Saline River, located in Hardin, Gallatin, Saline, and Hamilton Counties flows into the Ohio River near Ohio River Mile 867 (Figure 3-3). Water quality in the Saline Basin is poor due to strip mine wastes, siltation, channelization, and oil field pollution (Smith, 1971). Although habitat is minimal and water quality poor throughout much of the Saline Basin, prior studies indicate some unionid mollusks live in the basin (Table 3-10). Illinois Natural History Survey identified two species (*Q. pustulosa* and *T. texasensis*) in the Saline River and four species (*A. grandis*, *A. imbecillis*, *T. texasensis*, and *Uniomerus tetralasmus*) in Eagle Creek, a tributary of the Saline River. *U. tetralasmus* is currently listed as a threatened species in Illinois (IDOC, 1989). Several species were collected by INHS (1988) from ponds and reservoirs in the basin (*A. grandis*, *A. suborbiculata*, *L. subrostrata*, *L. complanata*, *P. ohiensis*,

Table 3-9. Status and Age Distribution of Freshwater Mussels in Bonpas Creek, 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Amblema plicata	16	5	76.19	--	--	16
Anodonta grandis	6	3	66.67	--	--	6
Arcidens confragosus	3	0	100.00	--	1	2
Fusconaia flava	1	0	100.00	--	--	1
Lampsilis r. luteola	0	1	0.00	--	--	--
Lampsilis t. teres	1	1	50.00	--	--	1
Lasmigona complanata	16	3	84.21	--	--	16
Leptodea fragilis	6	3	66.67	--	--	6
Ligumia subrostrata	0	2	00.0	--	--	--
Megalonaias nervosa	3	1	75.00	--	--	3
Potamilus alatus	4	1	80.00	--	--	4
Quadrula pustulosa	1	0	100.00	--	--	1
Quadrula quadrula	34	4	89.47	--	--	34
Toxolasma texasensis	5	1	83.33	--	--	5
Tritogonia verrucosa	23	1	95.83	--	7	16
Truncilla truncata	0	2	0.00	--	--	--
Total	119	28	81.52	--	8	111

* Live mussels.

Source: Hunter/ESE, 1989.

Figure 3-3
MUSSEL SAMPLING SITES IN SALINE RIVER BASIN, 1989

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

Table 3-10. Species Historically Occurring in the Saline River Basin

Anodonta grandis
Anodonta imbecilis
Anodonta suborbiculata
Lasmigona complanata
Ligumia subrostrata
Potamilus ohiensis
Quadrula pustulosa
Quadrula quadrula
Toxolasma texasensis
Uniomerus tetralasmus
Villosa lienosa

Sources: INHS, 1987-1988.
Parmalee, 1967.

Q. quadrula) Parmalee (1967) listed the Saline River as part of the range of *Q. quadrula*, *T. texasensis* and *V. lienosa* in Illinois.

The North Fork, Middle Fork, South Fork, and Saline River main stem were sampled for mussels during this survey (see Figure 3-3).

North Fork

The North Fork is channelized for most of its length. In addition, oil fields and runoff from agriculture are major sources of pollution. The IEPA designates the stream as a partial support of aquatic life stream with minor use impairment (IEPA, 1988). Five stations were sampled on the North Fork, one in Saline County, and four in Gallatin County (see Figure 3-3).

Habitat in the North Fork is limited due to channelization. Some riffle/pool development, however, was evident in the upper part of the watershed (Station 4 on North Fork and Station 5 on Cane Creek). Habitat in the lower three stations was limited to flowing pool. Substrate throughout the stream was fairly stable, consisting of gravel, rubble, sand, silt, and clay. Water was fairly turbid at all stations except Station 4, limiting the sampling effort to groping through substrate. Conductivity was near 400 µohms/cm, indicating a moderate amount of pollution in the stream (Table 3-11).

Though channelized and somewhat polluted, mussels were collected at all five sampling stations (Table 3-12). A total of 248 mussels of 17 species was collected. Mussels were most abundant at Station 2, and diversity was highest at Station 4. *Quadrula quadrula* was the most prevalent species (95 individuals), being collected at all stations. *A. plicata*, though less abundant, was equally ubiquitous.

