THE UNIONID MOLLUSK (MUSSEL) FAUNA OF THE VERMILION RIVER SYSTEM IN ILLINOIS

Final Report
to
Illinois Department of Conservation
Division of Forest Resources and Natural Heritage
600 North Grand Avenue West
Springfield, IL 62706

A Study by the
Illinois Natural History Survey
Liane Suloway
John J. Suloway
Wallace E. LaBerge
607 East Peabody
Champaign, IL 61820

July, 1981

INTRODUCTION

Because of the alarming rate of disappearance of natural areas in Illinois, the Illinois Department of Conservation funded a project to locate and describe natural areas in Illinois with the ultimate goal of protecting the remnants of the state's original environment. The three-year project was completed in 1978 by the University of Illinois and the Natural Land Institute and the findings were published in "Illinois Natural Areas Inventory" (White 1978). Outstanding aquatic habitats were among the several categories considered as natural areas. Recommendations for natural streams and lakes were provided by Drs. P. W. Smith and L. M. Page of the Illinois Natural History Survey. These recommendations were based largely on the fish fauna of these areas. Two of the 12 natural stream segments identified in the inventory are located in the Vermilion River basin; one is the Middle Fork from Potomac to its confluence with the Salt Fork and the other is the Vermilion River proper from the mouth of the North Fork to the state line.

A study of the mussels, substrate and water quality of the Vermilion River system was undertaken to further characterize this aquatic ecosystem, including the areas already designated as natural areas in the inventory. Mussels have long been recognized as valuable indicators of environmental changes (Ortmann 1909). They are easily influenced by the deterioration of the water quality because they are basically sedentary, have a long life span compared to other invertebrates (Stein 1971), concentrate many foreign substances (Fuller 1974) and are adversely affected by many potentially toxic substances including chlorine (Fuller 1974), nitrogen (Fuller 1974), potassium (Imlay 1971), certain heavy metals (Wurtz 1962), silt (Ellis 1936), organic enrichment (Baker 1922)

and acid mine drainage (Stansbery 1969). Channelization, dredging and the construction of impoundments also contribute to changes in mussel communities (Baker 1922, Stansbery 1970, Wilson and Clark 1912). Because of these factors, it was hypothesized that the present status and the historical changes that have occurred in mussel communities would reflect environmental conditions over a period of time and thus be a good index of the status of a stream or river as a natural area.

DESCRIPTION OF AREA

The Vermilion River originates in Ford and Iroquois Counties in east central Illinois and flows southeasterly for approximately 121 km where it confluences with the Wabash River near Cayuga, Indiana (Fig. 1). The Vermilion River has a drainage area of 1435 m^2 ha of which 86% is drained by its three largest tributaries - the North Fork, Middle Fork and Salt Fork. The confluence of the Salt and Middle Forks in Vermilion County forms the Vermilion River proper and the North Fork joins the river south of Danville. The headwaters of the Salt Fork consist of two branches, the Saline Ditch which flows near Champaign-Urbana and the Spoon River.

The topography of the basin is mostly flat with some gently rolling morainal ridges. The Vermilion River and its three major tributaries are low gradient streams (Brigham 1979). Before Pleistocene glaciation, the area now within the Vermilion River system was drained by the Teays River which flowed to the west (opposite the present flow). The advance and retreat of the continental glaciers beginning about 1 million years ago and ending 10,000 years ago completely erased the Teays River system. In the Vermilion basin, the unconsolidated material that presently overlies the bedrock is of glacial origin.

East central Illinois was one of the last regions to be settled in Illinois because it had no navigable streams or other means of easy transportation, little timber and the lands were poorly drained. At present, the region is principally agricultural, specializing in corn and soybean production. Coal, sand and gravel are mined in the basin.

Man-made alterations to the Vermilion River consist of widening and deepening of natural channels and the construction of lateral ditches and tile mains to facilitate drainage. The majority of this work was completed by 1920. Virtually all of the Salt Fork upstream of Sidney has been dredged. The North Fork was impounded in Danville in 1925 to form Lake Vermilion. A lowhead dam on the Salt Fork near Homer was built sometime around 1900 but washed away prior to 1958. Sewage and industrial wastewater have been discharged into the system since at least the turn of the century. The location of major wastewater treatment plants are indicated on Fig. 1.

MATERIALS AND METHODS

Mussels were collected at 28 sites during August, September and October 1980 and April of 1981 (Appendices I and II). Mussels were handpicked for three man-hours at each site. Attempts were made to collect all habitats at a site including pools, riffles and backwaters. Mussels were identified to specific level in the field and returned to the riverbed except for voucher specimens which were deposited in the Illinois Natural History Survey collection and the reference collection prepared for the Illinois Department of Conservation. Measurements of river width, depth and flow were taken and maps were sketched at each site (Appendix I).

Substrate samples were collected at 29 sites in early November 1980. Two transects each composed of five core samples were taken at each site (290 total samples). Each transect consisted of one midchannel core, two near-shore cores and two cores midway between midchannel and shore. Cores were taken with a cylindrical plexiglass tube 70 mm in inside diameter which was forced 80 mm down into the substrate (Appendix III). Laboratory analyses were completed in February 1981. Percentages of clay (.0019-.0039 mm), silt (.0039-.0625 mm), fine sand (.0625- .125 mm), medium sand (.125-.5 mm), coarse sand (.5-2.0 mm) and gravel (>2.0 mm) were measured for each core sample. Each core sample was oven-dried, processed through a splitter and a 55 ml subsample was removed. A deflocculent (25 ml of sodium hexametaphorate) was added. The sample was agitated for six hours, after which the sample was poured into a graduated cylinder with de-ionized water to obtain a constant volume. The sample was agitated for three minutes and allowed to stand for 2 hours. Hydrometer readings were then taken (3.0 g were added to the reading to correct for temperature). Wet sieving separated the clay and most silt, sand and gravel.

After oven-drying the gravel was weighed. Sand was separated into fine, medium and coarse by dry sifting by ro-tap for 10 minutes and each category was weighed. The weight of silt was obtained by subtracting the total of clay, sand and gravel from the initial weight of the sample. The substrate at a site was characterized by averaging the values of the particle size categories for all the cores taken at the site.

Water samples were collected at 29 sites in early November 1980. The samples were taken at the surface in midstream in 250 ml Nalgene bottles and transported to the lab on ice. In the lab, pH was measured with a Beckman Altex Model 4500 pH Meter. Thirty ml were filtered through a 0.45 micron pore-size filter membrane and preserved with nitric acid and the remaining 220 ml of sample was frozen for further chemical analyses. During February 1981, water samples were analyzed for 23 inorganic chemical constituents with a Jarrell-Ash Atom Comp 975 Inductively Coupled Plasma Unit. Concentrations of nitrate, nitrite, ammonia, hardness and phosphorus were measured on a Technicon Auto Analyzer CSM-6.

Site selection was based on optimizing data available for historical comparisons and thus most of the sites sampled in 1980-81 corresponded to sites sampled in previous studies. The earliest historical information about the mussel fauna of the Vermilion River system is available from Baker (1906) who lists a few species collected prior to 1906. Extensive collections of the Salt Fork were made in 1907-1911 (Zetek 1918), 1918-1920 (Baker 1922), 1958-1962 (Matteson and Dexter 1966) and 1975 (J. Suloway 1975). Site 9 was collected 11 times between 1930 and 1939 (Van Cleave 1940) and again in 1955 (Parmalee unpubl.). Collections of the Salt, Middle and North Forks and the Vermilion River proper were made in 1956-60 by M. R. Matteson (Matteson unpubl.).

RESULTS AND DISCUSSION

Water Quality

Several studies have shown that anthropogenic activities have a profound effect on the mussel fauna. Physical alterations of the aquatic environment such as channelization (Baker 1922, Wilson and Clark 1912), construction of dams (Isom 1969) and addition of silt (Ellis 1936) have adverse effects on the mussel fauna. Alterations in water quality, such as the addition of organic waste products (Baker 1922, Starrett 1971, Wilson and Clark 1912), industrial wastes (Ortmann 1918, Williams 1969, Wilson and Clark 1912) and acid mine drainage (Williams 1969) can also be damaging to mussel populations. The absence of mussels where they once were present can be an indication of environmental pertubations.

In the Vermilion River system, 31 water quality parameters were measured at 29 sites in November 1980 (Table 1 and Fig. 2). Additional water quality data are available for previous years from the Illinois Environmental Protection Agency (IEPA 1980) and the United States Geological Survey (Grason and Healy 1979, IEPA 1980). The pH was measured immediately upon return from the field and water samples were collected for analysis of ammonia, hardness, nitrite-nitrate, nitrite, nitrate, phosphate and the presence of several elements (Fig. 2).

Measurements of pH made in this study in 1980 ranged from 7.6 to 8.6 and were within the established IEPA criteria (Illinois Pollution Control Board 1979). Two violations were found in 1978 and 1979, one on the Salt Fork at Mayview and the other on the Middle Fork at Kickapoo State Park (Table 2).

There are no IEPA criteria for hardness, which in natural waters is a function of the geological composition of the of the watershed. In the

Vermilion River system in November 1980, hardness ranged from 162-412 mg/l $CaCO_3$.

Nitrogenous compounds cycle through aquatic ecosystems in a complex manner, generally beginning as atmospheric nitrogen which is fixed by plants and/or organic matter and decomposing to ammonia, nitrite (NO_2^-), and nitrate (NO_3). In unpolluted aquatic ecosystems, ammonia and ammonium occurs in relatively small quantities, usually 0.1 mg/l or less; levels greater than this are usually indicative of sewage and industrial contamination (Environmental Studies Board 1972). A level of 1.5 mg/l of total ammonia has been established as the maximum allowable by the IEPA. Ranges of 0.06-18.1 mg/l were found in November 1980 in the Vermilion River system. On the Salt Fork, the first 10 sites below the Champaign-Urbana Wastewater Treatment Facility (WTF) exceeded IEPA critera with the first site downstream of the WTF exceeding the criteria by a factor of 12. On the Middle Fork, site 15, the first site below Paxton's WTF, also exceeded the standard. No North Fork sites exceeded the criteria, however, the first site downstream from the Danville WTF did. During 1978-79, violations of the ammonia criterium occurred on the Salt Fork at Mayview (which had numerous violations), at St. Joseph and at Oakwood and on the Vermilion River below Danville (Table 2).

Nitrite and nitrate are by-products of the decomposition of organic matter. In unpolluted freshwater systems, these two components occur in small quantities. Nitrite-nitrate levels in November 1980 ranged from 0.08 to 6.91 mg/l with nitrite ranging from 0.01 to 0.37 and nitrate from 0.07 to 6.71 mg/l. All nitrite-nitrate levels were below the IEPA maximum criteria of 10 mg/l. During 1978-1979, nitrite-nitrate levels ranged from 0.0 to 29.0 mg/l.

Phosphorus, a naturally occurring constituent of surface water, is also released in the breakdown of organic matter and high levels can indicate organic pollution. In natural water and in wastewater, phosphorus occurs almost exclusively as phosphate. Soluble ortho-phosphate levels in the Vermilion River system in November 1980 ranged from 0.01 to 7.5 mg/l. The maximum allowed by the IEPA is 0.05 mg/l. In November 1980 this level was exceeded at all Salt Fork, two Middle Fork, three North Fork and both Vermilion River sites.

Water samples taken from 29 sites in November 1980 were analyzed for 23 elements (Table 1). Several of these elements were at or below detection limits, i.e., aluminum, antimony, arsenic, cadmium, chromium, copper, lead, nickel, selenium and tin. The concentrations of elements for which IEPA standards exist did not exceed the levels allowed by the IEPA except for the level of zinc at site 15 which was measured at 1.1 mg/l (criterion is 1.0 mg/l). The concentrations of certain elements below wastewater treatment facilities were found at concentrations greater than background levels; boron, potassium, sodium and zinc were found at relatively high levels at sites 3, 15, and 22 compared to the other sites (Table 1).

The overall water quality of the Vermilion River and its tributaries varies from good to fair. The Water Quality Index, which was established by the IEPA and based on DO, fecal coliform, ammonia and total dissolved solids measurements, is used as an indication of overall water quality. Streams are rated A-good, B-average, C-fair and D-poor. The IEPA (1979) rated the Vermilion River system as follows:

	1978	1979
Saline Branch at Mayview	C	C
Salt Fork at St. Joseph	B	C
Salt Fork at Oakwood	B	C
Middle Fork at Kickapoo St. Pk.	A	A
North Fork near Bismarck	-	C
Vermilion River below Danville	B	C

The historical record of effects of the discharge of wastes to the Salt Fork have been documented in several studies. Among the classic studies documenting the effects of organic pollution on the biota of a stream is Baker's (1922) study of the Salt Fork of the Vermilion River. In 1922, sewage from the Champaign-Urbana area (population 30,000) entered the Salt Fork practically untreated and comprised nearly half of the volume of the Salt Fork (during October) at the point of entry (Baker 1922). The portion of the Salt Fork above Champaign-Urbana was a "clean water steam, filled with aquatic life", which abruptly terminated at the junction with the wastewater effluent. The Salt Fork just below the wastewater outflow was characterized by low concentrations of dissolved oxgyen, high bacteria counts, and high levels of nitrogenous substances. The stream was described as follows: "Fecal matter, in dark brown masses, as well as partly decomposed organic matter colored green by the presence of blue-green algae and the protozoan Euglena, are usually floating down the stream. . . . Bars of sand and gravel occur at irregular intervals and are covered with masses of putrescent matter forming long, alternating streaks of black and green." Baker (1922) considered the Salt Fork to be modified by

the organic pollution from Champaign-Urbana as far as Homer Park (site 9), a distance of 43 km from the source of pollution.

A wastewater treatment plant utilizing activated sludge and sprinkling filters was later built (prior to 1926) to treat wastes from the Champaign-Urbana area. Although treatment improved since Baker's study, the volume of effluent from the treatment plant increased as the Champaign-Urbana area population grew. In 1917, Baker estimated the effluent volume to be 1.5 million gallons per day. In 1975 the treatment plant discharged 13.6 $\pm$ 2.5 million gallons per day. Low concentrations of dissolved oxygen have been recorded by Larimore and Smith (1963), Brigham (1972) and J. Suloway (1975). In 1957, Matteson noted the presence of blue-green algae and no other aquatic life and a septic odor at a site 1.6 km north of Mayview, approximately 10 km below the sewage outlet. As of 1975, a large portion of the upper stretch of the Salt Fork remained unfit for most aquatic life (Suloway 1975).

Even the November 1980 water chemistry data from the Vermilion River system indicates organic pollution from wastewater treatment still alters the aquatic chemistry of the watershed. Several chemical parameters can indicate organic pollution, including depressed DO levels and elevated levels of ammonia, nitrite, nitrate and phosphate. Measurements of some of these parameters below wastewater treatment facilities indicate varying degrees of organic contamination. At site 3 (below the Champaign-Urbana WTF) ammonia and phosphate levels peak in the Salt Fork (Fig. 2). At site 15 (below Paxton WTF) ammonia, nitrite and phosphate levels peak in the Middle Fork. Several effluents discharge into the North Fork between sites 21 and 22 (including the Hoopeston WTF); levels of nitrite-nitrate and phosphate peak at site 22 for the North

Fork. Site 28, which had a high nitrite-nitrate level, is below the Danville WTF.

Substrate

In the Vermilion River system substrate composition has been altered by human activities. Channelization destabilizes the substrate and increases siltation (Harman 1974). After 1880, there was a period of rapid and extensive construction of drainage ditches and installation of drainage tiles in the Vermilion River watershed in order to drain marshy land for cultivation and eradicate diseases such as malaria and cholera. With the improved drainage and resulting increased loading of the natural channels, the Saline Ditch was cleared and straightened in order to increase flows. Between 1906 and 1912 the Saline Ditch from Urbana to St. Joseph was straightened from 31 to 23 km; in the 1930's, the Salt Fork south of St. Joseph to just north of Sidney was dredged and straightened (Figs. 3 and 4), completely destroying the bottom fauna. The dredging south of St. Jospeh, which occurred after Baker's (1922) study, drastically altered several of Baker's sites (J. Suloway 1975).

Intensive agricultural practices have contributed to erosion of farm land into streams and the resulting siltation represents a serious threat to aquatic life in Champaign County (Larimore and Smith 1963). Smith (1971) considered excessive siltation to be a major factor adversely affecting fish in the state and drastically altering stream habitats.

Brigham (1972) noted that the substrate of newly dredged areas of the Salt Fork were generally a uniform sand-silt mixture. In 1975, Suloway noted that much of the Salt Fork upstream of Sidney was laden with silt. Although it is difficult to assess the changes in the silt load in the Salt Fork since Baker's

study, the pool-riffle development has certainly been replaced with a silt-laden channel between St. Joseph and Sidney since Baker's study (J. Suloway 1975). Neither Baker nor Matteson and Dexter (1966) mention siltation in their reports.

Of substrate samples collected in November 1980, sites 6 and 7 (just below Sidney) had the highest proportions of fine particle sizes (clay and silt) in the Vermilion River system (Fig. 5). The relatively rapid flow from the channelized portion above Sidney becomes slower at Sidney, depositing its fine sediment load. The substrates at the upstream sites on the Salt Fork (1-4) were composed of relatively high proportions of coarse sand compared to the eight downstream sites. Substrates composed of relatively large proportions of gravel were found in the Salt Fork at sites 8-12, on the Middle Fork at sites 18-20, and on the North Fork at sites 21, 23-25, and 27. Some of these sites, with their gravel riffles and associated flora and fauna, are among the most aesthetically pleasing in the state (Page and Evers 1977).

Quantitative historical data concerning substrate composition is not available for comparison with data collected in this study, although Baker (1922) and Matteson provide qualitative information about the substrate at their collection sites. Baker noted in 1918-1920 that the newly dredged areas of the Salt Fork (i.e., the area upstream from St. Joseph) had substrates of hard sand which had "not yet silted up to any degree". In 1980, sites in the area described by Baker had similar proportions of silt relative to most other sites in the Vermilion River system (Fig. 5), although absolute levels of silt may have increased since Baker's observations.

The substrate at site 6 was characterized by Baker as being mostly mud, an observation in agreement with the 1980 findings. However, Baker reports the substrate at site 7 as mostly sand while 1980 samples were composed of large proportions of silt comparable to those found at site 6. This may be a result of the further dredging from St. Joseph to Sidney subsequent to Baker's study. The dredging may have increased the silt-carrying capacity by further increasing the flow.

In 1980, silt was observed at all sites, with the gross estimations ranging from 5 to 40% of the substrate. Matteson noted silt at most of his sample sites although he did not observe silt at several sites which had silt as a component of the substrate in 1980 (sites 10, 11, 18, 24, 27, 28, and 29).

Mussels

Present Abundance and Distribution

In 1980, 22 species of mussels were collected in 72 man-hours of sampling at 28 sites in the Vermilion River System (Table 3). The number of individuals found at a site ranged from 0 to 116 and the number of species ranged from 0 to 14 (Table 3). Relatively high densities and/or diversities were found at sites 10 and 13 on the Salt Fork, 16 and 17 on the Middle Fork, and 24 and 25 on the North Fork (Fig. 6). Relatively diverse mussel faunas were not encountered on the Salt Fork until site 9, while the uppermost sites on the Middle and North Forks supported a comparable number of species and/or individuals. *Lasmigona complanata*, *Lampsilis radiata siliquoidea*, and *L. ovata ventricosa*, the three most abundant species, comprised 60% of the individuals collected in 1980.

Several species found in the Vermilion River system in 1980 are uncommon in Illinois. *Alasmidonta marginata*, *Cyclonaias tuberculata*, *Lampsilis fasciola*,

Lasmigona compressa, Obovaria subrotunda, Quadrula cylindrica, Villosa iris, and V. lienosa were represented by less than 100 specimens (of a total of over 20,000) in a state-wide survey made in the 1950s by M. R. Matteson. Of these species, O. subrotunda and Q. cylindrica are restricted to the Ohio River basin in Illinois. Matteson found Q. cylindrica only in ther Vermilion River system in Illinois, despite extensive collections of other Ohio River tributaries (i.e., the Embarras, Little Wabash, and Little Vermilion Rivers). Some experts consider Q. cylindrica to be rare and endangered in the United States (Stansbery 1971). Another species collected in 1980, L. fasciola, is largely restricted to the Vermilion River system in Illinois.

Historical Comparisons

Historical information about the mussel fauna of the Vermilion River system is available for several years. Baker (1906) listed a few species collected prior to 1906. Zetek (1918) collected on the Salt and Middle Forks from 1907-11 (Baker identified Zetek's specimens). Extensive collections of the Salt Fork were made in 1918-20 (Baker 1922), 1956-60 (Matteson unpubl.), 1958-62 (Matteson and Dexter 1966), and 1975 (J. Suloway 1975). One site on the Salt Fork was collected 11 times between 1930 and 1939 (Van Cleave 1940) and once in 1955 (Parmalee unpubl.). Collections of the Salt, Middle and North Forks and the Vermilion River proper were made in 1956-60 by Matteson (Matteson unpubl.). The number of species and/or individuals found at sites in these historical studies are presented in Fig. 6.

Thirty-four species of mussels have been reported from the Vermilion River system since the turn of the century (Table 4). A comparison of the data from 1956-60 and 1980, the two studies made of the whole system, shows a decline in

number of species in the basin from 25 to 22 with a concurrent 62% reduction in number of individuals. Nineteen of the same sites were sampled in 1980 using the same methodology and sample time as in 1956-60. The average number of individuals/site declined from 81 in 1956-60 to 31 in 1980. Fewer individuals were found at 16 of the 19 sites; no mussels were found at two sites in either study and at the remaining site, no mussels were collected in 1956-60 but one was found in 1980.

