AD-A130 639 BIOLOGICAL INVENTORY CAPE LA CROIX CREEK WATERSHED CAPE GIRARDEAU COUNTY MISSOURI(U) MIDWEST AQUATIC ENTERPRISES MAHOMET IL JAN 77 LMSSD-76-25-26 1/3

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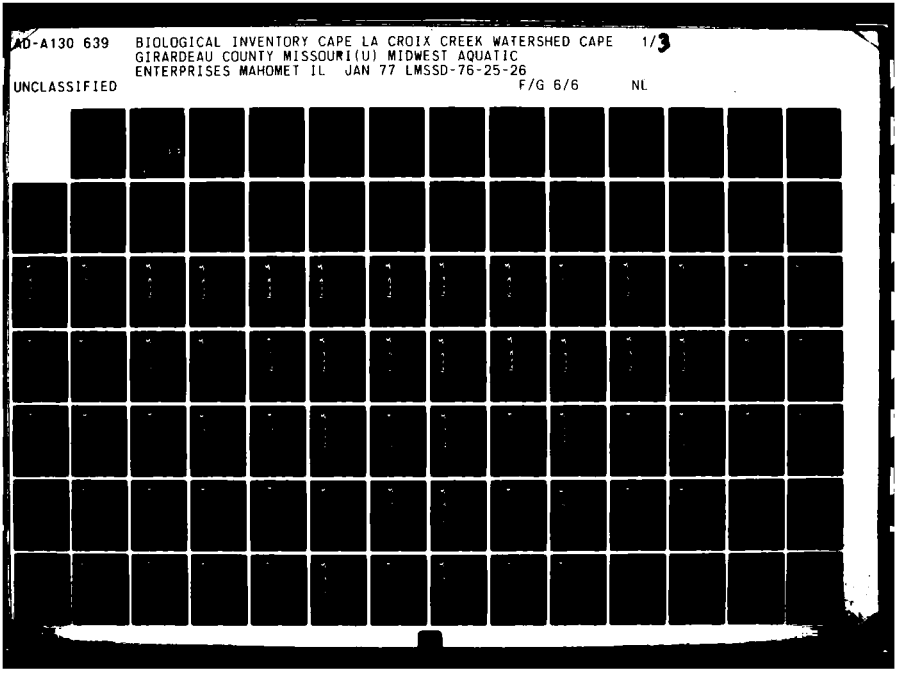

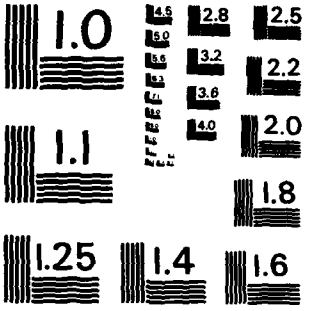

BIOLOGICAL INVENTORY
CAPE LA CROIX CREEK WATERSHED
CAPE GIRARDEAU COUNTY, MISSOURI

A Report Submitted to the U. S. Army Corps of Engineers
St. Louis District
Under Contract No. LMSSD 76-2526

By

MIDWEST AQUATIC ENTERPRISES
Rural Route 1
Mahomet, Illinois 61853

January, 1977

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A130 639 / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): BIOLOGICAL INVENTORY CAPE LA CROIX CREEK WATERSHED, CAPE GIRARDEAU COUNTY, MISSOURI	5. TYPE OF REPORT & PERIOD COVERED: Final Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s): LMSSD 76-25-26
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Midwest Aquatic Enterprises, Rural Route 1, Mahomet, Illinois 61853	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: U.S. Army Engineer District, St. Louis, 210 Tucker Boulevard, North, St. Louis, Missouri 63101	12. REPORT DATE: Jan 1977 13. NUMBER OF PAGES: 203
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Biological Inventory
Cape La Croix Creek
Cape Girardeau, Missouri

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was the end product of an eight-week survey of the biological elements of the Cape La Croix Creek watershed near Cape Girardeau, Missouri. The purpose of this study was to identify and quantify the biological elements and to gather sufficiently detailed information to permit analysis and understanding of short and long-term local and regional impacts which may

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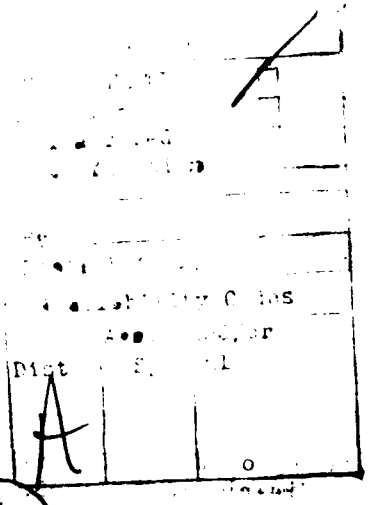
result from feasible water resource developments. In addition to obtaining quantitative data regarding the fauna and flora at designated aquatic and terrestrial sites, one of the prime purposes of this inventory was the qualitative evaluation of wildlife habitats found in the project area. This inventory served as part of a planning document for the Cape La Croix Creek watershed, providing environmental information to be considered in the identification of alternative solutions to water resource problems in the area.