Species more prevalent in the downstream stations, where conditions are more stable, included *A. plicata*, *M. nervosa*, and *Q. quadrula*. Species more prevalent in the upstream stations were those typically associated with a variety of conditions (*A. grandis*, *L. t teres*, *L. subrostrata*, *T. parvus*, *T. texasensis*). One species collected in the North Fork, *Uniomerus tetralasmus*,

Table 3-11. Summary of Habitat Characteristics in North Fork Saline River, 1989

	Stations				
	1	2	3	4	5
Habitat	flowing pool*	flowing pool*	flowing pool*	riffle/ pool*	riffle/ pool*
Substrate	gravel, rubble, sand, clay	gravel, rubble, silt, clay	gravel, rubble, sand, clay	gravel, sand, silt	gravel, clay
Water clarity (mm)	130.0	130.0	110.0	315.0	175.0
Temperature (°C)	21.0	21.0	20.0	24.9	18.2
Dissolved Oxygen (ppm)	6.7	5.8	6.0	8.6	8.2
Conductivity (μohms/cm)	395.0	410.0	410.0	415.0	355.0
Approximate area sampled (ft^2)	9,000	30,000	15,000	125,000	90,000

* Channelized.

Source: Hunter/ESE, 1989.

Table 3-12. Freshwater Mussels Collected in North Fork Saline River, Saline and Gallatin Counties, Illinois

Species	Stations 1	2	3	4	5	Total
Amblema plicata	11	3	2	1	5	22
Anodonta grandis	--	8	--	7	2	17
Lampsilis r. luteola	1	--	--	1	--	2
Lampsilis t. teres	1	--	9	21	2	33
Lampsilis ventricosa	--	1	--	--	--	1
Lasmigona complanata	--	9	2	3	3	17
Leptodea fragilis	--	--	4	--	1	5
Ligumia recta	--	--	--	--	1	1
Ligumia subrostrata	--	--	--	14	--	14
Megalonaias nervosa	2	2	--	--	1	5
Potamilus alatus	--	6	--	--	1	7
Potamilus ohiensis	--	--	--	14	--	14
Quadrula quadrula	3	66	17	4	5	95
Toxolasma parvus	--	--	--	9	--	9
Toxolasma texasensis	--	--	--	1	--	1
Truncilla truncata	--	--	3	--	--	3
Uniomerus tetralasmus	--	--	--	2	--	2
Total	18	95	37	77	21	248
Species	5	7	6	11	9	17

Source: Hunter/ESE, 1989.

is listed as threatened in Illinois. This species is widely distributed but uncommon in Illinois (Parmalee, 1967). INHS (1987) collected *U. tetralasmus* in Eagle Creek, but this appears to be the first recorded in the North Fork.

Many of the mussels collected in North Fork (over 50 percent) were collected as shells, particularly in the upstream stations (Table 3-13). Several species (*L. r. luteola*, *L. recta*, *L. subrostrata*, *M. nervosa*, *P. ohiensis*, *T. texasensis*) were represented only as shells. Some reproduction is evident in the stream as young individuals of three species (*L. complanata*, *P. alatus*, *Q. quadrula*) were collected.

Although channelized and polluted by agriculture and oil fields, the North Fork supports a fairly good mussel population. The upper watershed shows signs of recovery from channelization with some riffle/pool development. A number of mussel species, including one threatened species (*Uniomerus tetralasmus*) were collected in the upper watershed. However, like most small streams, fluctuating conditions prevent formation of mussel beds in the area. Many of the mussels collected in the upstream stations (4 and 5) were shells, probably washed down from farther upstream during high water. Habitat at the lower three stations was limited to a shallow flowing pool. However, stable substrates enabled mussels to inhabit the area. Though the mussel fauna of the North Fork is not extremely diverse, the number of mussels and species present indicate some recovery from channelization.

Middle Fork

The Middle Fork flows primarily through Saline County (see Figure 3-3). The Middle Fork, like the North Fork, suffers from channelization and agricultural runoff. In addition, surface mining and Harrisburg's wastewater treatment plant contribute to its water quality problems. As a result, the majority of Middle Fork has been designated as a partial support stream with minor use impairment (IEPA, 1988).