Almost all species declined in abundance since 1956-60. The three most abundant species in 1956-60, Lampsilis radiata siliquoidea, L. ovata ventricosa and Fusconaia flava, were reduced in abundance in 1980 to 33% of their 1956-60 levels. The absolute abundance of Lasmigona complanata, the fourth most abundant species in 1956-60 and the most abundant species in 1980, was approximately the same in 1980 as in 1956-60.

Since the turn the century, 31, 22, and 22 species have been reported from the Salt, Middle and North Forks, respectively (Table 4). The large number of species collected in the Salt Fork relative to the other two forks is probably the result of more extensive collection of the Salt Fork. Baker collected 25 sites on the Salt Fork, one on the Middle Fork, and none of the North Fork. The 1930-39, 1955, and 1958-62 (Matteson and Dexter 1966) studies were limited to the Salt Fork. The only comparable data for the system as a whole are from the two studies made of all three forks, i.e., the studies of 1956-60 and 1980. These two studies reveal that the North Fork supported the greatest number of species, 22 in 1956-60 and 20 in 1980 compared to the Salt Fork with 16 (1956-60) and 14 (1980) and the Middle Fork with 18 (1956-60) and 15 (1980) species (the same number of man-hours were sampled on the North and Middle Forks

and more man-hours were spent on Salt Fork in 1980 than in 1956-60). However, 1980 abundances relative to 1956-60 levels are 80% on the Salt Fork, 55% on the Middle Fork and 26% on the North Fork. In 1980, the North Fork still maintained the greatest average abundance/site (40 individuals/site) compared to Salt Fork (29/site) or Middle Fork (26/site).

The number of species reported from the Salt Fork in 1907-11, 1918-20, 1930-39, 1955-62, 1975, and 1980 were 12, 29, 29, 24, 18, and 14, respectively. Eighteen species collected in or prior to 1975 were not found in 1980 (Table 4). The only report of Ligumia subrostrata was from 1907-11. Lampsilis teres was last found in 1918-20. Since 1930-39, three species (Lasmigona compressa, Quadrula cylindrica and Carunculina glans) have not subsequently been collected in the Salt Fork. Seven species were last collected in the Salt Fork in the 1955-62 period (Actiononaias ellipsiformis, Anodonta imbecillis, Carunculina parva, Megalonaias gigantea, Lasmigona costata, Pleurobema clava and Villosa lienosa). Five species were last collected in 1975 in the Salt Fork (Anodontoides ferussacianus, Cyclonaias tuberculata, Pleurobema cordatum, Quadrula metanevra and Uniomerus tetralasmus). Seven of these 18 species were collected in the other forks in 1980 (Table 4).

On the Middle Fork, 11 of 26 species once reported were not collected in 1980. Four species were reported from the Middle Fork only in 1907-11 (Carunculina parva, Cyclonaias tuberculata, Elliptio dilatata and Quadrula cylindrica). Lampsilis teres, Lasmigona compressa, Pleurobema clava and Quadrula metanevra haven't been collected in the Middle Fork since 1918-20 and Lampsilis fasciola, Obovaria subrotunda and Villosa lienosa were last reported in 1956-60. Six of these species were found in 1980 in the other forks.

Two species found in 1956-60 in the North Fork, Pleurobema clava and Ptychobranchus fasciolaris, were not recollected in 1980. Five species were found only in the North Fork in 1980, i.e., Cyclonaias tuberculata, Lasmigona compressa, Quadrula cylindrica, Villosa iris and V. lienosa.

In the Vermilion River system as a whole, 12 species collected prior to 1980 were not recollected in this study (Table 4). Elliptio dilatata and Ligumia subrostrata were collected only in 1907-11. Lampsilis teres and Carunculina glans were not collected after 1918-20 and 1932, respectively. Species last collected in the 1955-62 period are Actinonaias ellipsiformis, Anodonta imbecillis, Carunculina parva, Megalonaias gigantea, Pleurobema clava and Ptychobranchus fasciolaris. Quadrula metanevra and Uniomerus tetralasmus were last collected in 1975. Seven of the 12 species have been found only in the Salt Fork and not the other forks. At the time of their last collection these 12 species were scarce in the system. Some of the species may still exist in the system but were not collected because of their scarcity. Noteworthy among these 12 species are Pleurobema clava and Ptychobranchus fasciolaris, both of which are restricted to the Ohio River basin in Illinois. Pleurobema clava was collected only in the Vermilion River system in Illinois in a statewide survey of mussels conducted in the 1950s by Matteson. Experts consider this species to be rare and endangered in the United States (Stansbery 1971).

The reduction in the mussel fauna of the Vermilion River system is comparable to those found in other aquatic systems in the state. The Rock River supported 31 species in 1926, but only 21 were found in 1970 (Miller 1972). Forty species have been reported from the Kaskaskia River since the turn of the century; 24 species were collected in 1978-79. Between 1956 and 1979, the

number of species declined from 30 to 24 with a concurrent 76% reduction in abundance in the Kaskaskia River (L. Suloway, J. Suloway, E. Herricks, in prep.). In the Kankakee River 37 species have been reported since the turn of the century but only 20 were collected in 1978 (Suloway 1981).

The mussel fauna of each of the forks of the Vermilion River has undergone changes which, in some cases, reflect man's impact on the basin. In the Salt Fork mussels have not established themselves from Champaign-Urbana to below Sidney. Baker found no living mussels in the Salt Fork until 23 km downstream (between 1980 sites 4 and 5) from the Champaign-Urbana sewage effluent. In 1956-60 Matteson collected living mussels 35 km downstream from Urbana (between sites 6 & 7) and in 1980, living mussels were first collected approximately 37 km below Urbana (site 7). Baker encountered sites with six and eight species at the approximate location of site 5. In 1956-60, nine species were collected between sites 6 and 7 (no mussels were found above this site). In 1980, the first site with a comparable number of species was site 9 (7 species), or 18 km further downstream than Baker. In the Salt Fork the mussel fauna has become more restricted in distribution; the dredging between sites 4 and 6 since Baker's study has undoubtedly damaged the fauna that Baker observed in this stretch. Periodic dredging of the upper Salt Fork has taken place since Baker's study. The influence of the Champaign-Urbana wastewater treatment effluent on water quality was evident in 1980. W. U. Brigham (pers. comm.) felt that the shallow and unshaded character of the stream and the nutrient loading from agricultural runoff lead to high primary productivity in the daylight and low dissolved oxygen concentrations at night when respiration becomes dominant.

The combination of these factors may be responsible for the failure of clams to re-establish themselves in the upper Salt Fork.

On the Middle and North Forks, the influence of human activity on the mussel fauna may be evident at the sites immediately below wastewater treatment facilities. The mussel fauna at site 15 on the Middle Fork and site 22 on the North Fork were much less diverse than the sites upstream of the wastewater treatment facilities and supported the poorest mussel faunas in both of these forks. Otherwise the mussel fauna of these two forks exhibit the same trend as observed on the Salt Fork and elsewhere in the state; i.e., the general degradation of both numbers of species and individuals at nearly all sites.

On the positive side, several sites still support diverse faunas, i.e. on the Salt Fork, sites 10 and 13, on the Middle Fork sites 16 and 17, and on the North Fork sites 24 and 25. Eight species found in 1980 in the Vermilion River system could be considered rare in the state and some species are restricted to the Ohio River system and/or the Vermilion River system in Illinois. Several species once reported from the Vermilion River and its tributaries are significant to the state mussel fauna because of their rarity and limited distribution; in particular, Pleurobema clava and Ptychobranchus fasciolaris.

Acknowledgements

The principal investigators wish to express thanks to the following: J. Beckman, N. Frye, S. Kamp, S. Lowe, S. Sandberg, T. Skelly, J. Summers, M. Vargo, and M. Wetzel for their assistance in the field and S. Peratt for typing the final report. The Illinois Natural History Survey provided M. R. Matteson's unpublished data and the Illinois State Museum provided P. W. Parmalee's unpublished data.

LITERATURE CITED

Baker, F. C. 1906. A catalogue of the Mollusca of Illinois. Bull. Ill. State Lab. Nat. Hist. 7:53-135.

Baker, F. C. 1922. The molluscan fauna of the Big Vermilion River with special reference to its modification as the result of pollution by sewage and manufacturing wastes. Ill. Biol. Monogr. 7:1-126.

Brigham, A. R. 1979. An assessment of the water quality of the Wabash River basin derived from a biological investigation. Report to Illinois Environmental Protection Agency, Springfield, IL. 297 p.

Brigham, W. U. 1972. The ecology of a polluted stream, the Salt Fork. Ph.D. thesis, Univ. of Illinois, Champaign-Urbana. 133 p.

Ellis, M. M. 1936. Erosion silt as a factor in aquatic environments. Ecology 17:29-42.

Environmental Studies Board. 1972. Water quality criteria 1972. U.S. Environmental Protection Agency, Washington, D.C. 594 p.

Fuller, S. L. H. 1974. Clams and mussels. Pages 215-273 in Pollution ecology of the freshwater invertebrates. C. W. Hart and S. L. H. Fuller, eds. Academic Press, New York. 390 p.

Grason, D. and R. W. Healy. 1979. Chemical analyses of surface water in Illinois, 1975-77. Vol. III. U.S. Geological Survey, Champaign, IL. 242 p.

Harman, W. N. 1974. Snails. Pages 272-312 in Pollution ecology of freshwater invertebrates. C. W. Hart and S. L. H. Fuller, eds. Academic Press, New York. 390 p.

Illinois Environmental Protection Agency. 1980. Illinois Water Quality Inventory Report. Vols. I and II. Illinois Environmental Protection Agency, Springfield, IL.

Illinois Pollution Control Board Rules and Regulations. Chapter 3: Water Pollution. 1979. Illinois Environmental Protection Agency, Springfield, IL. 51 p. + 14 p. amendments.

Imlay, M. J. 1971. Bioassay tests with naiads. Pages 38-41 in Proc. of a symp. on rare and endangered mollusks of the U. S. S. E. Jorgensen and R. W. Sharp, eds. U. S. Fish and Wildl. Serv., Twin Cities, MN. 79 p.

Isom, B. G. 1969. The mussel resources of the Tennessee River. Malacologia 7:397-425.

Larimore, R. W. and P. W. Smith. 1963. The fishes of Champaign County, Illinois, as affected by 60 years of stream changes. Bull. Ill. Nat. Hist. Surv. 28:299-382.

Matteson, M. R. and R. W. Dexter. 1966. Changes in the pelecypod populations in Salt Fork of Big Vermilion River, Illinois, 1918-1962. Nautilus 79:96-101.

Miller, T. B. 1972. Investigations of the freshwater mussels of the Rock River, Illinois. Ill. Dept. Cons., Div. Fish., Spec. Fish Rept. #43.

Ortmann, A. E. 1909. The destruction of the freshwater fauna in western Pennsylvania. Proc. Amer. Phil. Soc. 48:90-110.

Ortmann, A. E. 1918. The nayades (freshwater mussels) of the upper Tennessee drainage with notes on synonymy and distribution. Proc. Amer. Phil. Soc. 57:521-626.

Page, L. M. and R. A. Evers. 1977. Some unusual natural areas in Illinois. Ill. Nat. Hist. Surv. Biol. Note No. 100. 47 p.

Smith, P. W. 1971. Illinois streams: a classification based on their fishes and an analysis of factors responsible for disappearance of native species. Ill. Nat. Hist. Surv. Biol. Note No. 76. 14 p.

Stansbery, D. H. 1969. Changes in the naiad fauna of the Cumberland Falls in eastern Kentucky. Ann. Rep. 1969 Amer. Malacological Union: 16-17.

Stansbery, D. H. 1970. Eastern freshwater mollusks, the Mississippi and St. Lawrence River systems. Malacologia 10:9-21.

Stansbery, D. H. 1971. Rare and endangered mollusks in the eastern U. S. Pages 5-18 in Proc. of a symp. on rare and endangered mollusks of the U. S. S. E. Jorgensen and R. W. Sharp, eds. U. S. Fish and Wildl. Serv., Twin Cities, MN. 79 p.

Starrett, W. C. 1971. A survey of the mussels of the Illinois River, a polluted stream. Ill. Nat. Hist. Surv. Bull. vol. 30.

Stein, C. B. 1971. Naiad life cycles: their significance in the conservation of the fauna. Pages 19-25 in Proc. of a symp. on rare and endangered mollusks of the U. S. S. E. Jorgensen and R. W. Sharp, eds. U. S. Fish and Wildl. Serv., Twin Cities, MN. 79 p.

Suloway, J. J. 1975. Changes in the molluscan populations of the Salt Fork of the Big Vermilion River since F. C. Baker's study of 1918-1920. M.S. report, Univ. of Illinois, Champaign-Urbana, IL 51 p.

Suloway, L. 1981. Changes in the mussel fauna of the Kankakee River in Illinois. Amer. Midl. Nat. 105:233-239.

Suloway, L., J. J. Suloway and E. E. Herricks. In preparation. Changes in the unionid mollusk fauna of the Kaskaskia River, Illinois, with emphasis on the effects of impoundment.

Van Cleave, H. J. 1940. Ten years of observation on a fresh-water mussel population. Ecology 21:363-370.

White, J. 1978. Illinois natural areas inventory. Ill. Dept. Conservation. Springfield, IL. Summary Report, 27 p. Technical Report, 426 p.

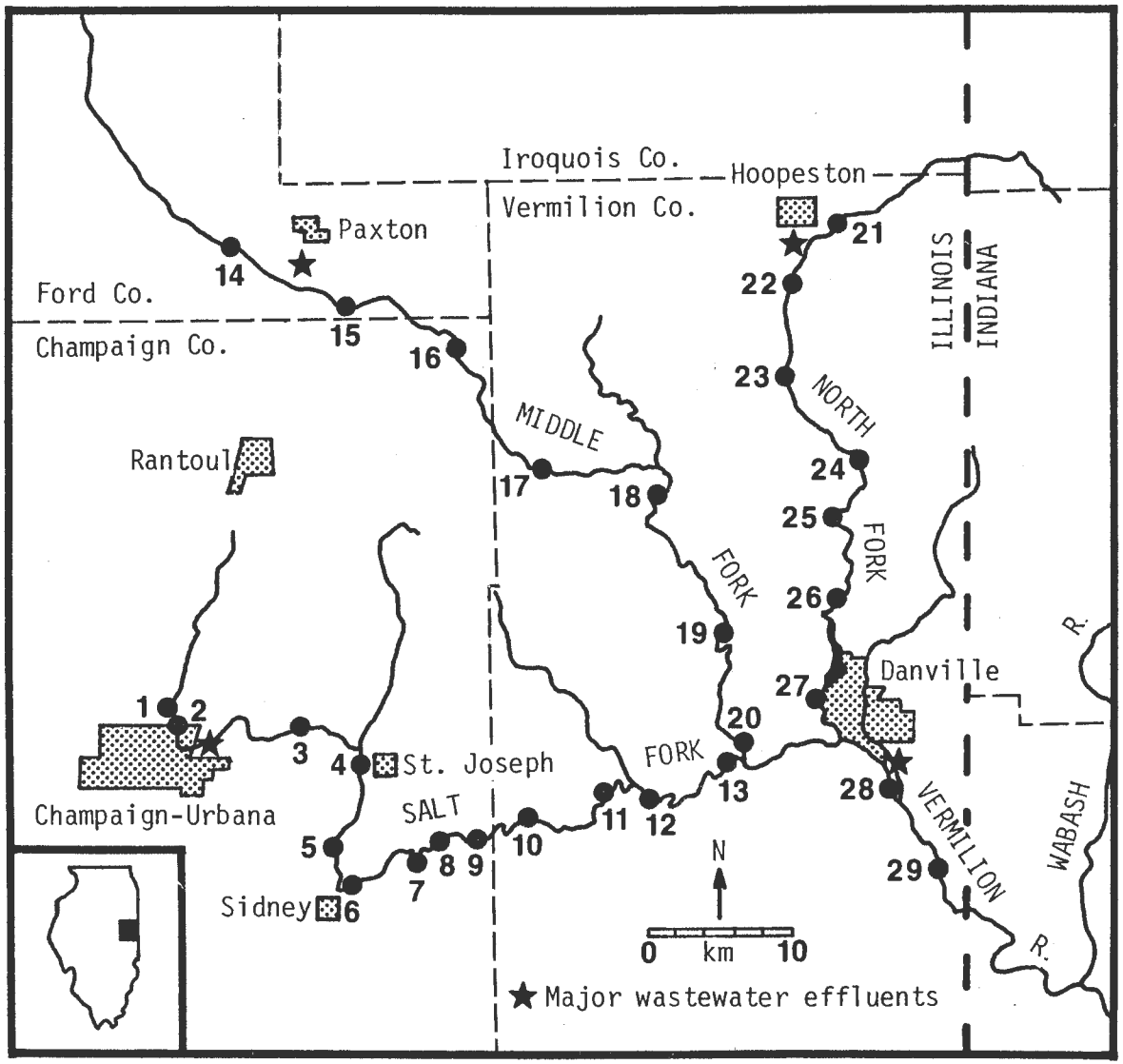
Williams, J. C. 1969. Mussel fishery investigation: Tennessee, Ohio and Green Rivers. Final Report to U. S. Fish and Wild. Serv. and Kentucky Dept. Fish Wildl. Resources. State of Kentucky Proj. No. 4-19-R, Louisville, KY. 107 p.

Wilson, C. B. and H. W. Clark. 1912. The mussel fauna of the Kankakee basin. Bur. Fish. Doc. No. 758. 52 p.

Wurtz, C. B. 1962. Zinc effects on freshwater mollusks. Nautilus 76:53-61.

Zetek, J. 1918. The Mollusca of Piatt, Champaign and Vermilion Counties of Illinois. Trans. Ill. State Acad. Sci. 11:151-182.

Figure 1. Sites of 1980-81 mussel, water sample and substrate collections in the Vermilion River system in Illinois.



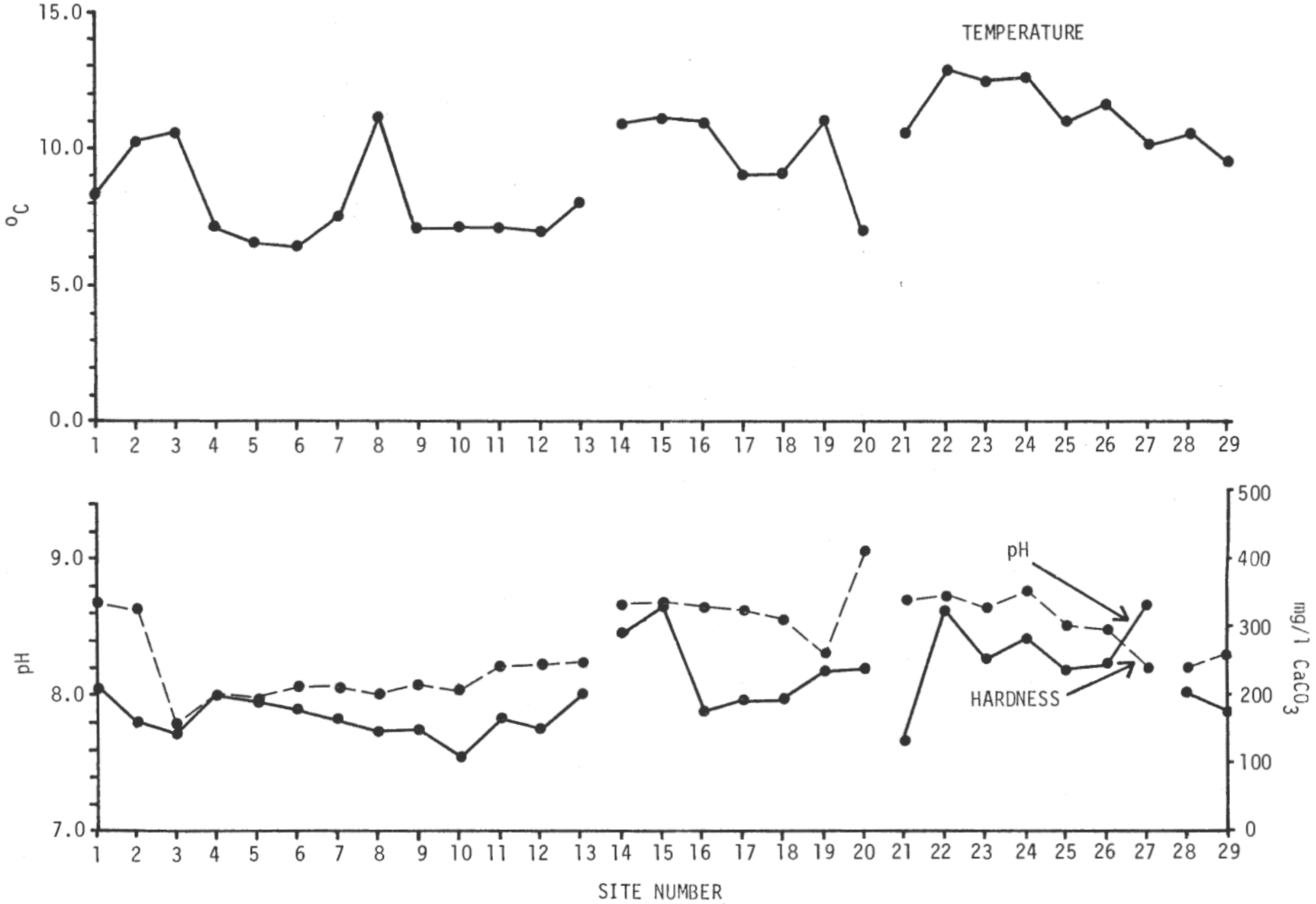


Figure 2. Measurements of temperature, pH, hardness, ammonia, soluble ortho-phosphate, nitrite-nitrate, nitrite and nitrate at 29 sites in the Vermilion River system in November 1980.