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ACKNOWLEDGMENTS

We would like to acknowledge the assistance and cooperation of the following individuals during the course of this study. Mr. Dan Ragland and Mr. James Zerega toured the project area with us, discussed proposed resource developments in the watershed, and indicated areas of possible environmental concern. We would especially like to thank the Wildlife Research Section, Illinois Natural History Survey, for their assistance in obtaining unpublished data regarding waterfowl censuses of the project area. In addition we would like to acknowledge the assistance of Mr. Paul L. Heye, Associate Professor of Biology, Southeast Missouri State University, in reviewing and supplementing the bird lists found in this inventory.

BIOLOGICAL INVENTORY
CAPE LA CROIX CREEK WATERSHED
CAPE GIRARDEAU COUNTY, MISSOURI

INTRODUCTION

This report is the end product of an eight-week survey of the biological elements of the Cape La Croix Creek watershed near Cape Girardeau, Missouri. The purpose of this study was to identify and quantify the biological elements and to gather sufficiently detailed information to permit analysis and understanding of short- and long-term local and regional impacts which may result from feasible water resource developments. In addition to obtaining quantitative data regarding the fauna and flora at designated aquatic and terrestrial sites, one of the prime purposes of this inventory was the qualitative evaluation of wildlife habitats found in the project area. This inventory will serve as part of a planning document for the Cape La Croix Creek watershed, providing environmental information to be considered in the identification of alternative solutions to water resource problems in the area.

Field work was conducted during May and June, 1976. This restriction in time affected the results in many ways. Virtually all migratory waterfowl were absent at the time of the inventory. Aspection of the plant community, a natural annual sequence of species replacement throughout the growing season, limited the inventory of herbaceous plants to late-spring species.

In addition to field data collection, this inventory relied upon compilation of pertinent data from published sources and consultation with acknowledged specialists. In this way it was possible to fill a number of gaps in the data caused by the eight-week late-spring time restriction.

DESCRIPTION OF THE STUDY AREA

The Cape La Croix Creek watershed encompasses approximately 22 square miles (14,100 acres) of urban, rural, and developing lands, all lying within Cape Girardeau County in southeast Missouri (Fig. 1). The stream flows from the wooded hills and undeveloped areas north of Cape Girardeau, through major residential and commercial districts in the city, and empties into the Mississippi River at approximately river mile 50 above the mouth of the Ohio River south of Cape Girardeau. The watershed includes about 70% of the city of Cape Girardeau, a community of approximately 35,000 persons. Extensive development in the upland portions of the watershed has been projected by both the City of Cape Girardeau and the Southeast Missouri Regional Planning Commission.

The physical geology of the study area is discussed in depth by Bratton (1974). His discussion, plus zoogeographic notes by Pflieger (1971) provide the basis for the following summary.

Four distinct physiographic regions occur in Missouri. Of these, two occur in the project area. Cape La Croix Creek and its tributary streams originate in the Ozark Uplands region and flow, for most of their length, through this region. Just south of Cape Girardeau, the stream flows onto the alluvial plain of the Mississippi Embayment of the Southeastern Lowlands physiographic region. The southern rim of the Ozark Uplands region is highly dissected by stream channels. The alluvial plain of the Southeastern Lowlands extends upstream along many of these streams, creating a broad transition zone between the two physiographic regions. Cape La Croix Creek is one such stream.