Four stations were sampled for mussels on the Middle Fork. All stations indicated some recovery from channelization, with some development of riffles

Table 3-13. Status and Age Distribution of Freshwater Mussels in North Fork Saline River, 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Amblema plicata	3	19	13.64	--	--	3
Anodonta grandis	9	8	52.94	--	--	9
Lampsilis r. luteola	0	2	0.00	--	--	--
Lampsilis t. teres	5	28	15.15	--	--	5
Lampsilis ventricosa	1	0	100.00	--	--	1
Lasmigona complanata	8	9	47.06	--	1	7
Leptodea fragilis	1	4	20.00	--	--	1
Ligumia recta	0	1	0.00	--	--	--
Ligumia subrostrata	0	14	0.00	--	--	--
Megalonaias nervosa	0	5	0.00	--	--	--
Potamilus alatus	2	5	28.57	--	1	1
Potamilus ohiensis	0	14	0.00	--	--	--
Quadrula quadrula	86	9	90.53	--	1	85
Toxolasma parvus	2	7	22.22	--	--	2
Toxolasma texasensis	0	1	0.00	--	--	--
Truncilla truncata	1	2	33.33	--	--	1
Uniomerus tetralasmus	1	1	50.00	--	--	1
Total	119	129	47.98	--	3	116

* Live mussels.

Source: Hunter/ESE, 1989.

and pools. However, water quality and substrate appear to limit unionids in this part of the Saline River Basin. Conductivity in the upper portion of the stream was over 500 µohms/cm, while conductivity at Station 1, below Harrisburg, was in excess of 2,000 µohms/cm (Table 3-14). Substrate throughout the stream was a hard clay covered in riffle areas by shifty sand and gravel.

Only one unionid mussel was collected in the Middle Fork, a *U. tetralasmus* (Table 3-15). This individual was a shell collected at Station 2. Other signs of mollusk life in the stream included a few very old unionid shell fragments and an abundance of *Corbicula fluminea* in sandy areas.

South Fork

The South Fork flows through Williamson and Saline Counties (see Figure 3-3). The primary source of pollution in the South Fork is surface mining. The lower 9 miles of South Fork are non-supportive of aquatic life (IEPA, 1988).

Only two stations were sampled on the South Fork; one in the upper watershed above Palzo (a major mining area) and one just above the confluence with Middle Fork (see Figure 3-3). The downstream station was devoid of signs of animal life. Water color was orange and garbage littered the bottom. Some periphyton was present in shallow areas and water clarity was good. Even with improvements in water quality it is doubtful this area would support mussels. Substrates were a hard clay with some shifty silt, sand, and pebble (Table 3-16). The upper area of the South Fork showed signs of life, however, no mussels were collected in the area (Table 3-17). Habitat consisted of flowing pool with some riffle development. Substrate was primarily hard clay with silt and sand. Although no unionids were collected, a few *Corbicula fluminea* shells were in the area.

Saline River Main Stem

The Saline River, downstream of the confluence of the South and Middle Forks, is designated a partial support stream with minor impairment (IEPA, 1988). This area of the Saline River suffers from channelization, as well as agricultural and mining runoff and wastewater imput.

Table 3-14. Summary of Habitat Characteristics in Middle Fork Saline River, 1989

	Stations			
	1	2	3	4
Habitat	riffle/ pool*	riffle/ pool*	riffle/ pool*	riffle/ pool*
Substrate	sand/gravel over clay	sand over clay	pebble/sand over clay	hard clay with sand
Water clarity (mm)	bottom	bottom	530.0	bottom
Temperature (°C)	24.0	25.0	20.0	18.2
Dissolved Oxygen (ppm)	12.8	9.4	7.9	8.0
Conductivity (μohms/cm)	2150.0	--	--	560.0
Approximate area sampled (ft^2)	200,000	50,000	100,000	100,000

* Channelized.

Source: Hunter/ESE, 1989.

Table 3-15. Freshwater Mussels Collected in Middle Fork Saline River, Saline County, Illinois

Species	Stations 1	2	3	4	Total
Uniomerus tetralasmus	--	1	--	--	1
Total	0	1	0	0	1
Species	--	1	--	--	1

Source: Hunter/ESE, 1989.

Table 3-16. Summary of Habitat Characteristics in South Fork Saline River, 1989

	Stations	
	1	2
Habitat	pool	flowing pool
Substrate	hard clay, minor silt/ pebble/sand	silt/sand/clay
Water clarity (mm)	bottom	315.0
Temperature (°C)	25.0	17.8
Dissolved Oxygen (ppm)	8.4	6.4
Approximate area sampled (ft^2)	50,000	26,130

Source: Hunter/ESE, 1989.

Table 3-17. Freshwater Mussels Collected in South Fork Saline River, Saline County, Illinois

Species	Stations 1	Stations 2	Total
	No mussels collected		
Total	0	0	0
Species	0	0	0

Source: Hunter/ESE, 1989.