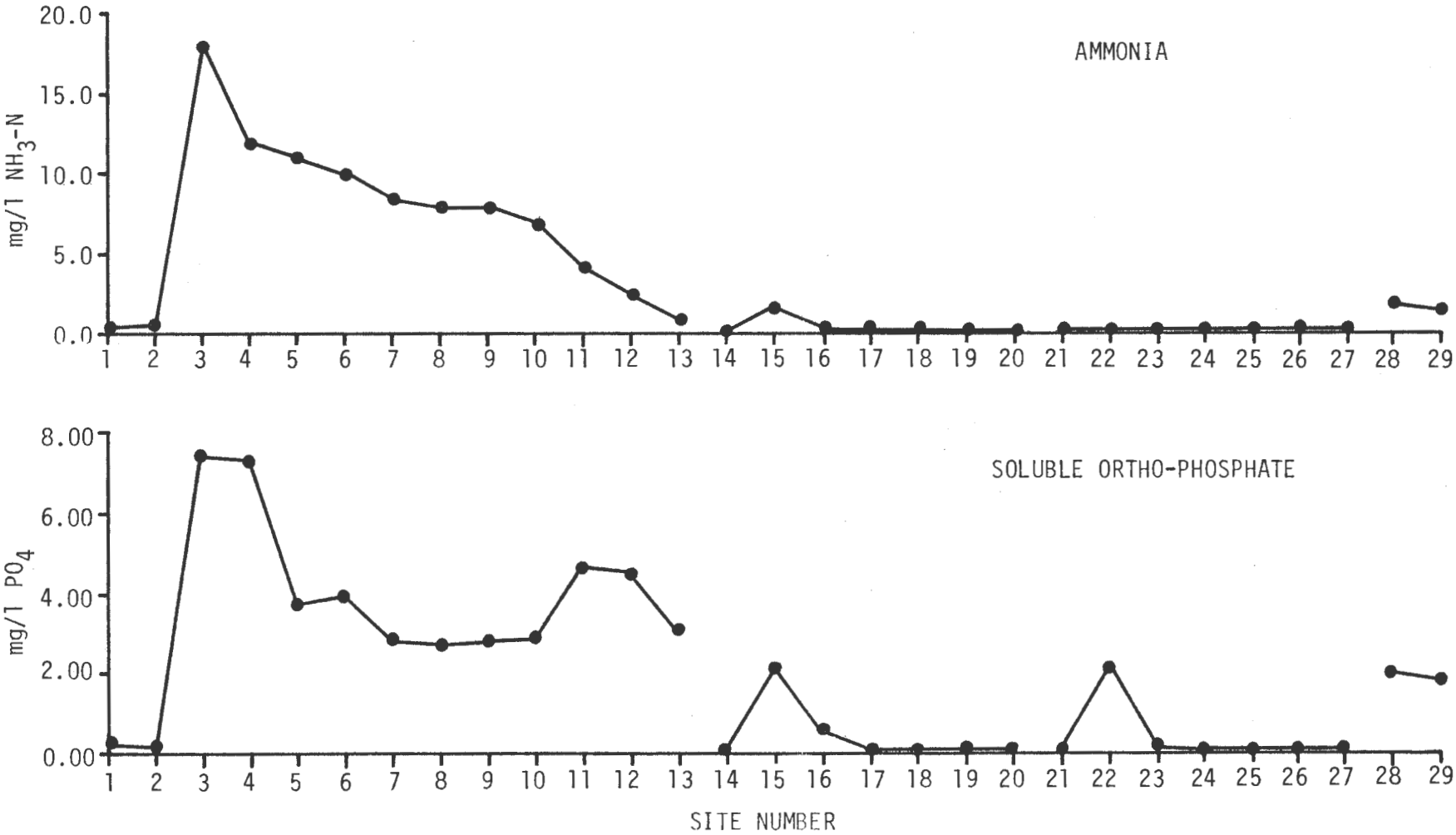


Figure 2. Continued.

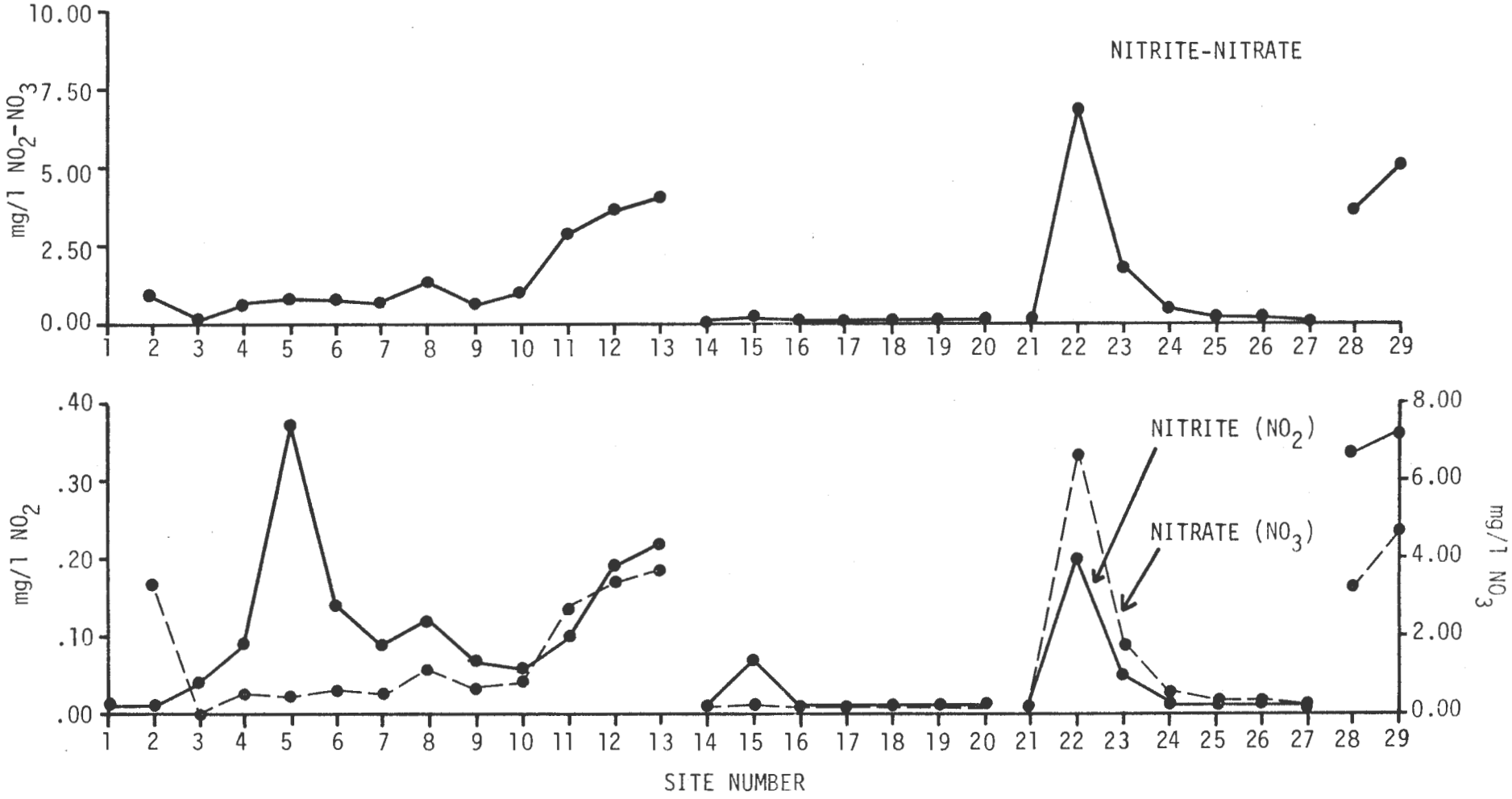


Figure 2. Continued.

Figure 3. The coarse of the Saline Ditch and Salt Fork in 1906 and 1970 showing the changes resulting from drainage improvements.

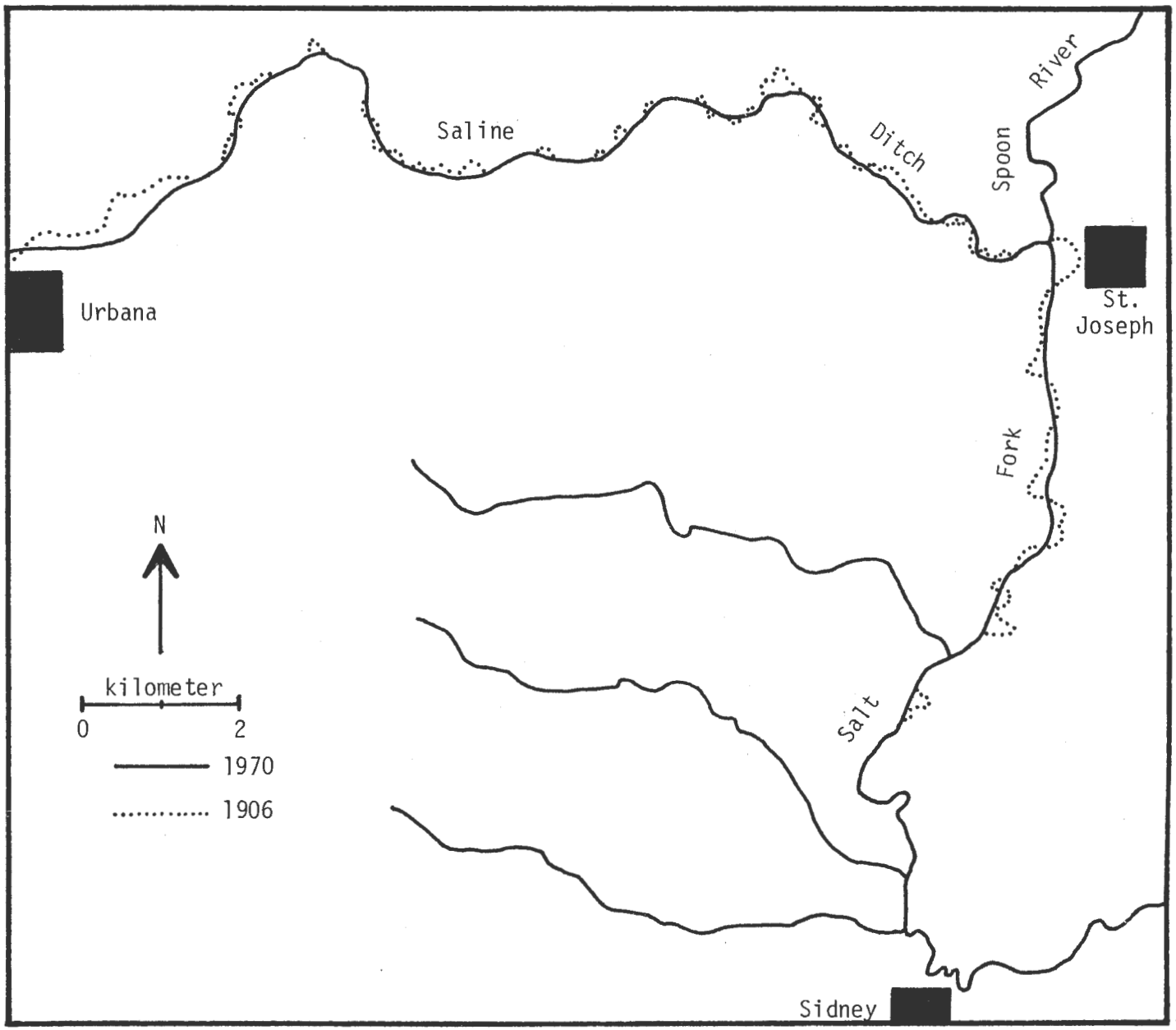
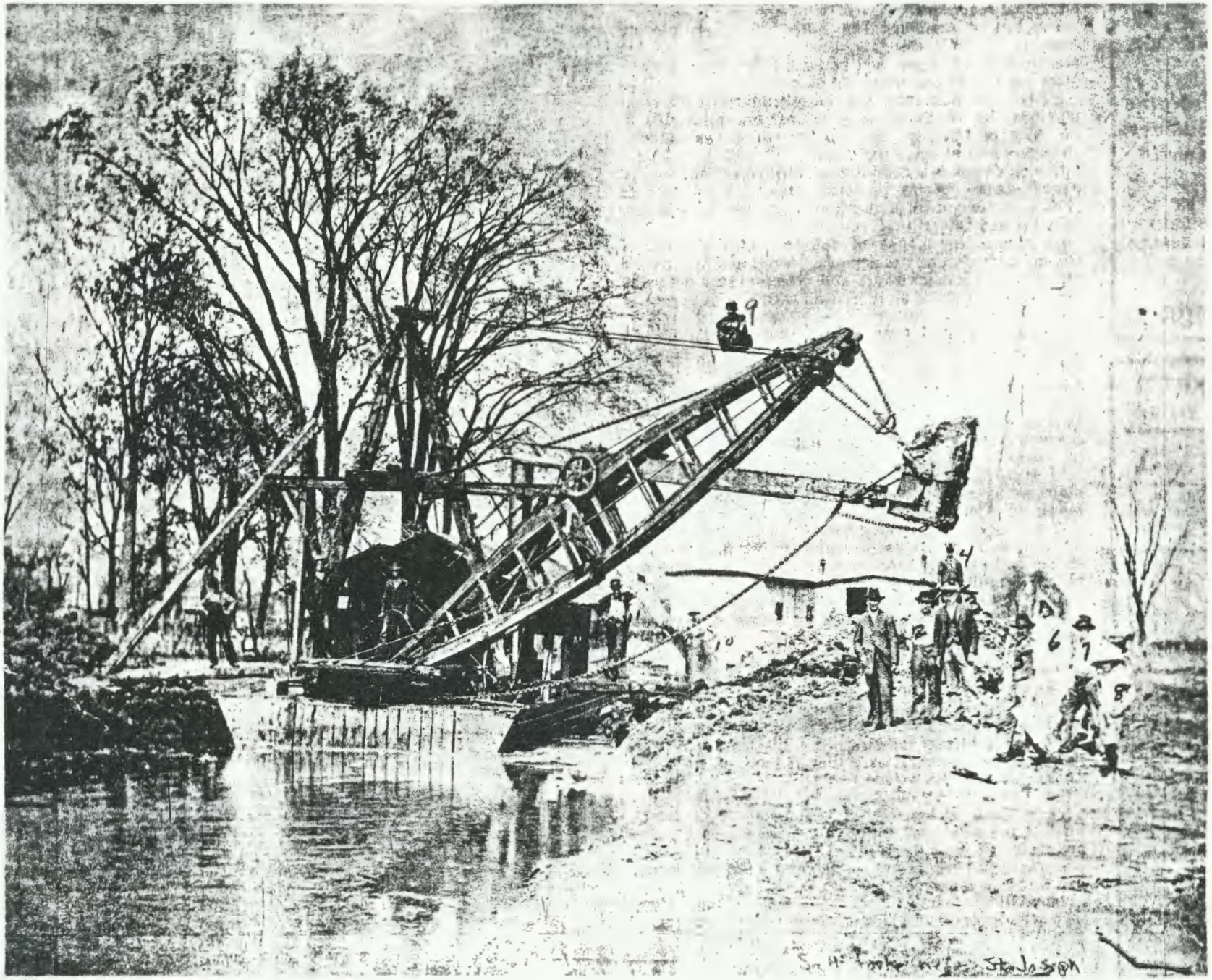


Figure 4. Dredging operation on the Salt Fork near St. Joseph.



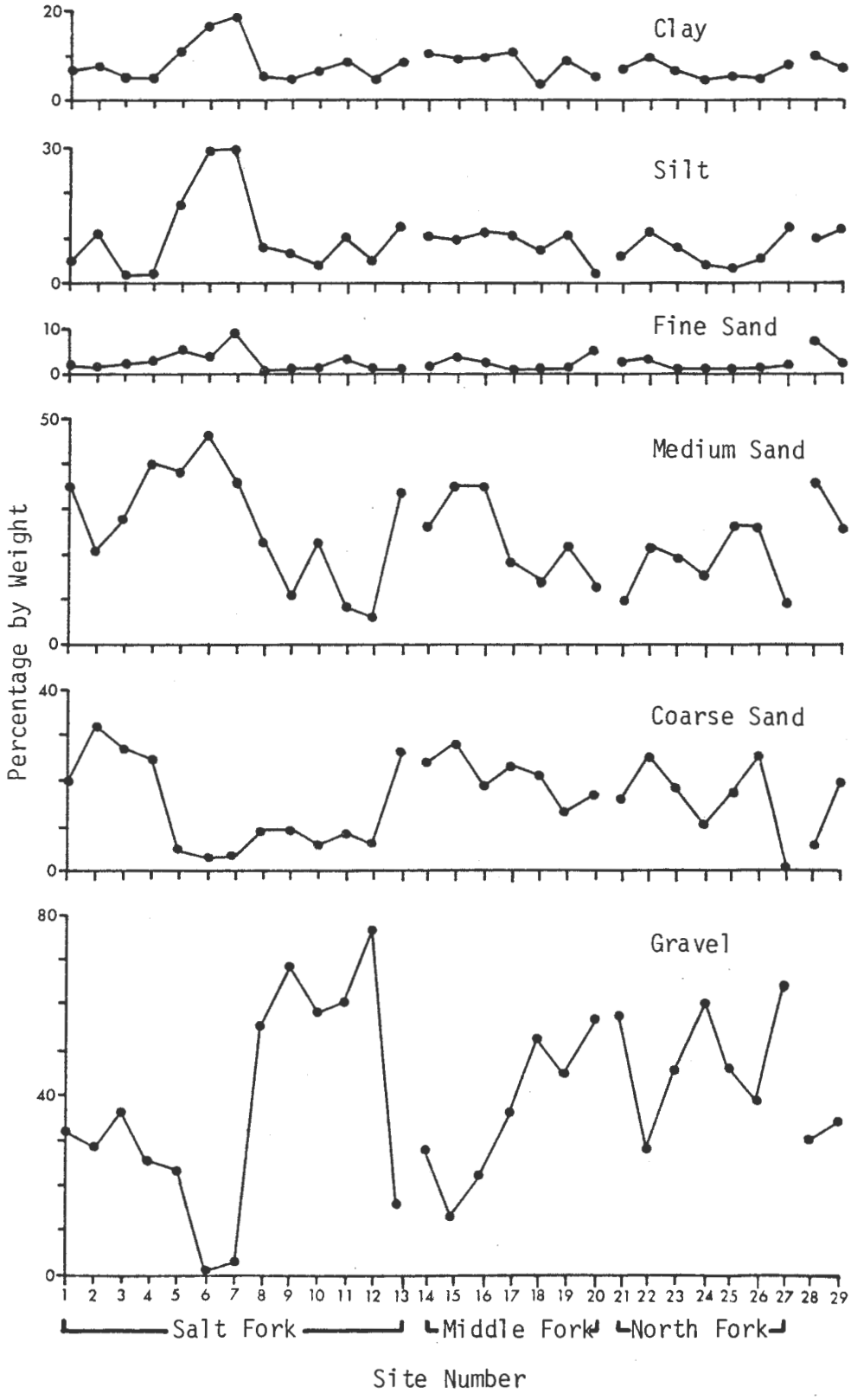


Figure 5. Composition of the substrate at sites on the Vermilion River system in Illinois in November 1980.

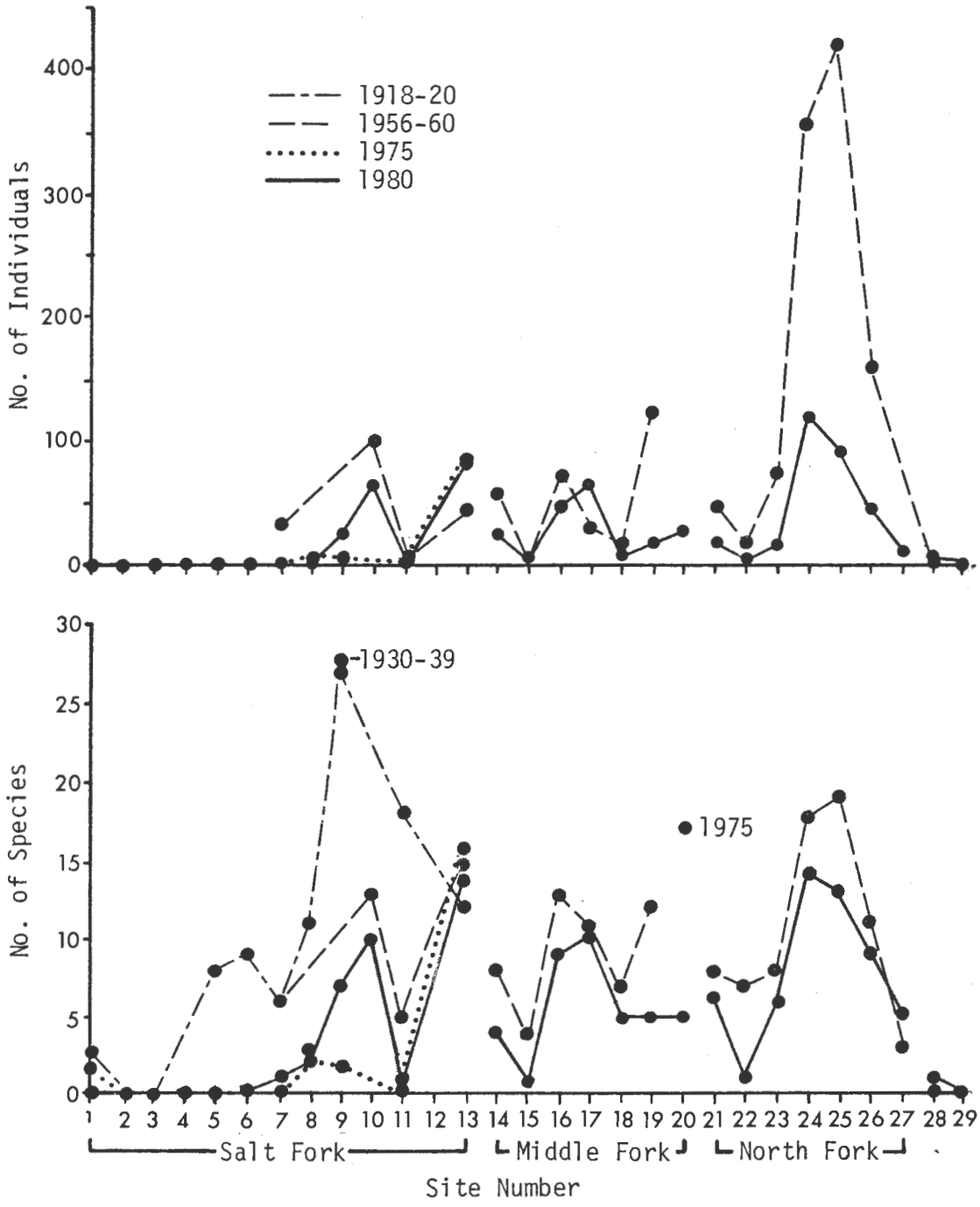


Figure 6. Numbers of species and individual mussels at 1980-1981 sites as reported in various studies.