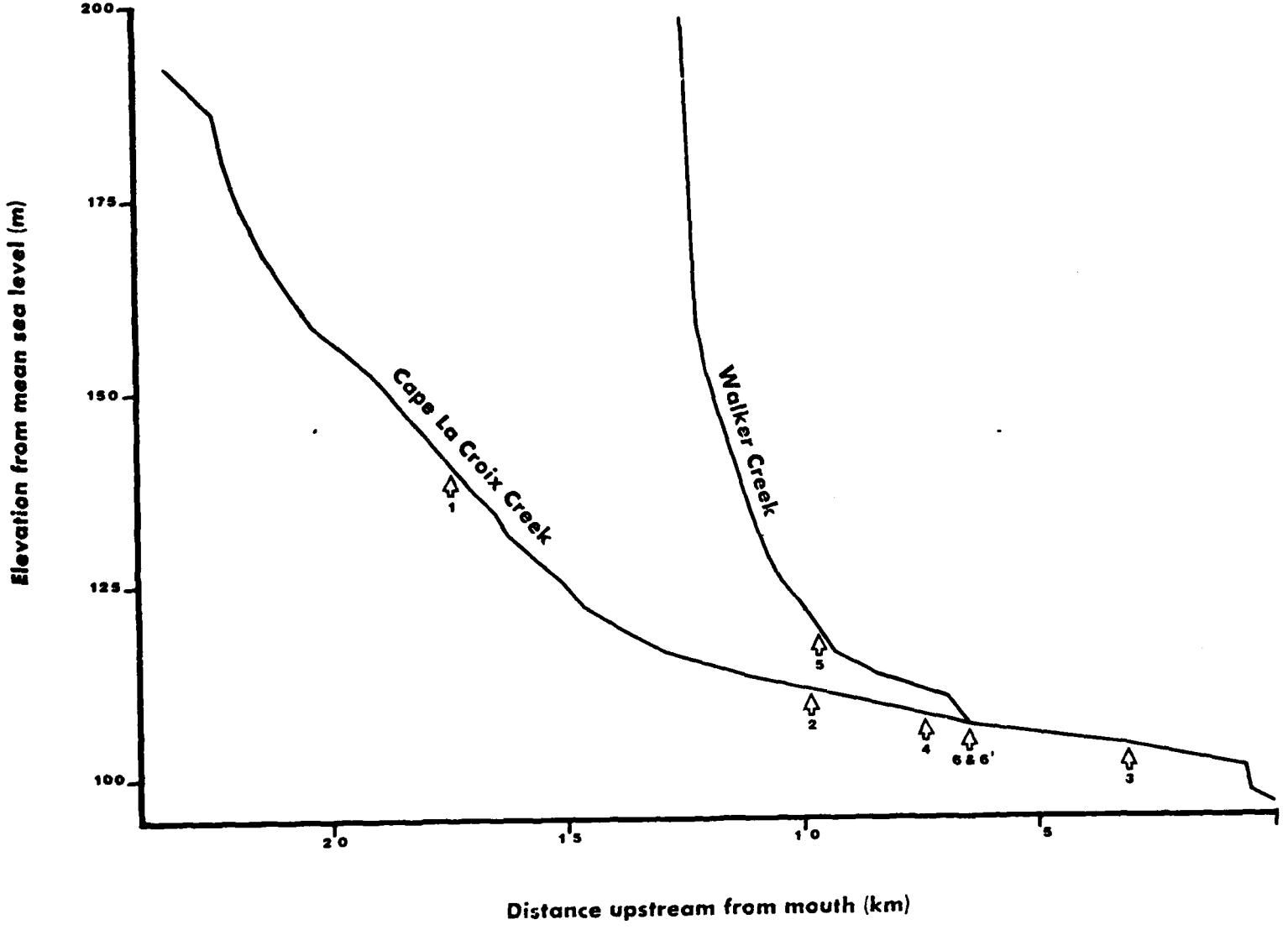
Figure 2 depicts the gradient of Cape La Croix Creek and Walker Creek from their sources to the junction of Cape La Croix Creek and the Mississippi River. Station locations are also shown. Based upon these data and the biological data gathered in this investigation, station 1 clearly represents Ozark Uplands and the wetland at station 6 and the stream at station 3 are typical of the Southeastern Lowlands. Station 2 probably is classified best as representing a transition zone. Stations 4 and 5 have been highly modified by man, and meaningful classification based upon biological criteria is often impossible. However, topographic criteria permit tentative designation of station 5 as Ozark Uplands and station 4 as transitory.

South of Cape Girardeau, the Ozark Uplands region is set off from the Southeastern Lowlands by a steep rocky bluff extending southwestward in a curved line. This bluff line constitutes a sharp rise of 20 to 80 m from the level of the lowlands to the level of the adjacent uplands.

The present topography of the Ozark Uplands is largely erosional, with the greatest relief along the major streams where dissection has proceeded most rapidly. An important stream flow characteristic of Cape La Croix Creek in this region is that it is a losing stream, or one which loses water to the groundwater system (Bratton 1974).