Five stations on the lower Saline River and one station on Eagle Creek were sampled for mussels. Habitat in the lower Saline River was limited to flowing pool. SCUBA was utilized to sample these stations as depth prevented adequate sampling by pollywogging. Substrate in most areas was silt and clay, with some sand and gravel in deeper channel areas (Table 3-18). Water quality in the lower Saline was poor with high conductivity and low dissolved oxygen; most likely a result of mining runoff and wastewater input. Water quality in Eagle Creek (Station 3) was also poor. Algal mats and anaerobic pockets in sediments implicate wastewater input. Conductivity was extremely high (2,300 µohms/cm) in the area. Substrate was mainly bedrock with pockets of gravel, silt, and clay. *Corbicula fluminea* were numerous throughout the creek.

Despite poor water quality and habitat, a few mussels were collected at all but Station 6. Water quality was particularly poor at Station 6. Conductivity was near 2,000 µohms/cm and dead fish littered the area. A few mussels were found scattered at each of the other locations. Species collected were those that are typically found in a variety of habitats (*A. plicata*, *Q. quadrula*) and species typical of softer substrates (*A. grandis*, *A. suborbiculata*, *L. t. teres*, *L. fragilis*, *P. ohiensis*, *T. texasensis*) (see Table 3-19). Most individuals were live, however only shells of *A. plicata* and *L. fragilis* were collected. Only one subadult, a *P. ohiensis*, was collected. The remainder of individuals were adult (Table 3-20).

Overall, water quality and habitat quality prevent unionid mollusks from inhabiting most of the Saline River Basin. The North Fork supports the best population of mussels due to stable substrate and slightly less polluted waters. Conversely, the South Fork is devoid of most life except in the upper reaches. The Middle Fork and Saline main stem yielded a few scattered individuals, however, substrate and water quality limit the colonization to only the hardiest of individuals.

Table 3-18. Summary of Habitat Characteristics in Saline River (Main Stem), 1989

	Stations					
	1	2	3*	4	5	6
Habitat	pool	pool	riffle/ pool	flowing pool	flowing pool	pool (channelized)
Substrate	silt/clay	silt/clay shoreline gravel/ pebble/ bedrock channel	bedrock, gravel, silt, clay	gravel, clay silt	silt over clay	silt, sand, clay
Water clarity (mm)	--	330.0	bottom	145.0	200.0	360.0
Temperature (°C)	24.0	24.5	20.0	22.2	20.1	22.0
Dissolved Oxygen (ppm)	2.4	2.0	5.5	4.5	6.4	—
Conductivity (μohms/cm)	462.0	1050.0	2300.0	1110.0	610.0	1950.0
Approximate area sampled (ft^2)	25,000	25,000	50,000	15,000	15,000	30,000

* Eagle Creek.

Source: Hunter/ESE, 1989.

Table 3-19. Freshwater Mussels Collected in Saline River Main Stem, Gallatin and Hardin Counties, Illinois

Species	Stations 1	2	3	4	5	6	Total
Amblema plicata	--	--	--	--	1	--	1
Anodonta grandis	2	1	2	1	1	--	7
Anodonta suborbiculata	1	--	--	--	--	--	1
Lampsilis t. teres	--	1	--	--	1	--	2
Leptodea fragilis	--	--	1	--	--	--	1
Potamilus ohiensis	1	--	--	3	1	--	5
Quadrula quadrula	--	--	1	--	--	--	1
Toxolasma texasensis	--	1	--	--	--	--	1
Total	4	3	4	4	4	0	19
Species	3	3	3	2	4	0	8

Source: Hunter/ESE, 1989.

Table 3-20. Status and Age Distribution of Freshwater Mussels in Saline River (Main Stem), 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Amblema plicata	0	1	0.00	--	--	--
Anodonta grandis	2	5	28.57	--	--	2
Anodonta suborbiculata	1	0	100.00	--	--	1
Lampsilis t. teres	2	0	100.00	--	--	2
Leptodea fragilis	0	1	0.00	--	--	--
Potamilus ohiensis	5	0	100.00	--	1	4
Quadrula quadrula	1	0	100.00	--	--	1
Toxolasma texasensis	1	0	100.00	--	--	1
Total	12	7	63.16	--	1	11

* Live mussels.

Source: Hunter/ESE, 1989.