Table 1. Concentrations (ppm) of 23 elements in water samples from sites on Vermilion River, Illinois. Water samples were collected 5-13 November 1980. Blanks indicate levels below detection limits. NA = not available.

	Salt Fork													Middle Fork							North Fork				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Aluminum																									
Antimony																									
Arsenic																									
Barium	0.06	0.06	0.03	0.02	0.07	0.03	0.09	0.02	0.02	0.02	0.02	0.03	0.03	0.08	0.05	0.04	0.04	0.04	0.04	0.05	0.04	0.02	0.03	0.04	
Beryllium																									
Boron	0.47	0.38	0.61	0.47	0.48	0.46	0.45	0.45	0.65	0.44	0.44	0.44	0.42	0.09	0.24	0.13	0.06	0.21	0.19	1.16		0.39	0.22	0.12	
Cadmium																									
Calcium	74.9	81.1	32.9	42.4	41.8	42.9	44.9	45.5	46.6	45.8	45.1	46.7	47.4	70.5	77.3	79.2	77.4	84.9	86.1	119.0	87.2	76.9	80.8	75.3	7
Chromium																									
Copper																									
Iron		0.16	0.15	0.11	0.11	0.12	0.16	0.10	0.12	0.12	0.07	0.06	0.07			0.08	0.11	0.07	0.07		0.10			0.05	
Lead																									
Magnesium	34.1	37.0	19.4	23.8	22.7	23.5	24.6	24.8	25.5	25.1	24.7	25.5	25.5	454	40.0	39.1	37.2	38.9	41.1	55.8	34.6	36.7	37.0	36.3	3
Manganese	0.12	0.25	0.08	0.09	0.10	0.12	0.16	0.06	0.11	0.10	0.06	0.04	0.03	NA	0.21	0.16	0.10	0.04		0.06	0.14	0.03	0.06		
Molybdenum																									
Nickel					0.01	0.01																			
Potassium	5.15	4.85	13.7	10.6	7.75	10.0	9.69	9.43	11.4	11.2	10.0	8.34	8.68	5.01	6.92	6.73	2.97	2.96	2.54	4.68	4.08	6.91	4.20	3.30	
Selenium																									
Silicon	3.90	2.67	5.95	4.04	3.67	3.65	3.76	3.54	3.59	3.27	2.31	1.90	0.96	0.28	2.13	2.86	2.61	3.74	3.67	2.40	2.99	4.64	3.60	1.62	
Sodium	74.3	59.6	125.0	111.0	97.1	96.8	92.6	93.8	95.4	95.1	94.6	92.6	86.8	34.0	71.6	53.9	29.3	28.9	26.5	46.9	9.94	74.9	40.7	25.0	2
Tin																									
Vanadium					0.04							0.04		0.07						0.08					
Zinc	0.44		0.93	0.49	0.02			0.01						0.34	1.10	0.23	0.80	0.55				0.60		0.02	

of 23 elements in water samples from sites on Vermilion River, Illinois. Water samples were collected 5-13 November 1980 and analyzed 30 January 1981.
is below detection limits. NA = not available.

Salt Fork									Middle Fork							North Fork							Vermilion River		Detection Limit
5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
																									0.06
																									0.03
																									0.04
0.07	0.03	0.09	0.02	0.02	0.02	0.02	0.03	0.03	0.08	0.05	0.04	0.04	0.04	0.04	0.05	0.04	0.02	0.03	0.04	0.03	0.04	0.04	0.04	0.03	0.001
																							0.01		0.001
0.48	0.46	0.45	0.45	0.65	0.44	0.44	0.44	0.42	0.09	0.24	0.13	0.06	0.21	0.19	1.16		0.39	0.22	0.12	0.10	0.11	0.05	0.59	0.47	0.01
																							0.01		0.01
41.8	42.9	44.9	45.5	46.6	45.8	45.1	46.7	47.4	70.5	77.3	79.2	77.4	84.9	86.1	119.0	87.2	76.9	80.8	75.3	72.0	71.9	47.4	77.2	80.2	0.02
																									0.03
																							0.01		0.01
0.11	0.12	0.16	0.10	0.12	0.12	0.07	0.06	0.07			0.08	0.11	0.07	0.07		0.10			0.05	0.08		0.05	0.07	0.05	0.04
																									0.03
22.7	23.5	24.6	24.8	25.5	25.1	24.7	25.5	25.5	454	40.0	39.1	37.2	38.9	41.1	55.8	34.6	36.7	37.0	36.3	35.5	35.8	31.2	34.2	34.8	0.01
0.10	0.12	0.16	0.06	0.11	0.10	0.06	0.04	0.03	NA	0.21	0.16	0.10	0.04		0.06	0.14	0.03	0.06					0.08	0.10	0.03
																							0.02		0.01
0.01	0.01																						0.01		0.01
7.75	10.0	9.69	9.43	11.4	11.2	10.0	8.34	8.68	5.01	6.92	6.73	2.97	2.96	2.54	4.68	4.08	6.91	4.20	3.30	4.24	4.22	1.92	7.99	6.79	0.99
																									0.03
3.67	3.65	3.76	3.54	3.59	3.27	2.31	1.90	0.96	0.28	2.13	2.86	2.61	3.74	3.67	2.40	2.99	4.64	3.60	1.62	1.18	1.10	0.24	1.43	1.65	0.02
97.1	96.8	92.6	93.8	95.4	95.1	94.6	92.6	86.8	34.0	71.6	53.9	29.3	28.9	26.5	46.9	9.94	74.9	40.7	25.0	24.0	25.2	14.2	110	110	1.32
																									0.02
0.04							0.04		0.07						0.08						0.03				0.03
0.02			0.01						0.34	1.10	0.23	0.80	0.55				0.60		0.02	0.06	0.03	0.18			0.01

Table 2. Illinois Environmental Protection Agency water quality criteria* for certain constituents and the number of violations in 1978 and 1979.

	IEPA Criteria**		No. Violations											
			Salt Fork						Middle Fork		North Fork		Verm. River	
			Mayview		St. Joe		Oakwood							
			1978	1979	1978	1979	1978	1979	1978	1979	1978	1979	1978	1979
DO	5.0		0	0	0	0	0	0	0	0	0	0	0	0
pH	6.500	9.000	1/14***	0	0	0	0	0	0	1/12	0	0	0	0
Ammonia-Ammonium	1.5	-	8/14	9/15	1/14	1/15	1/13	1/15	0	0	0	0	4/13	1/15
Chloride	500	-	0	0	0	0	0	0	0	0	0	0	0	0
Sulfate	500	-	0	0	0	0	0	0	0	0	0	0	0	0
Arsenic	1.0	-	0	-	0	-	0	-	0	-	0	-	0	0
Boron	1.0	-	0	-	-	-	0	-	0	-	0	-	0	-
Cadmium	0.05	-	0	-	0	-	0	-	0	-	0	-	0	0
Chromium	1.0	-	0	-	0	-	0	-	0	-	0	-	0	0
Copper	.02	-	0	0	0	0	1/11	0	0	1/15	0	0	0	1/15
Iron	1.0	-	1/4	-	-	-	1/13	3/17	2/12	4/15	0	-	3/12	8/18
Lead	0.0	-	0	0	0	0	0	0	0	0	0	0	0	0
Manganese	1.0	-	0	0	0	0	0	0	0	0	0	-	0	0
Zinc	1.0	-	0	0	0	0	0	0	0	0	0	0	0	0
Fecal Coliform	200	-	4/12	1/14	6/12	10/14	6/13	5/11	5/12	4/10	7/9	5/6	2/8	8/11
Mercury	0.0005	-	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus	0.05		-	-	-	-	-	-	-	-	12/12	13/13	-	-

*From Illinois Pollution Control Board Rules & Regulations Chapter 3: Water Pollution (1977 with amendments through July 1, 1979).

**All in mg/l except pH (in pH units) and fecal coliforms (FC/100ml) an all represent maximum allowed except DOC (minimum allowed) and pH (range).

***Violations expressed as number of violations/number of values.

Table 3. Numbers of live individual mussels collected in the Vermilion River system in Illinois in 1980. Stations 1, 2, 3, 5, and 12 have not y

	Salt Fork													Middle Fork							North Fork			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Actinonaias carinata										3			5			1		1						1
Alasmidonta marginata									1				3			1							1	7
Amblema plicata													5	1										1
Anodonta grandis grandis										1			1			5	11						1	2
Anodontoides ferussacianus																	2		1		4		3	
Cyclonaias tuberculata																								15
Fusconaia flava										1			9			2	1	1	2		1			4
Lampsilis fasciola										1			4											
L. ovata ventricosa									1	4			7	2	1	9	8	4	7	12				28
L. radiata siliquoidea							1		9	6			11	2		6	3	1	3	12	8	2	3	19
Lasmigona complanata								1	10	42	2		15	19		16	27	2	3	1	1		4	13
L. compressa																							1	
L. costata																				1				10
Obovaria subrotunda													1								1			
Pleurobema cordatum																	1							5
Quadrula cylindrica																								8
Q. pustulosa										1			4				2							
Q. quadrula								1	1	2			7			1	3							
Strophitus undulatus									1				1			5				1				1
Tritogonia verrucosa									2	1			7				5							
Villosa iris																								2
V. lienosa																					1			
Individuals			0		0	1	2	25	62	2			80	24	1	46	63	9	16	27	16	2	13	115
Species			0		0	1	2	7	10	1			14	4	1	9	10	5	5	5	6	1	6	14

ive individual mussels collected in the Vermilion River system in Illinois in 1980. Stations 1 2, 3, 5, and 12 have not yet been sampled.

Salt Fork											Middle Fork							North Fork							Vermilion River		
4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Total
						3			5			1		1						1			1			12
					1				3			1							1	7	6					19
									5	1										1						7
						1			1			5	11						1	2	1	1	3	1		27
													2		1		4		3		4					14
																				15	18	2				35
						1			9			2	1	1	2		1			4	5	11				37
						1			4												2	1				8
					1	4			7	2	1	9	8	4	7	12				28	17	8				108
		1			9	6			11	2		6	3	1	3	12	8	2	3	19	15	12	1			114
				1	10	42	2		15	19		16	27	2	3	1	1		4	13	4	3	1			164
																			1							1
																1				10	6	1				18
									1								1									2
													1							5	2	2				10
																				8	3					11
						1			4				2														7
				1	1	2			7			1	3										3				18
					1				1			5				1				1							9
					2	1			7				5														15
																				2	1					3
																	1									1
0		0	1	2	25	62	2		80	24	1	46	63	9	16	27	16	2	13	115	84	41	9	1	0	639
0		0	1	2	7	10	1		14	4	1	9	10	5	5	5	6	1	6	14	13	9	5	1	0	22

Table 4. Species of mussels collected from the Vermilion River System prior to 1906 and in 1918-20, 1930-39, 1955-62, 1975, and 1980.

	Salt Fork						Middle Fork					North Fork		Verm. River		System						
Species	1907-11	1918-20	1930-39	1955-62	1975	1980	1907-11	1918-20	1956-60	1975	1980	1956-60	1980	1906-60	1980	1906	1907-11	1918-20	1930-39	1955-62	1975	1980
Actinonaias carinata	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	+	+
A. ellipsiformis	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-
Alasmidonta marginata	-	+	+	+	+	+	+	+	-	-	+	+	+	-	-	-	+	+	+	+	+	+
Amblema plicata	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	+	+
Anodonta grandis grandis	+	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+
A. imbecillis	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-
Anodontoides ferussacianus	+	+	-	-	+	-	-	+	+	-	+	+	+	-	-	-	+	+	-	+	+	+
Carunculina glans	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-
C. parva	+	+	+	+	-	-	+	-	-	-	-	-	-	-	-	+	+	+	+	+	-	-
Cyclonaias tuberculata	-	+	+	+	+	-	+	-	-	-	-	+	+	-	-	-	+	+	+	+	+	+
Elliptio dilata	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Fusconaia flava	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	+	+
Lampsilis fasciola	-	+	+	+	+	+	-	-	+	-	-	+	+	-	-	+	+	+	+	+	+	+
L. ovata ventricosa	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	+	+	+	+

Table 4. Species of mussels collected from the Vermilion River System prior to 1906 and in 1918-20, 1930-39, 1955-62, 1975, and 1980. (continued)

Species	1907-11	1918-20	1930-39	1955-62	1975	1980	1907-11	1918-20	1956-60	1975	1980	1956-60	1980	1906-60	1980	1906	1907-11	1918-20	1930-39	1955-62	1975	1980
L. radiata siliquoidea	-	+	+	+	+	+	-	+	+	-	+	+	+	-	-	-	-	+	+	+	+	+
L. teres	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	+	-	-	-
Lasmigona complanata	+	+	+	+	+	+	-	+	+	-	+	+	+	-	-	-	+	+	+	+	+	+
L. compressa	-	+	+	-	-	-	+	+	-	-	-	+	+	-	-	-	+	+	+	+	-	+
L. costata	-	+	+	+	-	-	-	+	+	+	+	+	+	-	-	-	-	+	+	+	+	+
Ligumia subrostrata	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Megalonaias gigantea	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Obovaria subrotunda	-	+	+	-	+	+	+	+	+	-	-	+	+	-	-	-	+	+	+	+	+	+
Pleurobema clava	-	+	+	+	-	-	+	+	-	-	-	+	-	-	-	-	+	+	+	+	-	-
P. cordatum	-	+	+	+	+	-	+	-	+	-	+	+	+	-	-	-	+	+	+	+	+	+
Ptychobranchus fasciolaris	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-
Quadrula cylindrica	-	+	+	-	-	-	+	-	-	-	-	+	+	-	-	-	+	+	+	+	-	+
Q. metanevra	-	+	+	+	+	-	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	-
Q. pustulosa	-	+	+	+	+	+	-	-	+	-	+	-	-	-	-	-	-	+	+	+	+	+
Q. quadrula	-	+	+	+	+	+	-	-	+	-	+	-	+	-	-	-	-	+	+	+	+	+
Strophitus undulatus	+	+	+	+	+	+	-	+	+	-	+	+	+	-	-	-	+	+	+	+	+	+

Table 4. Species of mussels collected from the Vermilion River System prior to 1906 and in 1918-20, 1930-39, 1955-62, 1975, and 1980. (continued)

Species	1907-11	1918-20	1930-39	1955-62	1975	1980	1907-11	1918-20	1956-60	1975	1980	1956-60	1980	1906-60	1980	1906	1907-11	1918-20	1930-39	1955-62	1975	1980
Tritogonia verrucosa	-	+	+	+	-	+	-	+	+	-	+	-	-	-	-	-	-	+	+	+	-	+
Uniomerus tetralasmus	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	+	-
Villosa iris	-	-	+	+	-	-	-	-	-	-	-	+	+	-	-	-	-	-	+	+	-	+
V. lienosa	-	+	+	+	-	-	-	+	-	-	-	+	+	-	-	-	-	+	+	+	-	+
Species	12	29	29	24	18	14	15	17	16	3	15	21	21			4	23	29	29	29	19	22

Appendix I. Data sheets for individual sites on the Vermilion River system from 1980-1981 collections of mussels, water samples and substrate samples.

SITE # 1 STATE IL COUNTY Champaign STREAM Salt Fork (Saline Branch)

LOCATION In N. Urbana at Lincoln Ave. br. T20N,R9E,SE 1/4,Sec. 31 & SW 1/4,Sec. 32

MUSSEL COLLECTION: DATE 24 April 1981 METHOD hand MAN-HOURS 3

___ Actinonaias carinata carinata
___ Alasmidonta marginata
___ Amblema plicata
___ Anodonta grandis grandis
___ Anodontoides ferussacianus
___ Cyclonaias tuberculata
___ Fusconaia flava
___ Lampsilis fasciola
___ L. ovata ventricosa
___ L. radiata siliquoidea
___ Lasmigona complanata
___ L. compressa
___ Lasmigona costata
___ Obovaria subrotunda
___ Pleurobema cordatum
___ Quadrula cylindrica
___ Q. pustulosa
___ Q. quadrula
___ Strophitus undulatus
___ Tritogonia verrucosa
___ Villosa iris
___ V. lienosa
___ _____
___ _____

no live mussels found

SUBSTRATE: ESTIMATION (% BY VOL.) SILT__ SAND__ GRAVEL__ COBBLE__ BEDROCK__ OTHER__

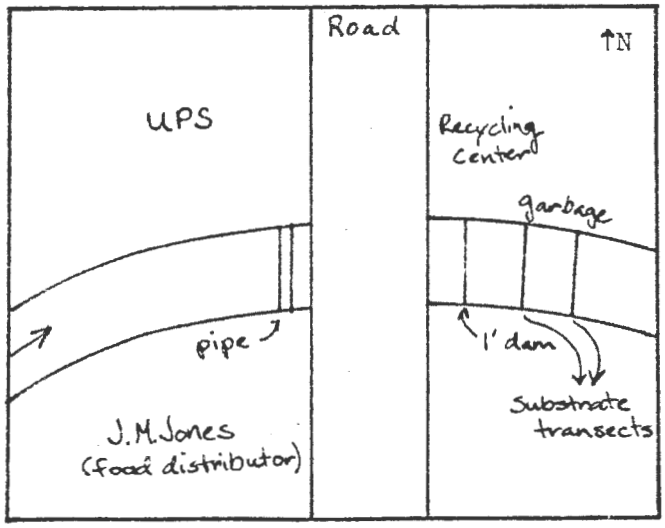
TRANSECTS (% BY WEIGHT)
CLAY 7.1 SILT 4.8 FINE SAND 1.6 MEDIUM SAND 34.5 COARSE SAND 20.1 GRAVEL 31.8

WATER QUALITY:
TEMP °C 8.2
DO 8.7
pH 8.055
HARDNESS mg/l 337
AMMONIA mg/l .51
PHOSPHATE mg/l .25
$NO_2^-NO_3$ mg/l (560)
NITRITE mg/l .01
NITRATE mg/l (560)

PHYSICAL DATA:
WIDTH max 8.5 m
DEPTH max .6 m
FLOW 0 m/sec
LAND USE industry, junk yard

REMARKS: stream is full of garbage and leaves, lots of clay

MAP



SITE # 2 STATE IL COUNTY Champaign STREAM Salt Fork (Saline Branch)

LOCATION In N. Urbana at Urbana Country Club T19N,R9E,S 1/2,Sec. 5

MUSSEL COLLECTION: DATE 24 April,1981 METHOD hand MAN-HOURS 3

___ Actinonaias carinata carinata
___ Alasmidonta marginata
___ Amblema plicata
___ Anodonta grandis grandis
___ Anodontoides ferussacianus
___ Cyclonaias tuberculata
___ Fusconaia flava
___ Lampsilis fasciola
___ L. ovata ventricosa
___ L. radiata siliquoidea
___ Lasmigona complanata
___ L. compressa
___ Lasmigona costata
___ Obovaria subrotunda
___ Pleurobema cordatum
___ Quadrula cylindrica
___ Q. pustulosa
___ Q. quadrula
___ Strophitus undulatus
___ Tritogonia verrucosa
___ Villosa iris
___ V. lienosa
___ _____
___ _____

no live mussels found

SUBSTRATE: ESTIMATION (% BY VOL.) SILT__ SAND__ GRAVEL__ COBBLE__ BEDROCK__ OTHER__

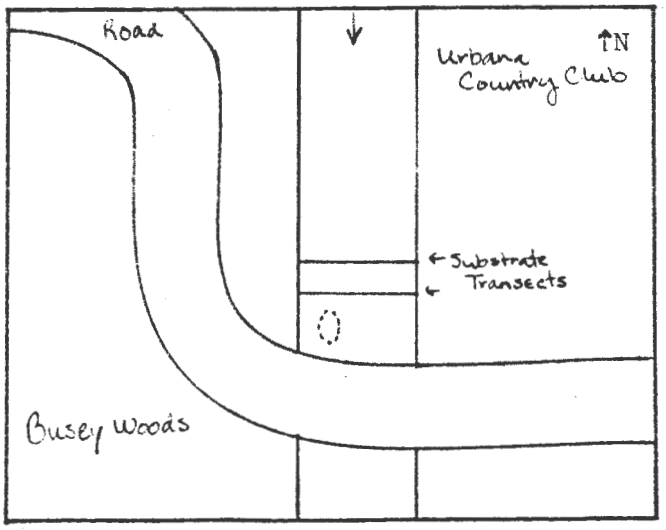
TRANSECTS (% BY WEIGHT)
CLAY 7.6 SILT 10.6 FINE SAND 1.6 MEDIUM SAND 20.7 COARSE SAND 32.3 GRAVEL 28.2

WATER QUALITY:
TEMP °C 10.2
DO 6.8
pH 7.808
HARDNESS mg/l 327
AMMONIA mg/l .29
PHOSPHATE mg/l .15
NO_2-NO_3 mg/l 0.8
NITRITE mg/l .01
NITRATE mg/l 3.4

PHYSICAL DATA:
WIDTH max 11.5 m
DEPTH max .5 m
FLOW 0 m/sec
LAND USE urban, golf course

REMARKS: _____

MAP



SITE # 3 STATE IL COUNTY Champaign STREAM Salt Fork (Saline Branch)

LOCATION 3-1/2 mi NE of St. Joseph T19N,R10E,SW 1/4,Sec. 5.