The topography of the Southeastern Lowlands region as a whole is a broad plain with a gentle slope to the south. For the most part, the

Figure 2. Approximate gradient of Cape La Croix and Walker Creeks, Cape Girardeau County, Missouri, showing locations of the six biological sampling stations (based upon U. S. G. S. topographic maps, 7.5 minute series, Cape Girardeau and Cape Girardeau NE quadrangles, 1967 ed.).


Elevation from mean sea level (m)
200
175
150
125
100
Cape La Croix Creek
Walker Creek
1
5
2
4
6 & 6'
3
2·0
1·5
1·0
·5
Distance upstream from mouth (km)

surface relief is less than 3 m. Cretaceous and Tertiary sediments are rarely exposed. These older deposits are overlain by alluvium ranging in thickness from one to more than 60 m, and in the uplands they are overlain by a thick mantle of loess. The alluvium and loess were deposited during Pleistocene and Recent times.

Before settlement, much of the Southeastern Lowlands consisted of swamp, and during times of flood, the area was inundated by the Mississippi River. Modification began in 1913 and 1914 with the diversion of a number of streams eastward along the northern border of the lowlands to the Mississippi River south of Cape Girardeau. Construction of a network of smaller drainage ditches eliminated the extensive swamps that formerly occupied the Southeastern Lowlands.

The climate of the project area may be inferred from weather service records from Cape Girardeau. Data for 1975 show a temperature range from 11° F to 95° F with an annual mean temperature of 57.4° F. Annual mean precipitation is 44.83 inches. Fifteen years of records exist.

Seven aquatic and seven terrestrial sampling sites were located within the Cape La Croix Creek watershed (Fig. 1). Specific locations of sampling sites are found in Tables 1 (aquatic sites) and 2 (terrestrial and wetland transects).

As a portion of the larger surface water quality investigation of the Cape Girardeau-Jackson, Missouri, Metropolitan Study Area conducted by Southeast Missouri State University, three stations in Cape La Croix Creek were sampled for 20 parameters from February through May, 1975, at approximately biweekly intervals. In all, seven collections were made. The monitoring stations were located in the watershed as follows: station CLC-11 corresponded closely to station 1 of the present study; station CLC-5 to station 4; and station CLC-1 to station 3. These data have been summarized in Table 3.

They concluded, based upon the water quality standards established by the Missouri Clean Water Commission, that water quality in the study area was acceptable for existing water use. Furthermore, they observed that during periods of "sufficient" flow, urbanization did not appear to degrade water quality. As this was a short-term investigation, they cautioned that this might not be true during the low-flow periods of late summer and early autumn (Southeast Missouri State University 1975).

These data also characterize the existing water quality of the Ozark Uplands (station CLC-11), through the urban areas of Cape Girardeau (station CLC-5), to the Southeastern Lowlands (station CLC-1).

Although Cape La Croix Creek flows through these distinct areas, the overall effect upon the baseline water quality appears to be minimal: of 20 parameters measured, 15 did not demonstrate any significant differences (0.05 level) among stations (Table 3). In general, concentrations appeared to increase from upstream to downstream.

The five parameters demonstrating significant differences (0.05 level) among stations included dissolved oxygen, total solids, hardness, total

Table 1. Locations of aquatic sampling stations[1].

STATION	BODY OF WATER	DISTANCE[2] (km)	DIRECTION[2] (°)	LOCATION[3]
1	Cape La Croix Creek	7.8	333	T31N, R13E, W½, NW¼, SW¼, Sec. 12
2	Cape La Croix Creek	4.4	288	T31N, R13E, SE¼, NW¼, NE¼, Sec. 35
3	Cape La Croix Creek	2.8	217	T30N, R14E, SE¼, NW¼, NW¼, Sec. 7
4	Cape La Croix Creek	2.8	265	T30N, R13E, NE¼, NE¼, NW¼, Sec. 1
5	Walker Creek	3.1	313	T31N, R13E, NW¼, SE¼, NE¼, Sec. 25
6	Unnamed Wetland	3.3	237	T30N, R13E, SE¼, SE¼, SW¼, Sec. 6
6'	Unnamed Wetland	4.1	221	T30N, R13E, SE¼, NE¼, SW¼, Sec. 12

[1]All stations in Cape Girardeau County, Missouri.
[2]Distance and direction given from U. S. Post Office, Cape Girardeau, Missouri.
[3]Located on U. S. G. S. Cape Girardeau, Missouri, quadrangle, 7.5 minute series, 1967 edition.