3.2.2 Big, Big Grande Pierre, Lusk Creeks

Big Creek, Big Grande Pierre Creek, and Lusk Creek flow through Shawnee National Forest. In contrast to the other study streams, these streams are rated as Class A by the IEPA/IDOC Biological Stream Characterization process (IEPA, 1988). The creeks are characterized by clear water, rock bottom, gravel riffles, and cold springs (Smith, 1971).

Big Creek

Big Creek flows through Hardin County and into the Ohio River near Ohio River Mile 889.5 (Figure 3-4). The lower portion of Big Creek is pooled due to the Ohio River. Substrate in this area is silt and clay. Water is fairly clear (Secchi disk depth 525). Dissolved oxygen, however, was low at the time of sampling (Table 3-21). The upper watershed is a clear free-flowing stream with alternating riffles and pools. Substrate consists of gravel, pebble, and sand.

Only a few mussels were collected in Big Creek (Table 3-22). The lower portion (Station 1) was sampled by diving in deep areas and pollywogging near the shoreline. Only four *A. grandis* were collected. All were live adults. Similarly, collection efforts by INHS (1987) just upstream of the Hunter/ESE collection area and prior to construction of the Highway 146 bridge, yielded only a few individuals. Species collected by INHS included *A. plicata*, *A. grandis*, *A. imbecilis*, and *T. parvus*.

Upstream, habitat changed to alternating pools and riffles. However, substrate was relatively loose sand/gravel which may have limited mussel colonization. No mussels or shells were collected. Only one *Corbicula fluminea* shell was collected in the area.

Big Grande Pierre Creek

Big Grande Pierre Creek flows through Pope County and into the Ohio River near Ohio River Mile 898. Habitat in the lower portion of the creek was shallow pool with a rubble, gravel, and bedrock substrate (Table 3-23). In the upstream stations, habitat consisted of riffle and pools with a variety of substrate types.

Figure 3-4
MUSSEL SAMPLING SITES ON BIG, BIG GRANDE PIERRE AND LUSK CREEKS, 1989

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

Table 3-21. Summary of Habitat Characteristics in Big Creek (Ohio Drainage), 1989

	Stations	
	1	2
Habitat	pool	riffle/pool
Substrate	silt/clay	gravel/pebble/sand
Water clarity (mm)	525.0	bottom
Temperature (°C)	25.1	22.0
Dissolved Oxygen (ppm)	3.2	5.6
Conductivity (μohms/cm)	388.0	--
Approximate area sampled (ft^2)	100,000	40,000

Source: Hunter/ESE, 1989.

Table 3-22. Freshwater Mussels Collected in Big Creek, Hardin County, Illinois

Species	Stations 1	Stations 2	Total
Anodonta grandis	4	--	4
Total	4	--	4
Species	1	0	1

Source: Hunter/ESE, 1989.

Table 3-23. Summary of Habitat Characteristics in Big Grande Pierre Creek, 1989

	Stations		
	1	2	3
Habitat	shallow pool	riffle/ pool	riffle/ pool
Substrate	rubble/ gravel/ bedrock	gravel/ pebble/sand silt/clay	rubble/ gravel/ sand over hard clay
Water clarity (mm)	bottom	bottom	bottom
Temperature (°C)	23.0	22.0	21.5
Dissolved Oxygen (ppm)	6.2	6.5	6.5
Approximate area sampled (ft^2)	100,000	125,000	23,000

Source: Hunter/ESE, 1989.

Mussels in Big Grande Pierre Creek were scattered throughout the sampled areas. A total of 88 mussels of nine species were collected. For a small stream, Big Grande Pierre supports a good mussel fauna. Mussels in low order streams such as Big Grande Pierre Creek are typically not abundant due to fluctuating water level, temperature, and low stream productivity.

Species collected throughout the creek, as expected in a small stream, were those tolerant of a wide variety of conditions (Table 3-24). One exception is *A. l. carinata*, which is more typically collected in medium or larger rivers where conditions are more stable (Parmalee, 1967). Deeper pools and springs may render some areas stable enough to support a mussel bed. A few concentrations of mussels were found at Station 3. Scattered individuals could result from high flow dislodging mussels, particularly in areas with shifty substrates (i.e., loose sand and gravel).

Most of the individuals (83.5 percent) collected in Big Grande Pierre Creek were live. Only a few individuals were subadult. No juveniles were collected (Table 3-25). However, due to their shape and size, juveniles are very difficult to collect, particularly in sand and gravel substrates.