MUSSEL COLLECTION: DATE 24 April 1981 METHOD hand MAN-HOURS 3

___ Actinonaias carinata carinata
___ Alasmidonta marginata
___ Amblema plicata
___ Anodonta grandis grandis
___ Anodontoides ferussacianus
___ Cyclonaias tuberculata
___ Fusconaia flava
___ Lampsilis fasciola
___ L. ovata ventricosa
___ L. radiata siliquoidea
___ Lasmigona complanata
___ L. compressa
___ Lasmigona costata
___ Obovaria subrotunda
___ Pleurobema cordatum
___ Quadrula cylindrica
___ Q. pustulosa
___ Q. quadrula
___ Strophitus undulatus
___ Tritogonia verrucosa
___ Villosa iris
___ V. lienosa
___ _____
___ _____

no live mussels found

SUBSTRATE: ESTIMATION (% BY VOL.) SILT__ SAND__ GRAVEL__ COBBLE__ BEDROCK__ OTHER__

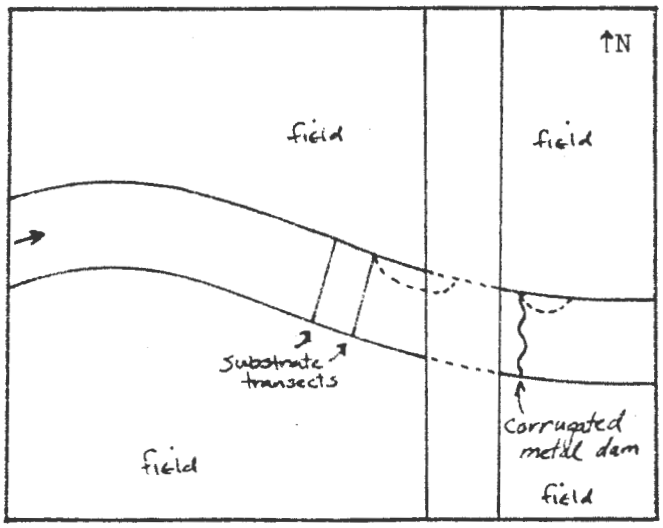
TRANSECTS (% BY WEIGHT)
CLAY 4.8 SILT 1.6 FINE SAND 2.0 MEDIUM SAND 27.9 COARSE SAND 27.0 GRAVEL 36.5

WATER QUALITY:
TEMP °C 10.5
DO 7.0
pH 7.732
HARDNESS mg/l 162
AMMONIA mg/l 18.1
PHOSPHATE mg/l 7.5
NO_2-NO_3 mg/l .17
NITRITE mg/l .04
NITRATE mg/l .13

PHYSICAL DATA:
WIDTH max 12.7m
DEPTH max .5m
FLOW .2 m/sec
LAND USE agricultural

REMARKS: _____

MAP



SITE # 4 STATE IL COUNTY Champaign STREAM Salt Fork

LOCATION W edge of St. Joseph T19N,R10E,NE 1/4,Sec. 15 & SE 1/4, Sec. 10

MUSSEL COLLECTION: DATE 22 Oct 1980 METHOD hand MAN-HOURS 3

___ Actinonaias carinata carinata
___ Alasmidonta marginata
___ Amblema plicata
___ Anodonta grandis grandis
___ Anodontoides ferussacianus
___ Cyclonaias tuberculata
___ Fusconaia flava
___ Lampsilis fasciola
___ L. ovata ventricosa
___ L. radiata siliquoidea
___ Lasmigona complanata
___ L. compressa
___ Lasmigona costata
___ Obovaria subrotunda
___ Pleurobema cordatum
___ Quadrula cylindrica
___ Q. pustulosa
___ Q. quadrula
___ Strophitus undulatus
___ Tritogonia verrucosa
___ Villosa iris
___ V. lienosa
___ _____
___ _____

no live mussels found

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 20 SAND 70 GRAVEL 10 COBBLE __ BEDROCK __ OTHER __

TRANSECTS (% BY WEIGHT)
CLAY 5.2 SILT 2.3 FINE SAND 2.4 MEDIUM SAND 39.3 COARSE SAND 25.2 GRAVEL 25.5

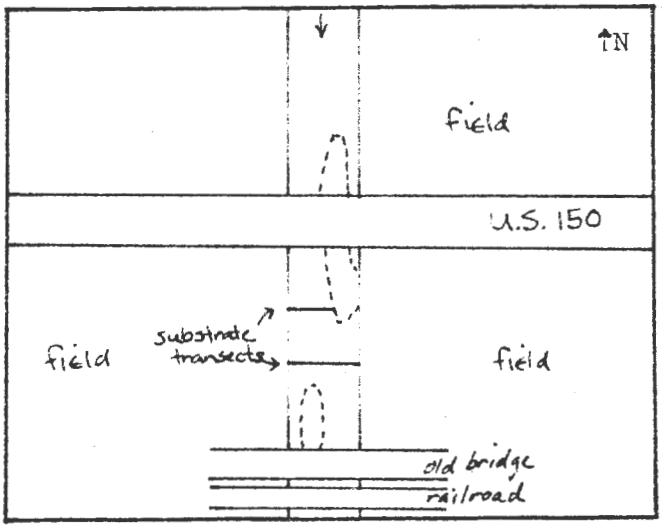
WATER QUALITY:

TEMP °C	7.0	HARDNESS mg/1	204	$NO_2^-NO_3$ mg/1	.61
DO	7.2	AMMONIA mg/1	11.9	NITRITE mg/1	.09
pH	8.091	PHOSPHATE mg/1	7.2	NITRATE mg/1	.52

PHYSICAL DATA: WIDTH max 22 m
DEPTH max .3 m
FLOW .3 m/sec
LAND USE agricultural

REMARKS: _____

MAP



SITE # 5 STATE IL COUNTY Champaign STREAM Salt Fork

LOCATION 2 mi N of Sidney T18N,R10E,NW 1/4,Sec 4 & T19N,R10E,SW 1/4,Sec 33

MUSSEL COLLECTION: DATE 24 April 1981 METHOD hand MAN-HOURS 3

___ Actinonaias carinata carinata
___ Alasmidonta marginata
___ Amblema plicata
___ Anodonta grandis grandis
___ Anodontoides ferussacianus
___ Cyclonaias tuberculata
___ Fusconaia flava
___ Lampsilis fasciola
___ L. ovata ventricosa
___ L. radiata siliquoidea
___ Lasmigona complanata
___ L. compressa
___ Lasmigona costata
___ Obovaria subrotunda
___ Pleurobema cordatum
___ Quadrula cylindrica
___ Q. pustulosa
___ Q. quadrula
___ Strophitus undulatus
___ Tritogonia verrucosa
___ Villosa iris
___ V. lienosa
___ _____
___ _____

no live mussels found

SUBSTRATE: ESTIMATION (% BY VOL.) SILT__ SAND__ GRAVEL__ COBBLE__ BEDROCK__ OTHER__

TRANSECTS (% BY WEIGHT)
CLAY 11.3 SILT 17.4 FINE SAND 4.9 MEDIUM SAND 38.4 COARSE SAND 4.8 GRAVEL 23.1

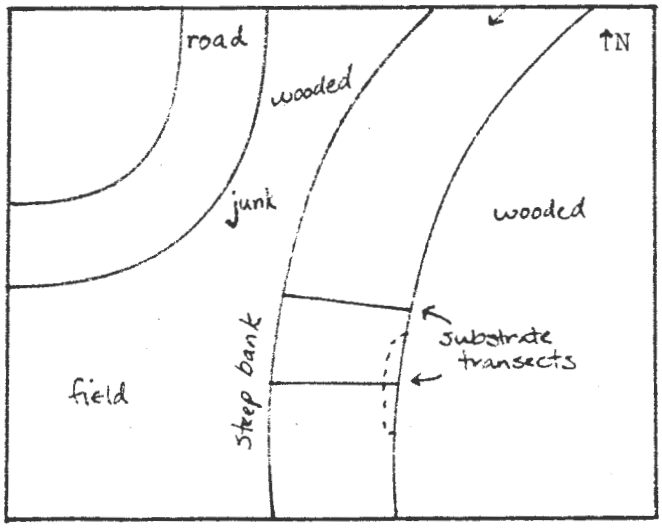
WATER QUALITY:

TEMP °C	6.5	HARDNESS mg/l	198	$NO_2^-NO_3$ mg/l	.77
DO	7.5	AMMONIA mg/l	11.0	NITRITE mg/l	.37
pH	7.951	PHOSPHATE mg/l	3.7	NITRATE mg/l	.40

PHYSICAL DATA: WIDTH max 11 m
DEPTH max .6 m
FLOW .3 m/sec
LAND USE agricultural

REMARKS: _____

MAP



SITE # 6 STATE IL COUNTY Champaign STREAM Salt Fork

LOCATION 1 mi NE of Sidney T18N,R10E,W 1/2,Sec 10

MUSSEL COLLECTION: DATE 22 Oct 1980 METHOD hand MAN-HOURS 3

___ Actinonaias carinata carinata
___ Alasmidonta marginata
___ Amblema plicata
___ Anodonta grandis grandis
___ Anodontoides ferussacianus
___ Cyclonaias tuberculata
___ Fusconaia flava
___ Lampsilis fasciola
___ L. ovata ventricosa
___ L. radiata siliquoidea
___ Lasmigona complanata
___ L. compressa
___ Lasmigona costata
___ Obovaria subrotunda
___ Pleurobema cordatum
___ Quadrula cylindrica
___ Q. pustulosa
___ Q. quadrula
___ Strophitus undulatus
___ Tritogonia verrucosa
___ Villosa iris
___ V. lienosa
___ _____
___ _____

no live mussels found (few dead ones)

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 40 SAND 60 GRAVEL __ COBBLE __ BEDROCK __ OTHER __
heavy silt at edges of stream

TRANSECTS (% BY WEIGHT)
CLAY 16.6 SILT 29.5 FINE SAND 3.9 MEDIUM SAND 45.9 COARSE SAND 2.7 GRAVEL 1.2

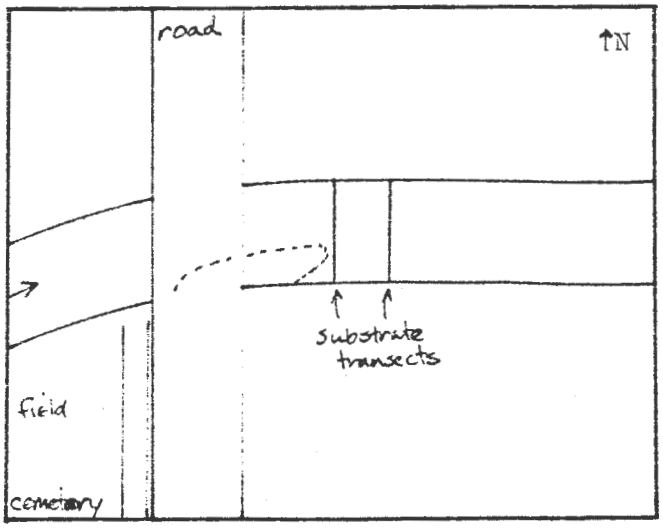
WATER QUALITY:

TEMP °C	6.5	HARDNESS mg/l	216	$NO_2^-NO_3$ mg/l	.77
DO	10.3	AMMONIA mg/l	9.8	NITRITE mg/l	.14
pH	7.883	PHOSPHATE mg/l	3.9	NITRATE mg/l	.63

PHYSICAL DATA: WIDTH max 18 m
DEPTH max .9 m
FLOW 0 m/sec
LAND USE agricultural

REMARKS: _____

MAP



SITE # 7 STATE IL COUNTY Champaign STREAM Salt Fork

LOCATION 3 mi NW of Homer T18N,R10E,NE 1/4,Sec 1 & T18N,R11E,NW 1/4,Sec 6

MUSSEL COLLECTION: DATE 22 Oct 1980 METHOD hand MAN-HOURS 3

___ Actinonaias carinata carinata
___ Alasmidonta marginata
___ Amblema plicata
___ Anodonta grandis grandis
___ Anodontoides ferussacianus
___ Cyclonaias tuberculata
___ Fusconaia flava
___ Lampsilis fasciola
___ L. ovata ventricosa
1 L. radiata siliquoidea
___ Lasmigona complanata
___ L. compressa
___ Lasmigona costata
___ Obovaria subrotunda
___ Pleurobema cordatum
___ Quadrula cylindrica
___ Q. pustulosa
___ Q. quadrula
___ Strophitus undulatus
___ Tritogonia verrucosa
___ Villosa iris
___ V. lienosa
___ _____
___ _____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 50 SAND 50 GRAVEL __ COBBLE __ BEDROCK __ OTHER __
lots of silt across streambed, 1-2' at edges
TRANSECTS (% BY WEIGHT)
CLAY 19.4 SILT 29.7 FINE SAND 8.8 MEDIUM SAND 36.0 COARSE SAND 4.1 GRAVEL 2.9

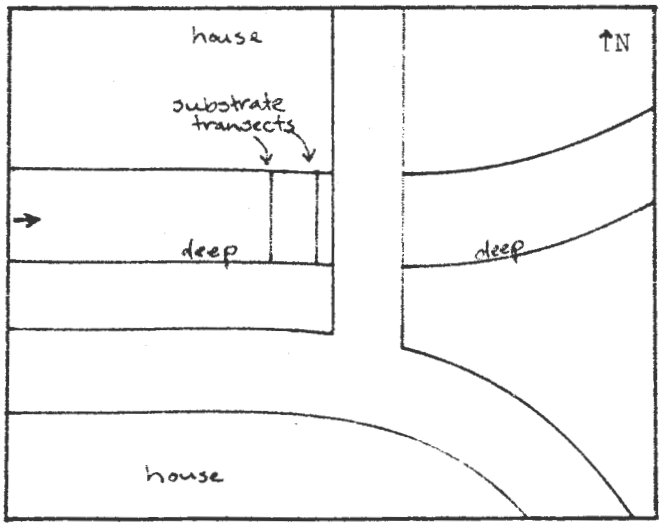
WATER QUALITY:

TEMP °C	7.5	HARDNESS mg/l	210	NO_2-NO_3 mg/l	.61
DO	11.0	AMMONIA mg/l	8.6	NITRITE mg/l	.09
pH	7.824	PHOSPHATE mg/l	2.9	NITRATE mg/l	.52

PHYSICAL DATA: WIDTH max 25 m
DEPTH max .9 m
FLOW 0 m/sec
LAND USE wooded

REMARKS: _____

MAP



SITE # 8 STATE IL COUNTY Champaign STREAM Salt Fork

LOCATION 2 mi NW of Homer T18N,R14W,NW 1/4,Sec 6

MUSSEL COLLECTION: DATE 19 Sept 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	1	Q. quadrula
___	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
___	L. ovata ventricosa	___	Villosa iris
___	L. radiata siliquoidea	___	V. lienosa
1	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 10 SAND 40 GRAVEL 50 COBBLE __ BEDROCK __ OTHER __

TRANSECTS (% BY WEIGHT)
CLAY 5.6 SILT 7.9 FINE SAND 0.6 MEDIUM SAND 22.5 COARSE SAND 8.4 GRAVEL 55.0

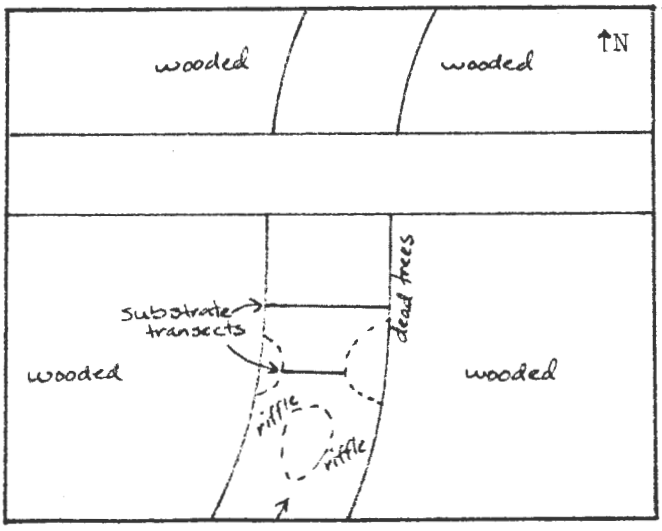
WATER QUALITY:

TEMP °C	11.0	HARDNESS mg/l	204	$NO_2^-NO_3$ mg/l	1.43
DO	6.2	AMMONIA mg/l	7.8	NITRITE mg/l	.12
pH	7.727	PHOSPHATE mg/l	2.7	NITRATE mg/l	1.31

PHYSICAL DATA:
WIDTH max 21 m
DEPTH max .6 m
FLOW .3 m/sec
LAND USE wooded

REMARKS: smelled septic

MAP



SITE # 9 STATE IL COUNTY Champaign STREAM Salt Fork

LOCATION 1-1/2 mi N of Homer at IL 49 br. T19N,R14W,SW 1/4, Sec 33

MUSSEL COLLECTION: DATE 14 Aug 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
1	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	1	Q. quadrula
___	Fusconaia flava	1	Strophitus undulatus
___	Lampsilis fasciola	2	Tritogonia verrucosa
1	L. ovata ventricosa	___	Villosa iris
9	L. radiata siliquoidea	___	V. lienosa
10	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT10 SAND50 GRAVEL40 COBBLE__ BEDROCK__ OTHER__

TRANSECTS (% BY WEIGHT)
CLAY5.1 SILT6.5 FINE SAND0.9 MEDIUM SAND10.9COARSE SAND9.0 GRAVEL68.4

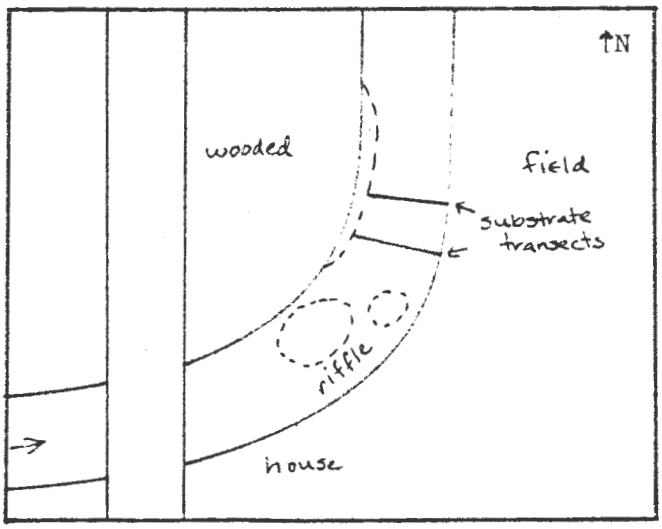
WATER QUALITY:

TEMP °C	7.0	HARDNESS mg/l	218	$NO_2^-NO_3$ mg/l	.65
DO	8.0	AMMONIA mg/l	8.1	NITRITE mg/l	.07
pH	7.750	PHOSPHATE mg/l	2.9	NITRATE mg/l	.58

PHYSICAL DATA:
WIDTH max 17 m
DEPTH max .6 m
FLOW .4 m/sec
LAND USE wooded

REMARKS: this is the site where Homer dam once was

MAP



SITE # 10 STATE IL COUNTY Vermilion STREAM Salt Fork

LOCATION 2-1/2 mi NE OF Homer at WICD tower T19N,R14W,SW 1/4, Sec 26

MUSSEL COLLECTION: DATE 14 Aug 1980 METHOD hand MAN-HOURS 3

3	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
1	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	1	Q. pustulosa
___	Cyclonaias tuberculata	2	Q. quadrula
1	Fusconaia flava	___	Strophitus undulatus
1	Lampsilis fasciola	1	Tritogonia verrucosa
4	L. ovata ventricosa	___	Villosa iris
6	L. radiata siliquoidea	___	V. lienosa
42	Lasmigona complanata	___	___
___	L. compressa	___	___

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 10 SAND 50 GRAVEL 40 COBBLE __ BEDROCK __ OTHER __