Table 2. Locations of vegetation transects[1].

TRANSECT	VEGETATION TYPE	ORIENTATION (°)	LENGTH OF TRANSECT (m)	WIDTH OF TRANSECT (m)	DISTANCE[2] (km)	DIRECTION[2] (°)
A-A'	Upland Forest	200	100	10	6.06	326
B-B'	Floodplain Forest	70	100	10	4.31	290
C-C'	Upland Forest	250	100	10	2.87	219
D-D'	Upland Forest	102	75	10	3.11	316
E-E'	Wooded Swamp	95	100	10	4.19	219
F-F'	Wetland	65	50	1	4.07	220
G-G'	Wetland	22.5	50	1	3.26	237

[1]All transects in Cape Girardeau County, Missouri.
[2]Distance and direction given from U. S. Post Office, Cape Girardeau, Missouri.

Table 3. Relationships among mean concentrations[1] of physical and chemical parameters observed at three stations in Cape La Croix Creek February through May, 1975[2].

PARAMETERS[3]	STATIONS		
	CLC-1	CLC-5	CLC-11
Flow (cfs)		9.56	6.00
Hydrogen Ion Concentration as pH	7.24	7.40	7.14
Air Temperature (C)	14.04	17.00	15.07
Water Temperature (C)	13.26	13.34	11.57
Dissolved Oxygen	7.25	10.76	9.60
Biochemical Oxygen Demand	2.77	1.93	1.24
Ammonia Nitrogen	0.070	0.148	0.027
Organic Nitrogen	0.526	0.359	0.259
Nitrate Nitrogen	0.570	0.420	0.539
Nitrite Nitrogen	0.019	0.018	0.012
Total Phosphate	0.320	0.277	0.145
Soluble Orthophosphate	0.080	0.082	0.059
Suspended Solids	130.3	206.9	21.0
Total Solids	365.6	401.0	129.0
Hardness as $CaCO_3$	143.0	122.6	56.8
Total Alkalinity as $CaCO_3$	126.3	106.3	43.9
Turbidity (FTU)	26.0	20.4	18.2
Specific Conductance ($\mu mho\ cm^{-1}$)	242.0	229.7	117.1
Fecal Coliforms (# per 100 ml)	2917.1	2020.6	333.7
Fecal Streptococci (# per 100 ml)	8672.0	7012.0	2244.0

[1]Any two means underscored by the same line are not significantly different (0.05 level) by the Modified New Duncan Multiple-Range Test (Kramer 1956). This test was performed following a model 1 analysis of variance.

[2]Raw data used for analyses appeared in Southeast Missouri State University (1975).

[3]As mg $liter^{-1}$ unless other units are indicated.

alkalinity, and specific conductance.

Dissolved oxygen concentrations were significantly lower (0.05 level) at station CLC-1. As the farthest downstream sampling point, station CLC-1 receives the cumulative organic load from the entire Cape La Croix Creek watershed upstream. This was reflected in biochemical oxygen demand being highest at this station (Table 3). It is therefore not unusual for dissolved oxygen concentrations to be lowest there.

The remaining four parameters showing significant differences are interrelated to the extent that each reflects the natural increase in both dissolved and particulate solids which occurs in a stream system from source to mouth. These parameters have, however, been influenced and increased by urbanization, primarily as storm water runoff.

Among total solids, hardness, total alkalinity, and specific conductance, station CLC-11 was significantly lower (0.05 level) than either stations CLC-5 or CLC-1 (Table 3). With the exception of total solids, the stations exhibited a continued downstream increase in concentration. Total solids, which includes a particulate fraction in addition to the dissolved fractions included in hardness (chiefly Ca^{+2} expressed as $CaCO_3$), total alkalinity (chiefly HCO_3^- expressed as $CaCO_3$), and specific conductance (which includes all electrolytes dissolved in water), might be expected to be greater in the urban areas. The decrease observed downstream at station CLC-1 could merely be the result of particle settling.

METHODS

Terrestrial vegetation. The dominant plant species occurring in the Cape La Croix Creek watershed were recorded during field reconaissance and sampling. Since field work was performed in May, the species list, presented later as an inventory table, was necessarily limited to trees, shrubs, spring wildflowers, and other early species. The species list was not intended to be exhaustive (primarily because of aspection and the sampling time restrictions), but the species recorded represent the predominant species which characterize the various habitats.

Nomenclature follows Mohlenbrock's *Guide to the Vascular Flora of Illinois* (1975), the single most recent and complete area document available.