Lusk Creek

Lusk Creek flows through Pope County and into the Ohio River near Ohio River Mile 902.5. The lower end of the creek near the Ohio is a wide pooled area. The area receives intensive recreation, as one bank is a marina and the other a campground. Substrate near shore is silt and clay (Table 3-26). Mussels collected at Station 1 reflect the available habitat (Table 3-27). Most of the individuals collected were *A. grandis*, a typical inhabitant of shallow, soft substrate areas. Other species collected (*L. t. teres*, *L. fragilis*, *P. alatus*, *P. ohiensis*, *Q. quadrula*) are also common inhabitants of softer substrates.

Upstream, habitat consists of alternating riffles and pools. Substrates at Station 2 were either hard rubble and clay or loose sand; difficult for mussels

Table 3-24. Freshwater Mussels Collected in Big Grande Pierre Creek, Pope County, Illinois

Species	Stations 1	2	3	Total
Actinonaias l. carinata	--	2	--	2
Amblema plicata	1	1	--	2
Anodonta grandis	--	8	1	9
Lampsilis r. luteola	10	8	22	40
Lampsilis ventricosa	4	2	2	8
Leptodea fragilis	--	1	--	1
Potamilus alatus	3	3	11	17
Quadrula quadrula	--	1	--	1
Strophitus undulatus	--	4	4	8
Total	18	30	40	88
Species	4	9	5	9

Source: Hunter/ESE, 1989.

Table 3-25. Status and Age Distribution of Freshwater Mussels in Big Grande Pierre Creek, 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Actionaias l. carinata	2	0	100.00	--	--	2
Amblema plicata	2	0	100.00	--	--	2
Anodonta grandis	9	0	100.00	--	1	8
Lampsilis r. luteola	33	7	82.50	--	--	33
Lampsilis ventricosa	3	5	37.50	--	--	3
Leptodea fragilis	0	1	0.00	--	--	--
Potamilus alatus	12	5	70.59	--	--	12
Quadrula quadrula	0	1	0.00	--	--	--
Strophitus undulatus	6	2	75.00	--	3	3
Total	67	21	83.75	--	4	63

* Live mussels.

Source: Hunter/ESE, 1989.

Table 3-26. Summary of Habitat Characteristics in Lusk Creek, 1989

	Stations			
	1	2	3	4
Habitat	pool	riffle/ pool	riffle/ pool	riffle/ pool
Substrate	silt/clay	hard rubble/ clay/ loose sand	rubble/ gravel/ sand	rubble/ gravel/ sand/ bedrock
Water clarity (mm)	355.0	bottom	bottom	bottom
Temperature (°C)	27.0	24.0	24.0	24.5
Dissolved Oxygen (ppm)	6.7	4.0	7.5	6.9
Approximate area sampled (ft^2)	6,000	15,000	79,200	79,200

Source: Hunter/ESE, 1989.

Table 3-27. Freshwater Mussels Collected in Lusk Creek, Pope County, Illinois

Species	Stations 1	2	3	4	Total
Anodonta grandis	50	2	2	--	54
Anodonta imbecilis	--	--	--	8	8
Lampsilis r. luteola	--	1	30	8	39
Lampsilis t. teres	1	--	--	--	1
Leptodea fragilis	2	--	--	--	2
Potamilus alatus	1	--	--	--	1
Potamilus ohiensis	1	--	--	--	1
Quadrula quadrula	4	--	--	--	4
Strophitus undulatus	--	--	1	6	7
Total	59	3	33	22	117
Species	6	2	3	3	9

Source: Hunter/ESE, 1989.

to inhabit. Consequently, only a few individuals were collected (*A. grandis and L. r. luteola*).

Habitat at Stations 3 and 4 was more conducive to mussels and more individuals were collected. Substrates at Stations 3 and 4 consisted of rubble, gravel, and sand with some bedrock areas at Station 4. Species collected were *A. grandis*, *A. imbecillis*, *L. r. luteola*, and *Strophitus u. undulatus*. Typical of a low order stream, individuals were scattered throughout the sampled area.

Most of the mussels collected in Lusk Creek were live. Only a few species were represented as shells (*L. t. teres*, *L. fragilis*, and *P. ohiensis*) (Table 3-28). Most individuals were adults, but subadults were collected of *A. grandis*, *L. r. luteola* and *S. u. undulatus*, indicative of a reproducing population.

Two areas of Lusk Creek were sampled by INHS in 1986. Results were similar to the present survey with *L. r. luteola* being the dominant taxa collected upstream. Additional species collected by INHS include *T. parvus* (not found in the present survey), *S. u. undulatus*, and *L. fragilis*.