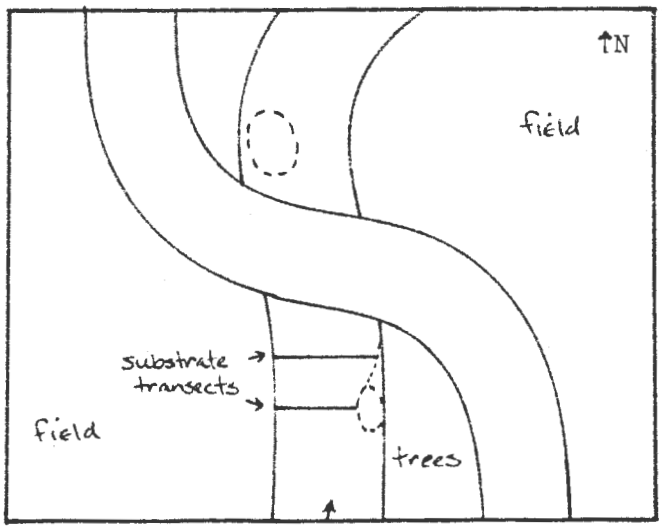
TRANSECTS (% BY WEIGHT)
CLAY 6.5 SILT 4.0 FINE SAND 1.2 MEDIUM SAND 23.3 COARSE SAND 5.9 GRAVEL 58.6

WATER QUALITY:	TEMP °C 7.0	HARDNESS mg/1 216	$NO_2^-NO_3$ mg/1 .98
	DO 11.9	AMMONIA mg/1 6.8	NITRITE mg/1 .06
	pH 7.556	PHOSPHATE mg/1 2.9	NITRATE mg/1 .92

PHYSICAL DATA: WIDTH max 29 m
DEPTH max .8 m
FLOW .3 m/sec
LAND USE agricultural

REMARKS: lots of dead shells, clams (live) scattered throughout sample area

MAP



SITE # 11 STATE IL COUNTY Vermilion STREAM Salt Fork

LOCATION 2 mi S of Muncie T19N,R13W,SW 1/4, Sec 21

MUSSEL COLLECTION: DATE 19 Sept 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
___	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
___	L. ovata ventricosa	___	Villosa iris
___	L. radiata siliquoidea	___	V. lienosa
2	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 20 SAND 30 GRAVEL 30 COBBLE 20 BEDROCK __ OTHER __

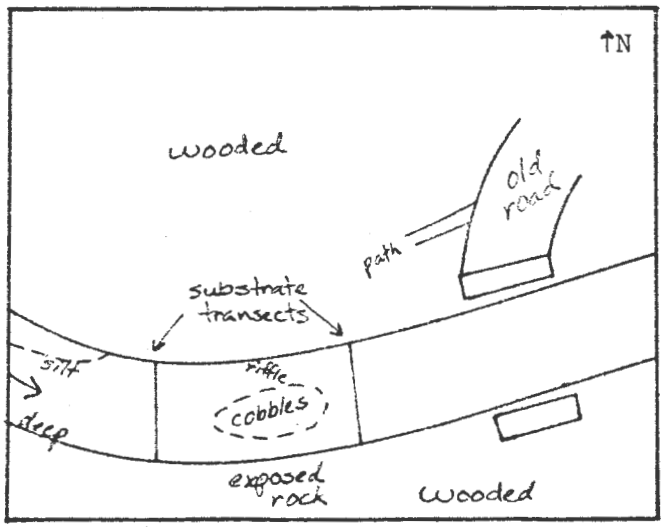
TRANSECTS (% BY WEIGHT)
CLAY 8.7 SILT 10.4 FINE SAND 2.8 MEDIUM SAND 9.0 COARSE SAND 8.4 GRAVEL 60.7

WATER QUALITY:	TEMP °C 7.0	HARDNESS mg/1	245	NO_2-NO_3 mg/1	2.97
	DO 9.2	AMMONIA mg/1	4.3	NITRITE mg/1	.10
	pH 7.832	PHOSPHATE mg/1	4.6	NITRATE mg/1	2.87

PHYSICAL DATA: WIDTH max 28 m
DEPTH max >1.5 m
FLOW .4 m/sec
LAND USE wooded

REMARKS: _____

MAP



SITE # 12 STATE IL COUNTY Vermilion STREAM Salt Fork

LOCATION 3 mi SW of Oakwood T19N,R13W,NW 1/4, Sec 26

MUSSEL COLLECTION: DATE _____ METHOD _____ MAN-HOURS _____

___ Actinonaias carinata carinata
___ Alasmidonta marginata
___ Amblema plicata
___ Anodonta grandis grandis
___ Anodontoides ferussacianus
___ Cyclonaias tuberculata
___ Fusconaia flava
___ Lampsilis fasciola
___ L. ovata ventricosa
___ L. radiata siliquoidea
___ Lasmigona complanata
___ L. compressa
___ Lasmigona costata
___ Obovaria subrotunda
___ Pleurobema cordatum
___ Quadrula cylindrica
___ Q. pustulosa
___ Q. quadrula
___ Strophitus undulatus
___ Tritogonia verrucosa
___ Villosa iris
___ V. lienosa
___ _____
___ _____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT__ SAND__ GRAVEL__ COBBLE__ BEDROCK__ OTHER__

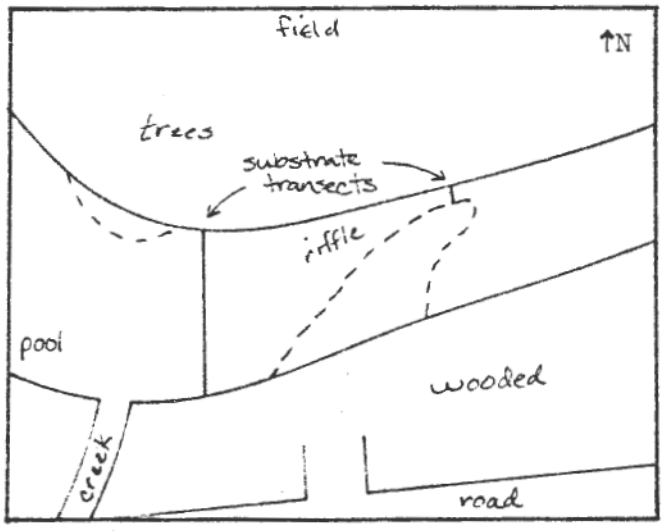
TRANSECTS (% BY WEIGHT)
CLAY 4.8 SILT 4.8 FINE SAND 1.5 MEDIUM SAND 6.3 COARSE SAND 5.7 GRAVEL 76.7

WATER QUALITY:
TEMP °C 7.0
DO 10.0
pH 7.765
HARDNESS mg/l 245
AMMONIA mg/l 2.6
PHOSPHATE mg/l 4.4
NO_2-NO_3 mg/l 3.66
NITRITE mg/l .19
NITRATE mg/l 3.47

PHYSICAL DATA:
WIDTH max 22 m
DEPTH max -- m
FLOW .3 m/sec
LAND USE wooded

REMARKS: _____

MAP



SITE # 13 STATE IL COUNTY Vermilion STREAM Salt Fork

LOCATION 2-1/2 mi N of Catlin at jct. with Middle Fork T19N,R12W,SE 1/4,Sec 16

MUSSEL COLLECTION: DATE 24 July 1980 METHOD hand MAN-HOURS 3

5	Actinonaias carinata carinata	___	Lasmigona costata
3	Alasmidonta marginata	1	Obovaria subrotunda
5	Amblema plicata	___	Pleurobema cordatum
1	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	4	Q. pustulosa
___	Cyclonaias tuberculata	7	Q. quadrula
9	Fusconaia flava	1	Strophitus undulatus
4	Lampsilis fasciola	7	Tritogonia verrucosa
7	L. ovata ventricosa	___	Villosa iris
11	L. radiata siliquoidea	___	V. lienosa
15	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 20 SAND 40 GRAVEL 40 COBBLE __ BEDROCK __ OTHER __

TRANSECTS (% BY WEIGHT)
CLAY 8.8 SILT 12.5 FINE SAND 1.3 MEDIUM SAND 33.7 COARSE SAND 27.0 GRAVEL 16.4

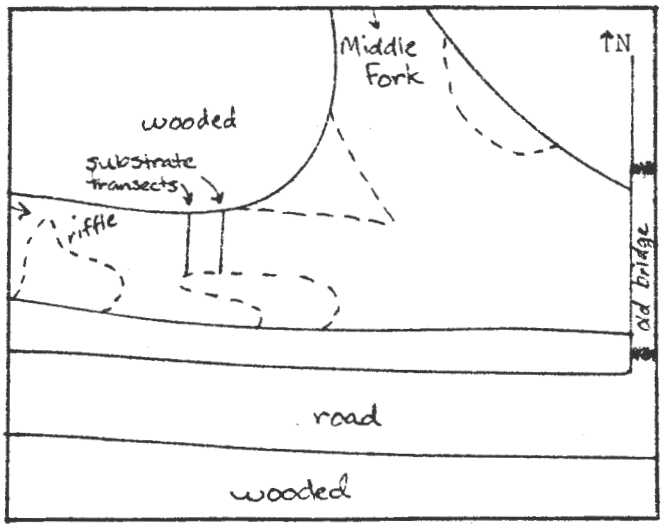
WATER QUALITY:

TEMP °C	8.0	HARDNESS mg/l	254	NO_2-NO_3 mg/l	4.10
DO	13.1	AMMONIA mg/l	1.00	NITRITE mg/l	.22
pH	8.111	PHOSPHATE mg/l	3.0	NITRATE mg/l	3.88

PHYSICAL DATA: WIDTH max 16 m (actual water width, streambed is 30 m)
DEPTH max .5 m
FLOW .2 m/sec
LAND USE wooded, recreational

REMARKS: pile of cleaned shells found

MAP



SITE # 14 STATE IL COUNTY Ford STREAM Middle Fork

LOCATION 4-1/2 mi WSW of Paxton T23N,R9E,SE 1/4,Sec 15.

MUSSEL COLLECTION: DATE 10 Oct 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
1	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
___	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
2	L. ovata ventricosa	___	Villosa iris
2	L. radiata siliquoidea	___	V. lienosa
19	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 15 SAND 70 GRAVEL 10 COBBLE 5 BEDROCK ___ OTHER ___

TRANSECTS (% BY WEIGHT)
CLAY 11.4 SILT 10.4 FINE SAND 2.0 MEDIUM SAND 25.9 COARSE SAND 24.1 GRAVEL 26.1

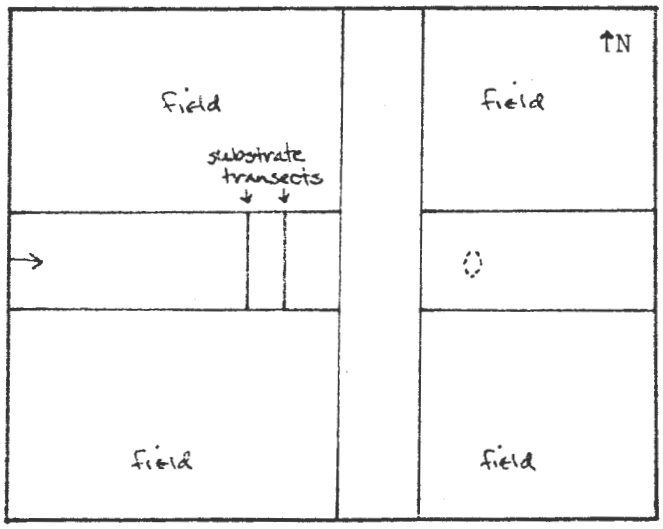
WATER QUALITY:

TEMP °C	10.8	HARDNESS mg/l	335	$NO_2^-NO_3$ mg/l	.08
DO	11.8	AMMONIA mg/l	.20	NITRITE mg/l	.01
pH	8.453	PHOSPHATE mg/l	.01	NITRATE mg/l	.07

PHYSICAL DATA:
WIDTH max 13 m
DEPTH max .5 m
FLOW 0 m/sec
LAND USE agricultural

REMARKS: ditch, lots of glass

MAP



SITE # 15 STATE IL COUNTY Ford STREAM Middle Fork

LOCATION 4-1/2 mi SE of Paxton T23N,R10E,SW 1/4,Sec 34

MUSSEL COLLECTION: DATE 10 Oct 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
___	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
1	L. ovata ventricosa	___	Villosa iris
___	L. radiata siliquoidea	___	V. lienosa
___	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 15 SAND 80 GRAVEL 5 COBBLE __ BEDROCK __ OTHER __

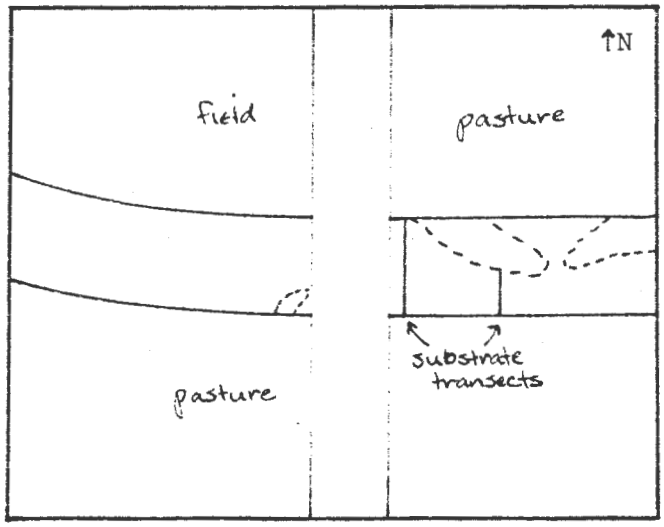
TRANSECTS (% BY WEIGHT)
CLAY 9.7 SILT 9.6 FINE SAND 2.8 MEDIUM SAND 35.3 COARSE SAND 27.9 GRAVEL 14.1

WATER QUALITY:	TEMP °C	11.2	HARDNESS mg/l	341	$NO_2^-NO_3$ mg/l	.33
	DO	12.2	AMMONIA mg/l	1.68	NITRITE mg/l	.07
	pH	8.647	PHOSPHATE mg/l	2.2	NITRATE mg/l	.26

PHYSICAL DATA: WIDTH max 15 m
DEPTH max .3 m
FLOW .1 m/sec
LAND USE agricultural

REMARKS: lots of muskrat holes in bank, cow pasture upstream of bridge

MAP



SITE # 16 STATE IL COUNTY Champaign STREAM Middle Fork

LOCATION 9 mi SE of Paxton T22N,R14W,SW 1/4,Sec 5

MUSSEL COLLECTION: DATE 26 Sept 1980 METHOD hand MAN-HOURS 3

1	Actinonaias carinata carinata	___	Lasmigona costata
1	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
5	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	1	Q. quadrula
2	Fusconaia flava	5	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
9	L. ovata ventricosa	___	Villosa iris
6	L. radiata siliquoidea	___	V. lienosa
16	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 30 SAND 50 GRAVEL 20 COBBLE__ BEDROCK__ OTHER__

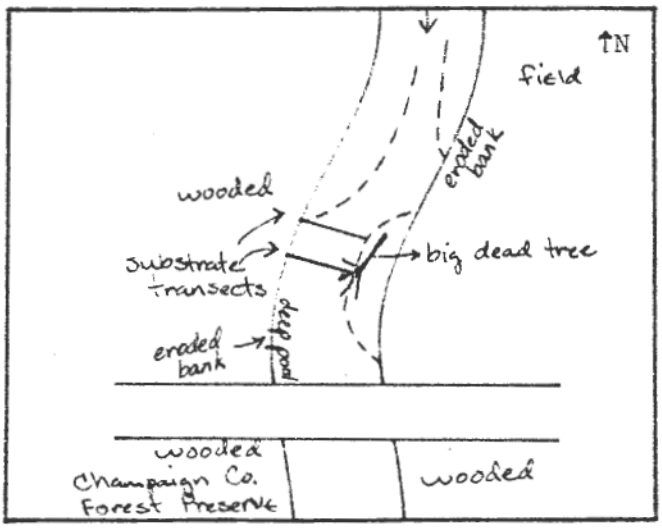
TRANSECTS (% BY WEIGHT)
CLAY 9.8 SILT 11.2 FINE SAND 2.3 MEDIUM SAND 35.0 COARSE SAND 18.8 GRAVEL 22.8

WATER QUALITY:	TEMP °C 10.8	HARDNESS mg/l 332	$NO_2^-NO_3$ mg/l .08
	DO 9.9	AMMONIA mg/l .21	NITRITE mg/l .01
	pH 7.866	PHOSPHATE mg/l .62	NITRATE mg/l .07

PHYSICAL DATA: WIDTH max 12 m
DEPTH max .6 m
FLOW 0 m/sec
LAND USE agricultural

REMARKS: banks badly eroded at outer sides of meanders

MAP



SITE # 17 STATE IL COUNTY Vermilion STREAM Middle Fork

LOCATION 5 miW of Potomac T21N,R14W,SE 1/4,Sec 2

MUSSEL COLLECTION: DATE 26 Sept 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	1	Pleurobema cordatum
11	Anodonta grandis grandis	___	Quadrula cylindrica
2	Anodontoides ferussacianus	2	Q. pustulosa
___	Cyclonaias tuberculata	3	Q. quadrula
1	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	5	Tritogonia verrucosa
8	L. ovata ventricosa	___	Villosa iris
3	L. radiata siliquoidea	___	V. lienosa
27	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 10 SAND 60 GRAVEL 30 COBBLE ___ BEDROCK ___ OTHER ___

TRANSECTS (% BY WEIGHT)
CLAY 10.7 SILT 10.4 FINE SAND 0.7 MEDIUM SAND 18.1 COARSE SAND 23.4 GRAVEL 36.7

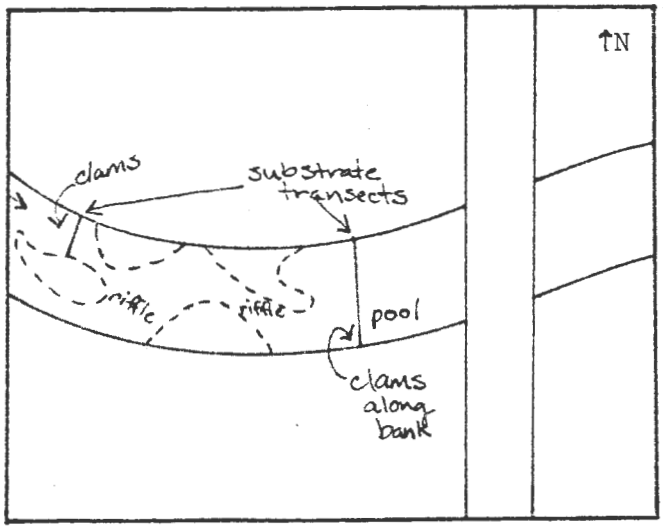
WATER QUALITY:

TEMP °C	9.0	HARDNESS mg/1	325	$NO_2^-NO_3$ mg/1	.16
DO	11.4	AMMONIA mg/1	.18	NITRITE mg/1	.01
pH	7.960	PHOSPHATE mg/1	.01	NITRATE mg/1	.15

PHYSICAL DATA:
WIDTH max 18 m
DEPTH max .6 m
FLOW .1 m/sec
LAND USE wooded

REMARKS: layer of silt on most areas of streambed

MAP



SITE # 18 STATE IL COUNTY Vermilion STREAM Middle Fork

LOCATION 1-1/2 mi S of Potomac T21N,R13W,NE 1/4, Sec 15

MUSSEL COLLECTION: DATE 26 Sept 1980 METHOD hand MAN-HOURS 3

1	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
1	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
4	L. ovata ventricosa	___	Villosa iris
1	L. radiata siliquoidea	___	V. lienosa
2	Lasmigona complanata	___	___
___	L. compressa	___	___

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 5 SAND 45 GRAVEL 50 COBBLE ___ BEDROCK ___ OTHER ___

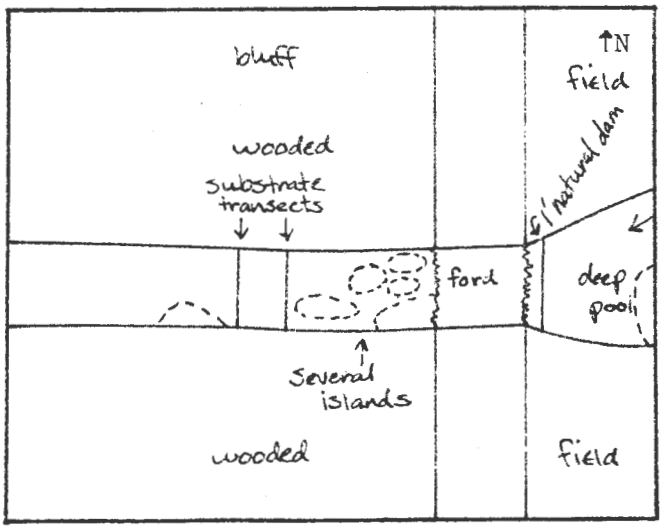
TRANSECTS (% BY WEIGHT)
CLAY 3.9 SILT 6.8 FINE SAND 1.2 MEDIUM SAND 14.3 COARSE SAND 20.8 GRAVEL 52.9

WATER QUALITY:					
TEMP °C	9.2	HARDNESS mg/l	313	$NO_2^-NO_3$ mg/l	.08
DO	11.4	AMMONIA mg/l	.23	NITRITE mg/l	.01
pH	7.987	PHOSPHATE mg/l	.01	NITRATE mg/l	.07

PHYSICAL DATA: WIDTH max 19 m
DEPTH max .5 m
FLOW .1 m/sec
LAND USE agricultural

REMARKS: water turbid, nice place but few clams

MAP



SITE # 19 STATE IL COUNTY Vermilion STREAM Middle Fork

LOCATION 7-1/2 mi S of Potomac T21N,R12W,NE 1/4,SW 1/4,Sec 8
(in Middle Fork State Fish and Wildlife Area)

MUSSEL COLLECTION: DATE 13 Nov 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
1	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
2	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
7	L. ovata ventricosa	___	Villosa iris
3	L. radiata siliquoidea	___	V. lienosa
3	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 10 SAND 60 GRAVEL 30 COBBLE __ BEDROCK __ OTHER __