Intensive sampling in floodplain forest, wooded swamp, and upland forest habitats was accomplished by transect sampling. Five transects were established in the vicinities of aquatic sampling stations 1, 2, 3, 5, and 6 (Fig. 1). Transects were originally proposed to include only bottomland forest/wooded swamp habitats. During field reconaissance, however, it became evident that bottomland or floodplain forest was either (1) reduced to a small band along the stream's edge because of encroaching agriculture or urban development or (2) reduced when the elevation rose sharply along the stream. Consequently, representative stands near stations 1, 3, and 5 were more appropriately termed upland forest (Table 2).

Each transect was 10 m wide and 100 m long (only 75 m available near station 5), in all instances extending virtually from forest edge to forest edge. In each transect all vegetation was classified and recorded according to the first applicable category in the following hierarchy: (1) woody stems equal to or greater than 18 inches dbh; (2) woody stems greater than 6 ft tall or 4 inches dbh; (3) woody stems less than 6 ft tall or 4 inches dbh; and (4) herbaceous stems of ground cover species.

Results of each transect were summarized in tabular form. Species composition and abundance were expressed as: (1) the number of trees greater than or equal to 18 inches dbh; and (2) the number of individuals, dominance (%), and ground covered (%) for each species in the categories overstory, understory, and ground cover, respectively (defined above). Dominance was the percent composition based upon basal area: [(total basal area of given species) ÷ (total basal area of all species)] x 100. The percent ground covered by each species was determined from the estimated crown areas as a percent of the total area sampled in each transect.

Aquatic vegetation. Four wetland types were present in the Cape La Croix Creek watershed: type 3, inland shallow fresh marsh; type 4, inland deep fresh marsh; type 5, inland open fresh water or lakes and ponds; and type 7, wooded swamp. While type 5 wetlands were scattered throughout the watershed, types 3, 4, and 7 were concentrated in the southern one-sixth of the watershed. These latter wetlands contained the greatest diversity of aquatic macrophytes.

Only wetland types 4 and 7 were sampled for aquatic macrophytes.

Type 3 wetlands occupied only a few acres. Analyses in the wooded swamp (type 7) were accomplished as discussed above.

Aquatic macrophyte quantitative sampling was done in two type 4 wetlands, each containing a distinct open water plant community. As transect sampling best described the vegetation changes along the environmental gradient from open water to dry land, a quantitative sample consisted of a transect 1 m wide (1) from the "center" deep-water area of the wetland to beyond the shoreline in F-F' and (2) from shore to shore in wetland G-G'. Thus, representatives of the hydrosere succession (attached floaters, amphibious state, wet meadow stage) were included. The transect continued until the encroaching agricultural or urban land was reached. All individuals were identified and counted.

A 100 m^2 area was sampled in type 4 wetlands. While this exceeded the 81 m^2 proposed for two transects, it was considered important to include the complete succession of species present.

Locations of the aquatic macrophyte transects are presented in Table 2. The first transect F-F' was in a wetland dominated by arrow arum (*Peltandra virginica*), lizard's-tail (*Saururus cernuus*), and smartweed (*Polygonum* spp.). The second quantitative sample was in an area dominated by yellow pond lily (*Nuphar luteum* ssp. *macrophyllum*) and lizard's-tail. Since this second wetland was not extensive, the transect ran from shore to shore.

Inventory tables. Inventory tables were prepared for terrestrial and aquatic species known or likely to occur in the project area. These tables include general information concerning the spatial distribution and relative abundance of each species in the total environment. As a convenience to lay users, families within each major group (*i. e.*, amphibians, reptiles, birds, and mammals) are arranged alphabetically rather than phylogenetically. Likewise, species within each family are arranged alphabetically.

Twelve categories were established for the inventory tables including: city, suburban, exurban, agriculture, old field, upland forest, wooded swamp, open fresh marsh, Cape La Croix Creek and tributaries, Mississippi River, shallow and deep fresh marshes, and other (parks, estates, and cemeteries). These generally correspond to the habitat types of Figure 3.

Fishes were not included in the 12-category tables discussed above. Similar general information for these organisms was included in 7-category tables subdividing the aquatic habitats as follows: Mississippi River, backwaters and oxbows, open fresh marsh, wooded swamp and deep and shallow fresh marshes, and Cape La Croix Creek (Southeastern Lowlands, Transitional, and Ozark Uplands). Presentation is alphabetical.