4.0 SUMMARY

Three Wabash River drainage creeks, the Saline River Basin, and three Ohio River drainage creeks were sampled for freshwater mussels in July, August, and September 1989. A total of 637 mussels of 25 species were collected (Table 4-1). One species, *Uniomerus tetralasmus*, is listed as threatened in Illinois. One live and one shell were collected in the North Fork Saline River and one shell was collected in the Middle Fork.

Water quality, habitat quality, and stream size appeared to determine the abundance and species of mussels collected. Of the three Wabash drainage streams, Big Creek appeared to have the best water quality, but shifty substrate limited mussel colonization. In contrast, 147 mussels of 16 species were collected in Bonpas Creek where water quality was fair but substrate was stable.

Table 3-28. Status and Age Distribution of Freshwater Mussels in Lusk Creek, 1989

Species	Status			Age Distribution*		
	Live	Shells	Live	Juvenile	Subadult	Adult
Anodonta grandis	48	6	88.89	--	3	45
Anodonta imbecilis	8	0	100.00	--	--	8
Lampsilis r. luteola	38	1	97.44	--	1	37
Lampsilis t. teres	0	1	0.00	--	--	--
Leptodea fragilis	0	2	0.00	--	--	--
Potamilus alatus	1	0	100.00	--	--	1
Potamilus ohiensis	0	1	0.00	--	--	--
Quadrula quadrula	4	0	100.00	--	--	4
Strophitus undulatus	7	0	100.00	--	3	4
Total	106	11	90.60	--	7	99

* Live mussels.

Source: Hunter/ESE, 1989.

Table 4-1. Summary of Mussels Collected in Eastern and Southern Illinois, 1989

Species	Wabash Drainage			Ohio Drainage							Total
	Big Creek	Mill Creek	Bonpas Creek	North Fork	Middle Fork	South Fork	Saline River	Big Creek	Big Grande Creek	Lusk Creek	
Actinonaias l. carinata	--	--	--	--	--	--	--	--	2	--	2
Amblema plicata	--	--	21	22	--	--	1	--	2	--	46
Anodonta grandis	--	--	9	17	--	--	7	4	9	54	100
Anodonta imbecilis	--	--	--	--	--	--	--	--	--	8	8
Anodonta suborbiculata	--	--	--	--	--	--	1	--	--	--	1
Arcidens confragosus	--	--	3	--	--	--	--	--	--	--	3
Fusconaia flava	--	--	1	--	--	--	--	--	--	--	1
Lampsilis r. luteola	--	--	1	2	--	--	--	--	40	39	82
Lampsilis t. teres	--	2	2	33	--	--	2	--	--	1	40
Lampsilis ventricosa	--	5	--	1	--	--	--	--	8	--	14
Lasmigona complanata	--	--	19	17	--	--	--	--	--	--	36
Leptodea fragilis	--	2	9	5	--	--	1	--	1	2	20
Ligumia recta	--	--	--	1	--	--	--	--	--	--	1
Ligumia subrostrata	--	--	2	14	--	--	--	--	--	--	16
Megalonaias nervosa	--	--	4	5	--	--	--	--	--	--	9
Potamilus alatus	--	--	5	7	--	--	--	--	17	1	30
Potamilus ohiensis	--	--	--	14	--	--	5	--	--	1	20
Quadrula pustulosa	--	1	1	--	--	--	--	--	--	--	2
Quadrula quadrula	--	--	38	95	--	--	1	--	1	4	139
Strophitus u. undulatus	--	--	--	--	--	--	--	--	8	7	15
Toxolasma parvus	--	3	--	9	--	--	--	--	--	--	12
Toxolasma texasensis	--	--	6	1	--	--	1	--	--	--	8
Tritogonia verrucosa	--	--	24	--	--	--	--	--	--	--	24
Truncilla truncata	--	--	2	3	--	--	--	--	--	--	5
Uniomerus tetralasma	--	--	--	2	1	--	--	--	--	--	3
Total	0	13	147	248	1	0	19	4	88	117	637
Number of species	0	5	16	17	1	0	8	1	9	9	25

Source: Hunter/ESE, 1989.

Mussels in the Saline River Basin were limited by stream alternation, pollution (oil fields, agriculture runoff, strip mine runoff, sewage effluent), and substrate. Water quality and substrate were most suitable for mussels in the North Fork where 248 mussels of 17 species, including *U. tetralasmus*, were collected. No mussels were collected in the South Fork and only one shell was collected in the Middle Fork. A few individuals were scattered in the main stem.