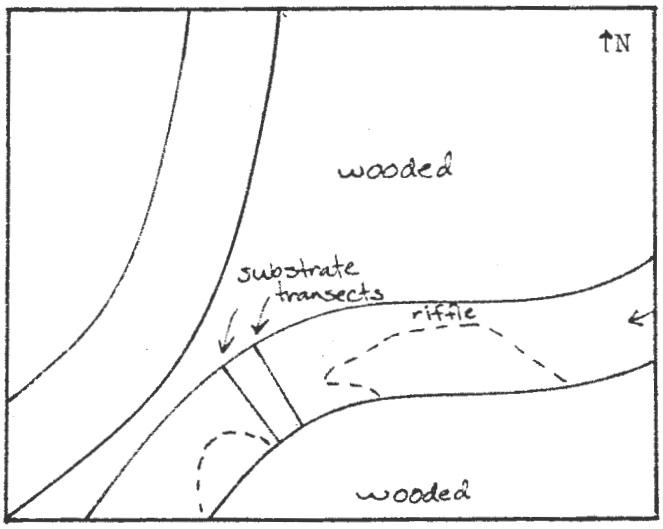
TRANSECTS (% BY WEIGHT)
CLAY 9.1 SILT 10.4 FINE SAND 1.0 MEDIUM SAND 21.7 COARSE SAND 12.8 GRAVEL 44.9

WATER QUALITY:	TEMP °C 11.0	HARDNESS mg/1 283		$NO_2^-NO_3$ mg/1 .08	
	DO 14.0	AMMONIA mg/1 .09		NITRITE mg/1 .01	
	pH 8.170	PHOSPHATE mg/1 .01		NITRATE mg/1 .07	

PHYSICAL DATA: WIDTH max 19 m
DEPTH max .8 m
FLOW .1 m/sec
LAND USE recreational

REMARKS: silt over most of streambed

MAP



SITE # 20 STATE IL COUNTY Vermilion STREAM Middle Fork

LOCATION 2-1/2 mi N of Catlin at jct. with Salt Fork T19N,R12W,SE 1/4,Sec 16

MUSSEL COLLECTION: DATE 24 July 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	1	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
___	Fusconaia flava	1	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
12	L. ovata ventricosa	___	Villosa iris
12	L. radiata siliquoidea	___	V. lienosa
1	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 10 SAND 50 GRAVEL 40 COBBLE __ BEDROCK __ OTHER __

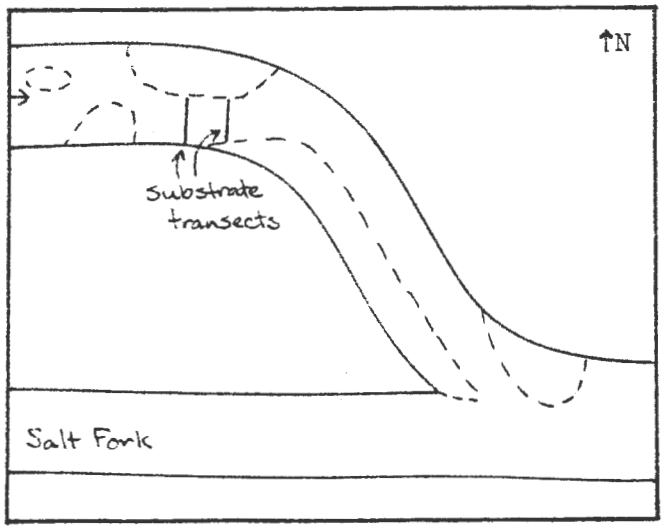
TRANSECTS (% BY WEIGHT)
CLAY 5.6 SILT 2.3 FINE SAND 4.8 MEDIUM SAND 13.4 COARSE SAND 17.0 GRAVEL 57.3

WATER QUALITY:	TEMP °C 7.0	HARDNESS mg/1 412		$NO_2^-NO_3$ mg/1 .08	
	DO 11.0	AMMONIA mg/1 .06		NITRITE mg/1 .01	
	pH 8.208	PHOSPHATE mg/1 .01		NITRATE mg/1 .07	

PHYSICAL DATA: WIDTH max 8 m (streambed max width 21 m)
DEPTH max .6 m
FLOW .1 m/sec
LAND USE wooded, recreational

REMARKS: _____

MAP



SITE # 21 STATE IL COUNTY Vermilion STREAM North Fork

LOCATION 1-1/2 mi E of Hoopeston at IL 9 br. T23N,R11W,NE 1/4,Sec 18

MUSSEL COLLECTION: DATE 7 Aug 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	1	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
4	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
1	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
___	L. ovata ventricosa	___	Villosa iris
8	L. radiata siliquoidea	1	V. lienosa
1	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 30 SAND 40 GRAVEL 30 COBBLE __ BEDROCK __ OTHER __

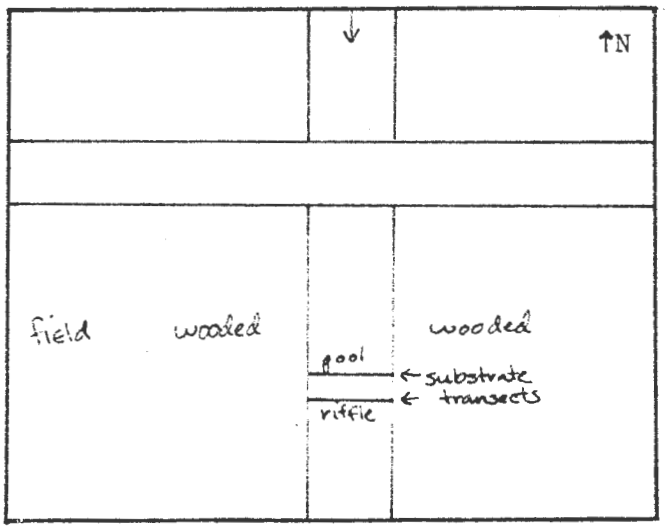
TRANSECTS (% BY WEIGHT)
CLAY 7.4 SILT 6.1 FINE SAND 2.4 MEDIUM SAND 10.1 COARSE SAND 15.6 GRAVEL 58.0

WATER QUALITY:	TEMP °C	10.5	HARDNESS mg/1	343	$NO_2^-NO_3$ mg/1	.08
	DO	5.1	AMMONIA mg/1	.12	NITRITE mg/1	.01
	pH	7.668	PHOSPHATE mg/1	.07	NITRATE mg/1	.07

PHYSICAL DATA: WIDTH max 9 m
DEPTH max .3 m
FLOW 0 m/sec
LAND USE agricultural

REMARKS: most clams at edge of stream on top of silt

MAP



SITE # 22 STATE IL COUNTY Vermilion STREAM North Fork

LOCATION 2-1/2 mi N of Rossville T23N,R12W,NW 1/4, Sec 35

MUSSEL COLLECTION: DATE 7 Aug 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
___	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
___	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
___	L. ovata ventricosa	___	Villosa iris
2	L. radiata siliquoidea	___	V. lienosa
___	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 10 SAND 80 GRAVEL 10 COBBLE__ BEDROCK__ OTHER__

TRANSECTS (% BY WEIGHT)
CLAY 9.8 SILT 10.9 FINE SAND 2.6 MEDIUM SAND 21.8 COARSE SAND 25.4 GRAVEL 29.4

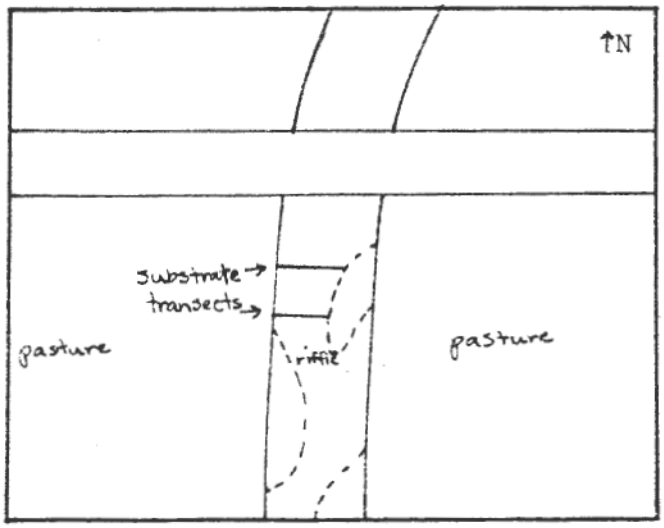
WATER QUALITY:

TEMP °C	12.9	HARDNESS mg/l	347	NO_2-NO_3 mg/l	6.91
DO	10.6	AMMONIA mg/l	.24	NITRITE mg/l	.20
pH	8.613	PHOSPHATE mg/l	2.1	NITRATE mg/l	6.71

PHYSICAL DATA:
WIDTH max 11 m
DEPTH max .2 m
FLOW 0 m/sec
LAND USE agricultural

REMARKS: silt layer over sand, clear enough to look for clams, not many dead shells

MAP



SITE # 23 STATE IL COUNTY Vermilion STREAM North Fork

LOCATION 2 mi SW of Rossville T22N,R12W,NE 1/4,Sec 23

MUSSEL COLLECTION: DATE 7 Aug 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
1	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
1	Anodonta grandis grandis	___	Quadrula cylindrica
3	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
___	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
___	L. ovata ventricosa	___	Villosa iris
3	L. radiata siliquoidea	___	V. lienosa
4	Lasmigona complanata	___	_____
1	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 15 SAND 50 GRAVEL 25 COBBLE 10 BEDROCK __ OTHER __

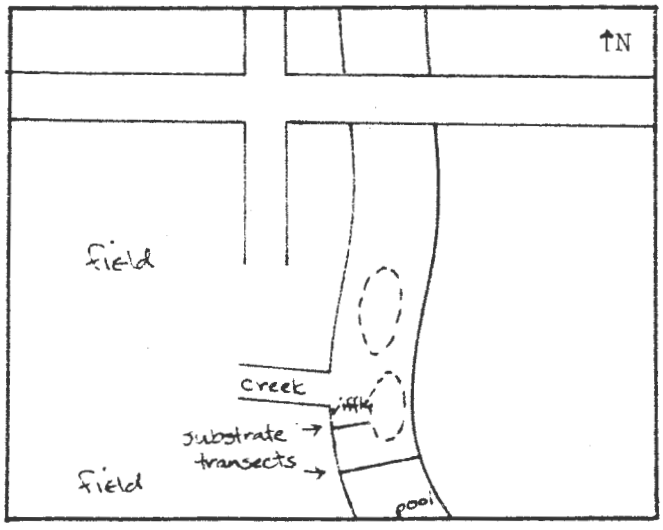
TRANSECTS (% BY WEIGHT)
CLAY 7.3 SILT 7.8 FINE SAND 1.2 MEDIUM SAND 18.8 COARSE SAND 18.5 GRAVEL 46.4

WATER QUALITY:	TEMP °C 12.5	HARDNESS mg/l 333	$NO_2^-NO_3$ mg/l 1.87
	DO 12.4	AMMONIA mg/l .12	NITRITE mg/l .05
	pH 8.283	PHOSPHATE mg/l .24	NITRATE mg/l 1.82

PHYSICAL DATA: WIDTH max 8 m
DEPTH max .9 m
FLOW .2 m/sec
LAND USE agricultural

REMARKS: silt over most of substrate

MAP



SITE # 24 STATE IL COUNTY Vermilion STREAM North Fork

LOCATION 3/4 mi E of Alvin T21N,R11W,SW 1/4,Sec 5

MUSSEL COLLECTION: DATE 7 Aug 1980 METHOD hand MAN-HOURS 3

1	Actinonaias carinata carinata	10	Lasmigona costata
7	Alasmidonta marginata		Obovaria subrotunda
1	Amblema plicata	5	Pleurobema cordatum
2	Anodonta grandis grandis	8	Quadrula cylindrica
	Anodontoides ferussacianus		Q. pustulosa
15	Cyclonaias tuberculata		Q. quadrula
4	Fusconaia flava	1	Strophitus undulatus
	Lampsilis fasciola		Tritogonia verrucosa
28	L. ovata ventricosa	2	Villosa iris
19	L. radiata siliquoidea		V. lienosa
13	Lasmigona complanata		
	L. compressa		

SUBSTRATE: ESTIMATION (% BY VOL.) SILT__ SAND__ GRAVEL__ COBBLE__ BEDROCK__ OTHER__

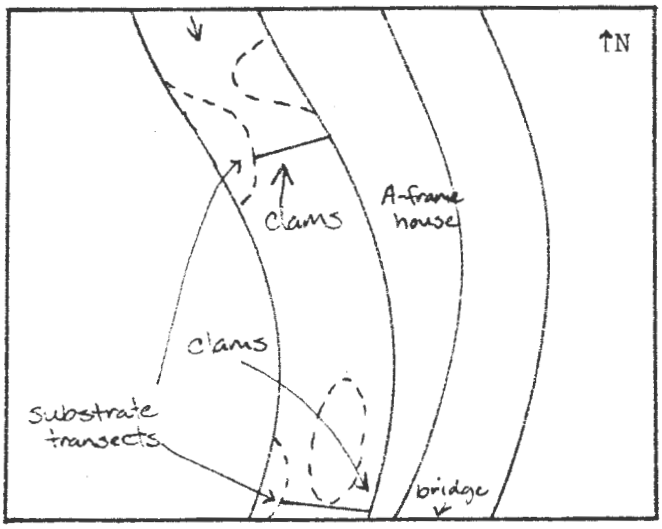
TRANSECTS (% BY WEIGHT)
CLAY 5.5 SILT 4.3 FINE SAND 1.2 MEDIUM SAND 15.6 COARSE SAND 11.3 GRAVEL 61.0

WATER QUALITY:	TEMP °C 12.0	HARDNESS mg/l 356		NO_2-NO_3 mg/l .57	
	DO 12.6	AMMONIA mg/l .18		NITRITE mg/l .01	
	pH 8.414	PHOSPHATE mg/l .03		NITRATE mg/l .56	

PHYSICAL DATA: WIDTH max 15 m
DEPTH max .3 m
FLOW .2 m/sec
LAND USE agricultural

REMARKS:

MAP



SITE # 25 STATE IL COUNTY Vermilion STREAM North Fork

LOCATION 3-1/2 mi SW of Alvin T21N,R12W,NE 1/4,Sec 24

MUSSEL COLLECTION: DATE 24 July 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	6	Lasmigona costata
6	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	2	Pleurobema cordatum
1	Anodonta grandis grandis	3	Quadrula cylindrica
4	Anodontoides ferussacianus	___	Q. pustulosa
18	Cyclonaias tuberculata	___	Q. quadrula
5	Fusconaia flava	___	Strophitus undulatus
2	Lampsilis fasciola	___	Tritogonia verrucosa
17	L. ovata ventricosa	1	Villosa iris
15	L. radiata siliquoidea	___	V. lienosa
4	Lasmigona complanata	___	___
___	L. compressa	___	___

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 10 SAND 50 GRAVEL 40 COBBLE ___ BEDROCK ___ OTHER ___

TRANSECTS (% BY WEIGHT)
CLAY 5.8 SILT 3.2 FINE SAND 1.0 MEDIUM SAND 25.8 COARSE SAND 17.2 GRAVEL 46.9

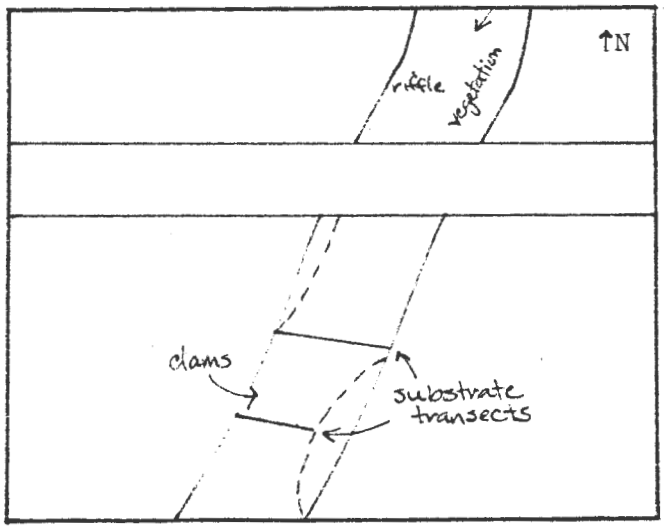
WATER QUALITY:

TEMP °C	11.2	HARDNESS mg/l	299	NO_2-NO_3 mg/l	.29
DO	11.0	AMMONIA mg/l	.24	NITRITE mg/l	.01
pH	8.185	PHOSPHATE mg/l	.03	NITRATE mg/l	.28

PHYSICAL DATA:
WIDTH max 20 m
DEPTH max .6 m
FLOW .1 m/sec
LAND USE agricultural

REMARKS: good bed below bridge

MAP



SITE # 26 STATE IL COUNTY Vermilion STREAM North Fork

LOCATION 6-1/2 mi N of Danville at IL 1 br. T20N,R11W,NW 1/4,Sec 8

MUSSEL COLLECTION: DATE 30 Sept 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	1	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	2	Pleurobema cordatum
1	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
2	Cyclonaias tuberculata	___	Q. quadrula
11	Fusconaia flava	___	Strophitus undulatus
1	Lampsilis fasciola	___	Tritogonia verrucosa
8	L. ovata ventricosa	___	Villosa iris
12	L. radiata siliquoidea	___	V. lienosa
3	Lasmigona complanata	___	___
___	L. compressa	___	___

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 10 SAND 50 GRAVEL 40 COBBLE __ BEDROCK __ OTHER __

TRANSECTS (% BY WEIGHT)
CLAY 5.2 SILT 5.1 FINE SAND 1.1 MEDIUM SAND 25.4 COARSE SAND 25.8 GRAVEL 39.3

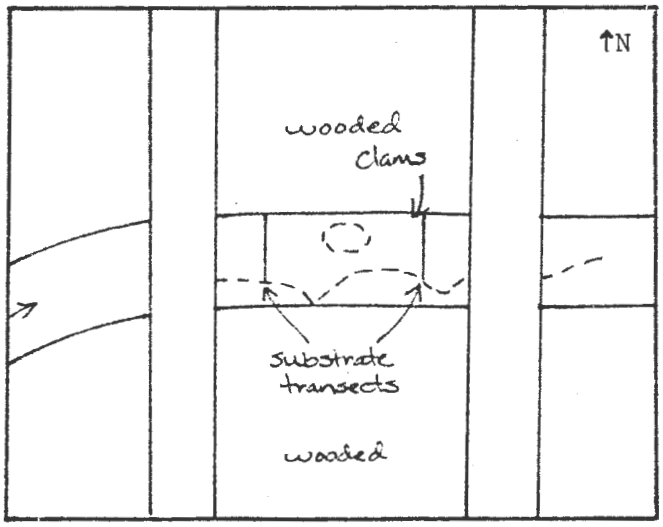
WATER QUALITY:

TEMP °C	11.5	HARDNESS mg/l	295	NO_2-NO_3 mg/l	.29
DO	11.0	AMMONIA mg/l	.12	NITRITE mg/l	.01
pH	8.237	PHOSPHATE mg/l	.02	NITRATE mg/l	.28

PHYSICAL DATA: WIDTH max 19 m
DEPTH max .8 m
FLOW .1 m/sec
LAND USE agricultural

REMARKS: most clams in roots of trees in silt-sand mixture

MAP



SITE # 27 STATE IL COUNTY Vermilion STREAM North Fork

LOCATION In w Danville at Harrrison Park T20N,R12W,SE 1/4,Sec 36 & T20N,R11W,SW 1/4, Sec 31

MUSSEL COLLECTION: DATE 30 Sept 1980 METHOD hand MAN-HOURS 3

1	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
3	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	3	Q. quadrula
___	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
___	L. ovata ventricosa	___	Villosa iris
1	L. radiata siliquoidea	___	V. lienosa
1	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT10 SAND25 GRAVEL25 COBBLE20 BEDROCK20 OTHER__

TRANSECTS (% BY WEIGHT)
CLAY8.2 SILT12.0FINE SAND2.1 MEDIUM SAND8.6 COARSE SAND0.8 GRAVEL65.2

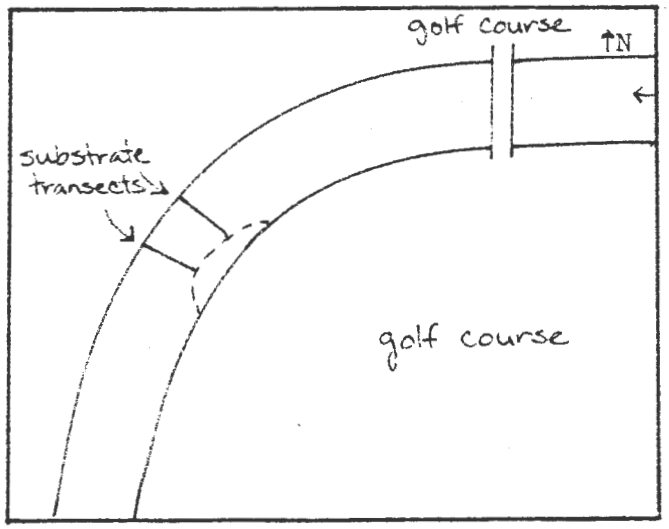
WATER QUALITY:

TEMP °C	10.2	HARDNESS mg/l	241	$NO_2^-NO_3$ mg/l	.08
DO	12.0	AMMONIA mg/l	.12	NITRITE mg/l	.01
pH	8.665	PHOSPHATE mg/l	.01	NITRATE mg/l	.07