Maps. Two maps of the Cape La Croix Creek watershed were prepared during this inventory (Figs. 1 and 3). Figure 1 serves as a base map and to locate sampling sites. The base map was drawn from U. S. G. S. topographic maps, 7.5-minute series, Cape Girardeau and Cape Girardeau NE quadrangles (1967 editions).

Figure 1, sampling sites, locates areas of point and transect sampling as identified in Tables 1 and 2, respectively. It should be noted that the transect "arrows" illustrated on the map are not intended to represent the actual length of the transect. In most cases, transect lengths were too short to permit accurate representation of length on the figure. Rather, the "arrows" on Figure 1 are intended to portray the location and general orientation of the transects.

Figure 3 depicts the distribution of wildlife habitat types in the Cape La Croix Creek watershed. In general, habitats shown are those used in the inventory tables discussed above. These habitats were mapped with reference to an uncontrolled aerial photomosaic (black-and-white) and a false-color infrared aerial photograph. Individual habitat subunits of less than 2 acres were, in general, not plotted.

The category *old field* probably does not apply in the project area. Because of the intensive agriculture practiced in the area, all suitable cleared land is under cultivation. Because of their ephemeral nature, it was felt that plotting the old field category would only increase the rate of out-dating of the habitat map. Hence, old field and *agriculture* habitats are plotted together.

Sand bars and *mudflats* existed in the project area only as small areas along the immediate course of Cape La Croix Creek and its tributary streams and the Mississippi River. Sand bar and mudflat habitat was not plotted separately from the two flowing water habitat types (*Cape La Croix Creek and tributaries* and *Mississippi River*) on the habitat map.

Backwaters and *oxbows* are aquatic habitats in close association with the Mississippi River. Because of their proximity to the river and because their physical and biological elements vary with the stage of the river, backwater and oxbow habitats were not plotted separately from *Mississippi River* on the habitat map.

Four wetland types, as defined by Shaw and Fredine (1956), were present in the project area. These are plotted conveniently on Figure 3, wildlife habitat types, as they are synonymous in most cases: (1) *lakes* and *ponds* corresponding to wetland type 5, inland *open fresh marsh*; (2) *floodplain forest* corresponding to wetland type 7, *wooded swamp*; and *marshes* and *wetlands* corresponding to wetland types 3 and 4, inland *shallow fresh marsh* and inland *deep fresh marsh*, respectively.

It should be pointed out that designation of "floodplain forest" habitat type was not based upon topographic association with a river floodplain. Much of the bottomland forest within the project area was virtually indistinguishable biologically from forest on adjacent uplands. Only one forest in the project area had a biological community which showed evidence that periodic and prolonged inundation were a normal part of its ecology. This will be discussed below, but it was necessary to mention that only this stand is indicated on Figure 3 as floodplain forest.

The remaining wildlife habitat types are plotted without change.

Phytoplankton. Two replicate net plankton samples of 30 to 60 liters each were collected at aquatic sampling stations 1 through 6 using a #25 plankton net. Sample volumes were determined by water turbidity. Samples were preserved with acidified Lugol's solution and later volume-adjusted to 100 ml.

Phytoplankters were counted using both a Sedgwick-Rafter counting cell under 160X magnification and a *nannoplankton* counting cell under 400X magnification. Two to five Whipple grids were counted at 160X on each of 12 replicate Sedgwick-Rafter cells prepared for each of the replicate plankton samples. In addition, five Whipple grids were counted at 400X on each of 12 identically prepared nannoplankton counting cells. This modification of standard counting methodologies (Weber 1973) has been shown to increase overall counting efficiency and to reduce the coefficient of variation of the counts obtained (Woelkerling, Kowal, and Gough 1976).

Filamentous species were recorded in 100 μ units. Diatoms were recorded during initial counting as Centrales, Pennales, or the lowest certain taxonomic level for the readily identifiable forms such as *Fragilaria* spp., *Melosira* spp., *Navicula* spp., and *Nitzschia* spp. All plants were identified to the lowest reasonable taxa. Densities were calculated by the formula:

$$\text{Number per liter} = \frac{C \cdot 1000\ mm^3/ml}{A \cdot D \cdot S \cdot F}$$

where C = the number of each organism tallied; A = area covered by the Whipple grid (mm^2); D = depth of the counting cell (mm); S = the number of grids counted; F = the concentration factor of the sample being counted (liters/ml).