Big, Big Grande Pierre, and Lusk Creeks were the best streams in terms of water quality. However, low order streams such as these typically lack the stability in flow, depth, and substrate necessary for a stable mussel population. Nevertheless, numerous mussels were collected in both Big Grande Pierre Creek and Lusk Creek. Only four mussels were collected in Big Creek which lacked suitable substrate.

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APPENDIX A

Description of Sample Areas

Description of Sample Areas (Page 1 of 3)

Creek	County	Station	Description	USGS Quad
Big Creek	Clark	1	T11N, R11W, Sec 35 county road bridge	Hutton
		2	T11N, R11W, Sec 17 US Hwy 40 bridge	Marshall
		3	T12N, R12W, Sec 36 Illinois Hwy 1 bridge	Marshall
		4	T12N, R12W, Sec 36 county road bridge	Marshall
	Clark, Edgar	5	T12N, R12W, Sec 24 county road bridge	Marshall
	Clark	6	T12N, R12W, Sec 34 + 35 county road bridge	Marshall
Mill Creek	Clark	1	T9N, R11W, Sec 28 + 33 gravel road bridge	West Union
		2	T10N, R12W, Sec 36 county road bridge	Snyder
		3	T10N, R12W, Sec 23 county road bridge	Snyder
Bonpas Creek	Edwards, Wabash	1	T2S, R14W, Sec 34 + 35 Illinois Hwy 1 bridge	Grayville
		2	T2S, R14W, Sec 26 county road bridge	Grayville
		3	T1S, R14W, Sec 33 Illinois Hwy 15 bridge	Bone Gap
		4	T1N, R14W, Sec 22 + 23 county road bridge	Berryville
North Fork	Gallatin	1	T9S, R8E, Sec 16 Illinois Hwy 13 bridge	Equality
		2	T8S, R8E, Sec 27 + 34 county road bridge	Ridgeway

Description of Sample Areas (Page 2 of 3)

Creek	County	Station	Description	USGS Quad
North Fork	Gallatin	3	T8S, R8E, Sec 23 county road bridge	Ridgeway
	Saline	4	T7S, R7E, Sec 25 US Hwy 45 bridge	Broughton
	Gallatin	5	T7S, R8E, Sec 34 county road bridge	Ridgeway
Middle Fork	Saline	1	T9S, R6E, Sec 11 US Hwy 45 bridge	Galatia
		2	T9S, R6E, Sec 3 + 4 Illinois Hwy 34 bridge	Galatia
		3	T8S, R6E, Sec 19 + 30 gravel road bridge	Galatia
		4	T8S, R5E, Sec 15 + 16 county road bridge	Harco
South Fork	Saline	1	T10S, R7E, Sec 6 county road bridge	Rudement
		2	T10S, R4E, Sec 6 county road bridge	Crab Orchard
Saline River Main Stem	Gallatin	1	T11S, R10E, Sec 8 near Saline Landing	Saline Mines
		2	T11S, R9E, Sec 34 SE¼ near bend in river	Saline Mines
Eagle Creek	Gallatin	3	T10S, R9E, Sec 18 Illinois Hwy 1 bridge	Equality
Saline River	Gallatin	4	T9S, R8E, Sec 26 0.5 mile upstream of Illinois Hwy 1 bridge	Equality
		5	T9S, R8E, Sec 21 downstream of North Fork confluence	Equality

Description of Sample Areas (Page 3 of 3)

Creek	County	Station	Description	USGS Quad
Big Creek	Hardin	1	T12S, R8E, Sec 27 downstream of Illinois Hwy 146 bridge	Rosiclare
		2	T12S, R8E, Sec 4 county road bridge	Rosiclare
Big Grande Pierre	Pope	1	T12S, R7E, Sec 22 Illinois Hwy 146 bridge	Shelterville
		2	T12S, R7E, Sec 9 county road bridge	Shelterville
		3	T11S, R7E, Sec 15 county road bridge	Herod
Lusk	Pope	1	T13S, R7E, Sec 19 Illinois Hwy 146 bridge	Galconda
		2	T13S, R6E, Sec 16 gravel road bridge	Waltersburg
		3	T12S, R6E, Sec 16 county road bridge	Waltersburg
		4	T12S, R6E, Sec 3 gravel road bridge	Eddyville