PHYSICAL DATA: WIDTH max 19 m (streambed maximum width is 23 m)
DEPTH max .6 m
FLOW .1 m/sec
LAND USE recreational

REMARKS: water turbid, lots of dead Corbicula, bottom composed of much rock and cobble which made it hard to sample by hand, live Corbicula also

MAP



SITE # 28 STATE IL COUNTY Vermilion STREAM Vermilion River

LOCATION 3 miE of Tilton T19N,R11W,NW 1/4, Sec 27

MUSSEL COLLECTION: DATE 30 Sept 1980 METHOD hand MAN-HOURS 3

___	Actinonaias carinata carinata	___	Lasmigona costata
___	Alasmidonta marginata	___	Obovaria subrotunda
___	Amblema plicata	___	Pleurobema cordatum
1	Anodonta grandis grandis	___	Quadrula cylindrica
___	Anodontoides ferussacianus	___	Q. pustulosa
___	Cyclonaias tuberculata	___	Q. quadrula
___	Fusconaia flava	___	Strophitus undulatus
___	Lampsilis fasciola	___	Tritogonia verrucosa
___	L. ovata ventricosa	___	Villosa iris
___	L. radiata siliquoidea	___	V. lienosa
___	Lasmigona complanata	___	_____
___	L. compressa	___	_____

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 20 SAND 60 GRAVEL 20 COBBLE__ BEDROCK__ OTHER__

TRANSECTS (% BY WEIGHT)
CLAY 10.0 SILT 9.5 FINE SAND 7.3 MEDIUM SAND 35.8 COARSE SAND 5.8 GRAVEL 31.6

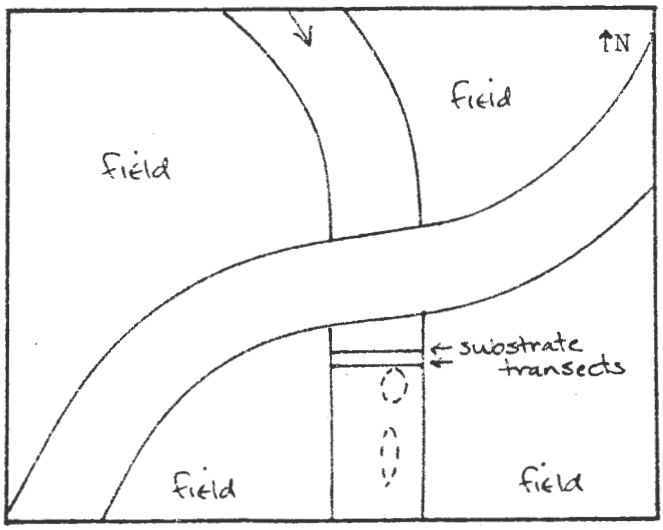
WATER QUALITY:

TEMP °C	10.5	HARDNESS mg/1	241	$NO_2^-NO_3$ mg/1	3.61
DO	11.4	AMMONIA mg/1	1.94	NITRITE mg/1	.33
pH	8.009	PHOSPHATE mg/1	2.0	NITRATE mg/1	3.28

PHYSICAL DATA: WIDTH max 36 m
DEPTH max .6 m
FLOW 0 m/sec
LAND USE agricultural

REMARKS: silt layer over all of streambed, some dead shells

MAP



SITE # 29 STATE IL COUNTY Vermilion STREAM Vermilion River

LOCATION 4-1/2 mi E of Westville T18N,R11W,SW 1/4, Sec 12

MUSSEL COLLECTION: DATE 30 Sept 1980 METHOD hand MAN-HOURS 3

___ Actinonaias carinata carinata
___ Alasmidonta marginata
___ Amblema plicata
___ Anodonta grandis grandis
___ Anodontoides ferussacianus
___ Cyclonaias tuberculata
___ Fusconaia flava
___ Lampsilis fasciola
___ L. ovata ventricosa
___ L. radiata siliquoidea
___ Lasmigona complanata
___ L. compressa
___ Lasmigona costata
___ Obovaria subrotunda
___ Pleurobema cordatum
___ Quadrula cylindrica
___ Q. pustulosa
___ Q. quadrula
___ Strophitus undulatus
___ Tritogonia verrucosa
___ Villosa iris
___ V. lienosa
___ _____
___ _____

no live clams

SUBSTRATE: ESTIMATION (% BY VOL.) SILT 10 SAND 60 GRAVEL 30 COBBLE__ BEDROCK__ OTHER__

TRANSECTS (% BY WEIGHT)
CLAY 6.9 SILT 11.6 FINE SAND 2.0 MEDIUM SAND 25.5 COARSE SAND 19.5 GRAVEL 35.0

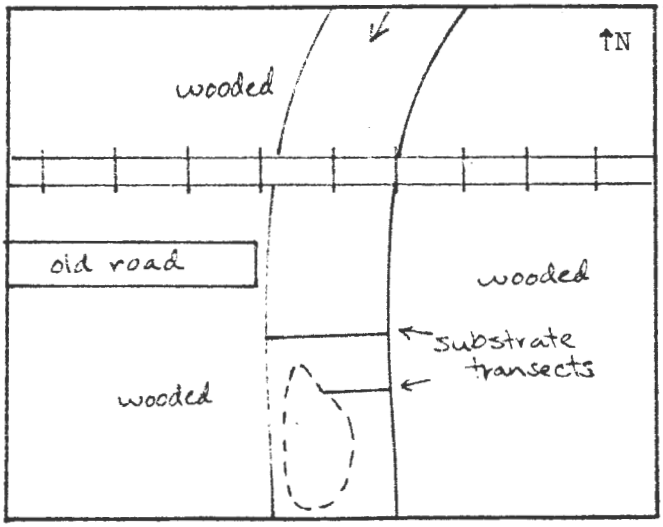
WATER QUALITY:

TEMP °C	9.5	HARDNESS mg/l	356	$NO_2^-NO_3$ mg/l	5.08
DO	12.8	AMMONIA mg/l	1.36	NITRITE mg/l	.36
pH	7.844	PHOSPHATE mg/l	1.8	NITRATE mg/l	4.72

PHYSICAL DATA: WIDTH max 45 m
DEPTH max .5 m
FLOW 0 m/sec
LAND USE agriculatural

REMARKS: live Corbicula

MAP



Appendix II. Site localities for 1980 mussel collections on the Vermilion River System.

1. IL: Champaign Co., Salt Fork. T20N, R9E, SE1/4, Sec. 31 +/or SW1/4 , Sec. 32. In N. Urbana at Lincoln Ave. br.

2. IL, Champaign Co., Salt Fork. T19N, R9E, S1/2 , Sec. 5. In N Urbana at Country Club.

3. IL: Champaign Co., Salt Fork. T19N, R10E, SW1/4 , Sec. 5. 3-1/2 mi NE of St. Joseph.

4. IL: Champaign Co., Salt Fork. T19N, R10E, NE1/4, Sec. 15 & SE 1/2, Sec. 10. W edge of St. Joseph at US 150 br.

5. IL: Champaign Co., Salt Fork. T18N, R10E, NW1/4, Sec. 4 & T19N, R10E, SW1/4, Sec. 33. 2 mi N of Sidney.

6. IL: Champaign Co., Salt Fork. T18N, R10E, W1/2, Sec. 10. 1 mi NE of Sidney.

7. IL: Champaign Co., Salt Fork. T18N, R10E, NE1/4, Sec. 1 & T18N, R11E, NW1/4, Sec. 6. 3 mi NW of Homer.

8. IL: Champaign Co., Salt Fork. T18N, R14W, NW1/4, Sec. 6. 2 mi NW of Homer.

9. IL: Champaign Co., Salt Fork. T19N, R14W, SW1/4, Sec. 33. 1-1/2 mi N of Homer at IL 49 br.

10. IL: Vermilion Co., Salt Fork. T19N, R14W, SW1/4, Sec. 26. 2-1/2 mi NE of Homer near WICD tower.

11. IL: Vermilion Co., Salt Fork. T19N, R13W, SW1/4, Sec. 21. 2 mi S of Muncie.

12. IL: Vermilion Co., Salt Fork. T19N, R13W, NW1/4, Sec. 26. 3 mi SW of Oakwood.

13. IL: Vermilion Co., Salt Fork. T19N, R12W, SE1/4, Sec. 16. 2-1/2 mi N of Catlin, at jct. with Middle Fork.

14. IL: Ford Co., Middle Fork. T23N, R9E, SE1/4, Sec. 15. 4-1/2 mi WSW of Paxton.

15. IL: Ford Co., Middle Fork. T23N, R10E, SW1/4, Sec. 34. 4-1/2 mi SE of Paxton.

16. IL: Champaign Co., Middle Fork. T22N, R14W, SW1/4, Sec. 5. 9 mi SE of Paxton.

Appendix II. Site localities for 1980 mussel collections on the Vermilion River System. (continued)

17. IL: Vermilion Co., Middle Fork. T21N, R14W, SE1/4, Sec. 2. 5 mi W of Potomac.

18. IL: Vermilion Co., Middle Fork. T21N, R13W, NE1/4, Sec. 15. 1-1/2 mi S of Potomoc.

19. IL: Vermilion Co., Middle Fork. T20N, R12W, NE1/4, SW1/4, Sec. 8. 7-1/2 mi S of Potomoc.

20. IL: Vermilion Co., Middle Fork. T19N, R12W, SE1/4, Sec. 16. 2-1/2 mi N of Catlin at jct. with Salt Fork.

21. IL: Vermilion Co., North Fork. T23N, R11W, NE1/4, Sec. 18. 1-1/2 mi E of Hoopeston at IL 9 br.

22. IL: Vermilion Co., North Fork. T23N, R12W, NW1/4, Sec. 35. 2-1/2 mi N of Rossville.

23. IL: Vermilion Co., North Fork. T22N, R12W, NE1/4, Sec. 23. 2 mi SW of Rossville.

24. IL: Vermilion Co., North Fork. T21N, R11W, SW1/4, Sec. 5. 3/4 mi E of Alvin.

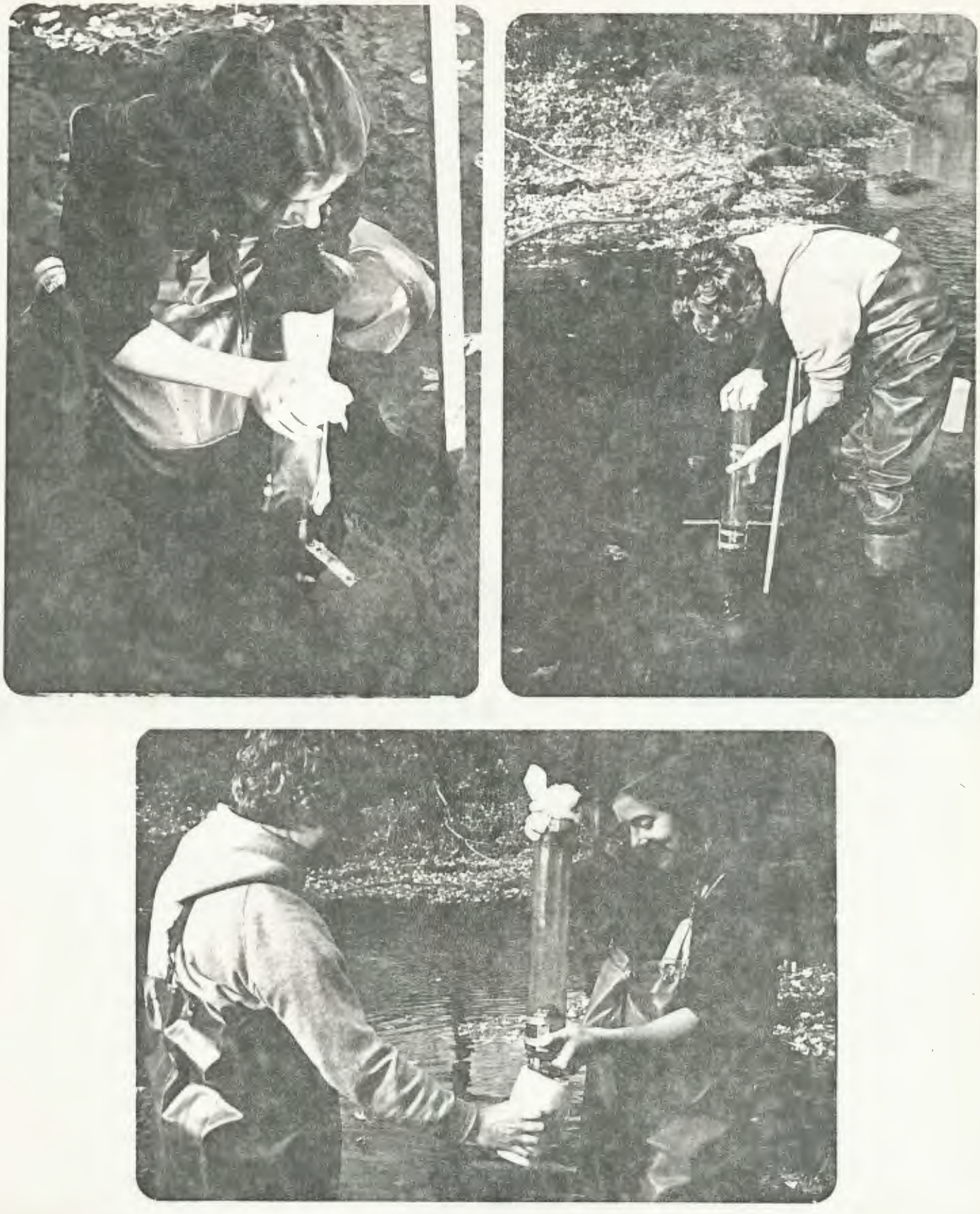
25. IL: Vermilion Co., North Fork. T21N, R12W, NE1/4, Sec. 24. 3-1/2 mi SW of Alvin.

26. IL: Vermilion Co., North Fork. T20N, R16W, NW1/4, Sec. 8. 6-1/2 mi N of Danville at IL 1 br.

27. IL: Vermilion Co., North Fork. T20N, R12W, SE1/4, Sec. 36 & T20N, R11W, SW1/4, Sec. 31. In W Danville at Harrison Park Golf Course.

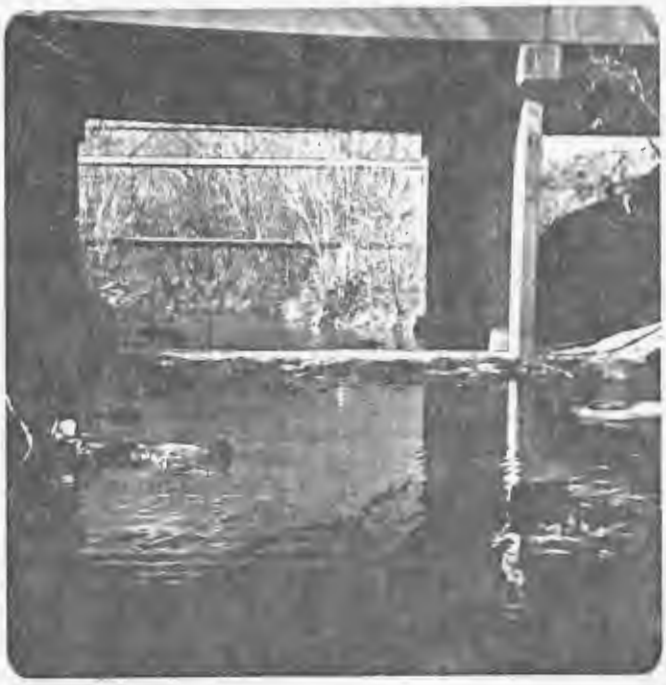
28. IL: Vermilion Co., Vermilion River. T19N, R11W, NW1/4, Sec. 27. 3 mi E of Tilton.

29. IL: Vermilion Co., Vermilion River. T18N, R11W, SW1/4, Sec. 12. 4-1/2 mi E of Westville.



Appendix III. Core sampler used for substrate sampling in November 1980 on the Vermilion River system.

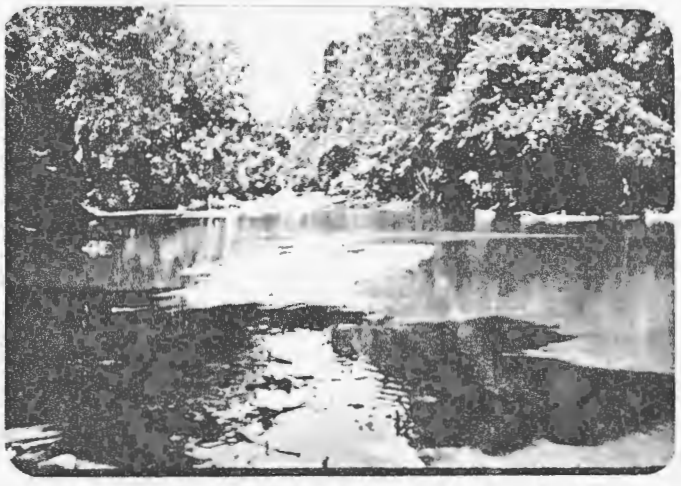
Appendix IV. Some of the sites collected in 1980-1981 on the Salt, Middle and North Forks and the Vermilion River proper.



Site 1

Site 2

Site 10



Site 13

Sites on the Salt Fork

Site 14

Site 15

Site 16

Site 17

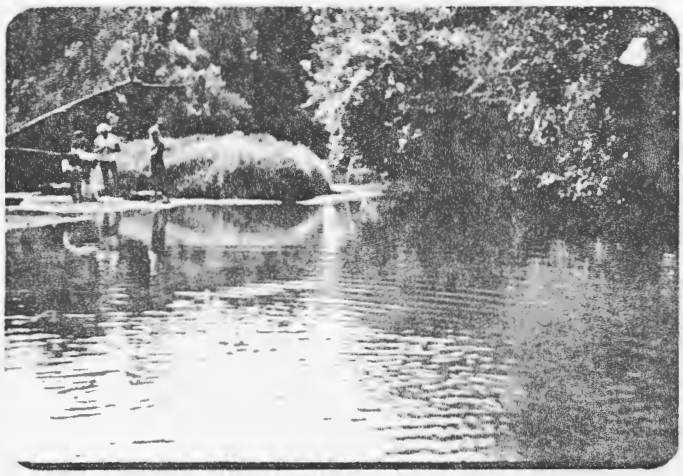
Site 18

Site 20

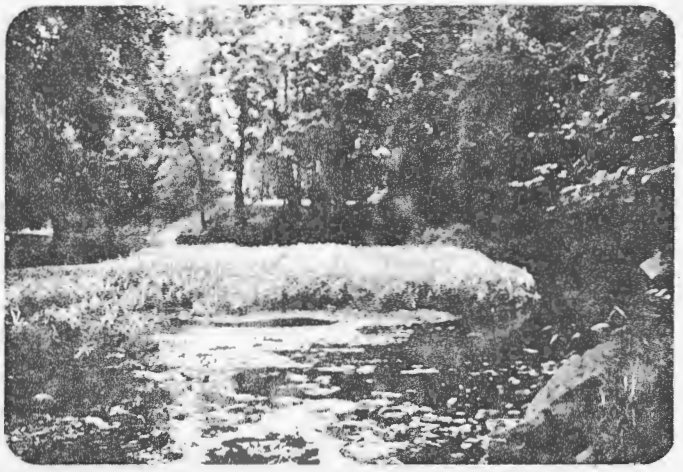
Sites on the Middle Fork

Site 21

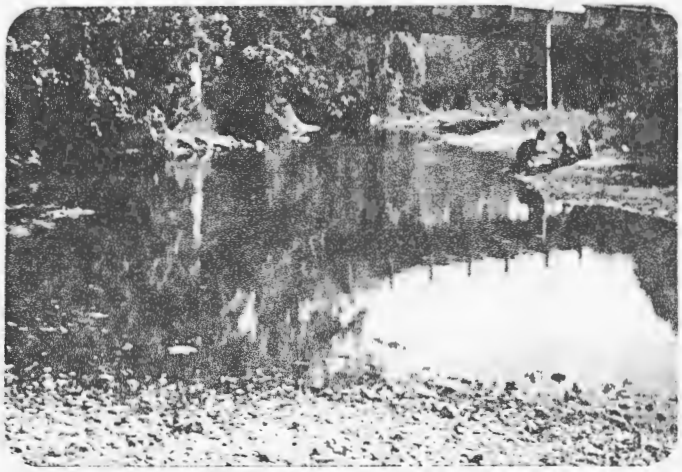
Site 22



Site 23



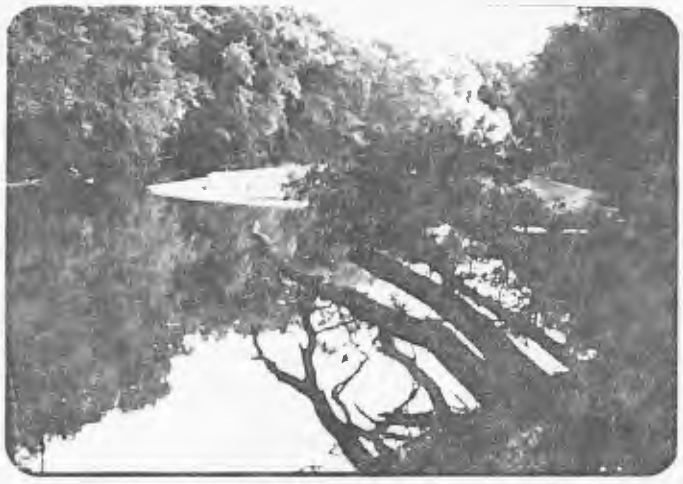
Site 24



Site 26

Sites on the North Fork

Site 28



Site 29

Sites on the Vermilion River