Diatoms were counted and identified from slides prepared by a potassium dichromate-hydrogen peroxide digestion of 5 ml of sample concentrate. The samples were then repeatedly rinsed with distilled water and centrifuged until the supernatant was clear. The diatoms were then concentrated to approximately 1 ml. Permanent slides were prepared in duplicate by adding an appropriate volume to 18 mm No. 1 glass coverslips. These were dried and affixed to glass slides with Hyrax high refractive index mounting medium.

Diatoms were grouped as described earlier and percent composition for each species was determined. This value was applied to the appropriate group total and reported as number per liter. In groups where only empty diatom frustules were recorded, the taxa enumerated from the prepared slides were recorded as present (+). Also, species present in concentrations of less than 1 per liter were recorded as plus.

Those species recorded as present were included in the total number of species for each sample. However, since no numerical values were applied, they were not included in the total number of organisms per sample.

Zooplankton. Two replicate net plankton samples of 30 to 60 liters were collected at aquatic sampling stations 1 through 6 using a #25 plankton net. Sample volumes were dependent upon water turbidity. Four ml of neosynephrine nosedrops were added to each sample to prevent contraction of non-loricate rotifers when samples were preserved after 15 to 30 minutes with sufficient formalin to achieve a 5% final concentration.

A species list for each zooplankton sample was prepared by scanning each sample with a stereo-zoom microscope at 10X to 80X. After the scan, the sample was thoroughly mixed and subsamples were withdrawn using an automatic pipette. Organisms were identified and counted using the stereo-zoom microscope in a modified Sedgwick-Rafter counting cell holding 2.5 ml of sample. Two entire cells were counted for each sample. Identification slides were made of the copepods, cladocerans, and some rotifers and examined with an interference contrast microscope at 1000X magnification for species determinations.

Results were reported as number per liter for each species. Conversion of the recorded counts was based upon the following formula:

$$\text{Number Species A per liter} = \frac{(A \div B) \cdot C}{D}$$

where A = total number of species A counted; B = total volume sample counted (ml); C = volume of concentrated sample (ml); and D = volume of sample filtered (liters).

Those species observed only during scanning and not in the subsamples counted or whose densities following counting and calculating were less than 1 per liter were recorded as present (+). These were included in the total number of species for each sample.

Benthos. Five quantitative benthic samples were collected from each of six aquatic sampling stations. Sampling was done with a 6-inch square Ekman grab at stations 3, 4, and 6 and with a Surber swift-water sampler at stations 1, 2, and 5. Substrate composition determined which sampling device was most appropriate: the Ekman sampler for softer clay-silt-detrital sediments and the Surber sampler for gravel, rubble, and bedrock substrates.

Samples were taken at equidistant points along a line perpendicular to the longitudinal axis of the stream. Sample 3 was the midstream sample and sample 1 was nearest the right bank (facing downstream) at each station. In the wetland the five samples were spaced at approximately equidistant points from the center of the wetland to the shore, samples 1 through 5, respectively.

Benthic samples were sieved in the field to reduce the volume of sample and all material retained by a standard 30-mesh sieve was preserved with formalin and returned to the laboratory for further processing. In the laboratory samples containing substantial amounts of inorganic substrate were floated with a saturated magnesium sulfate solution to separate

the organisms from the substrate. After flotation, the residue was examined under a stereoscopic microscope to retrieve snails, fingernail clams, and other organisms which did not float.

All samples were then sorted under stereoscopic microscopes at a magnification of 10X. Residue was scanned at 40X prior to disposal to insure that all organisms had been removed. Identification to generic or species level was performed by taxonomists specializing in each of the major groups of aquatic organisms.

To convert numbers of benthic macroinvertebrates per sample to numbers per m^2, each count from the Ekman grab samples was multiplied by 43 since it sampled 1/43 m^2 of bottom area while each count from the Surber swift-water sampler was multiplied by 11 as it sampled 1/11 m^2 of bottom area.

Quantitative sampling was supplemented with qualitative hand-picked collections at each station. In addition, blacklight trap samples were collected from stations 1, 3, and 6. These stations were considered to be representative of the three major aquatic areas investigated: upland headwater stream, lowland stream near mouth, and a wetland, respectively.

The occurrence of a species in qualitative samples is indicated on the species tables with a plus (+). These data are not included in the species totals.

Fishes. Fishes were collected from stations 1 through 6' by seining. Seining employed a 5 by 25 foot bag seine with 3/16-inch stretch mesh and a block seine of the same mesh size. Sampling continued until no further species were found and adequate series of each species had been collected.

The inventory table of fishes presented later in this report was compiled from results of field studies and various published sources including Smith, Lopinot, and Pflieger (1971) and Pflieger (1971, 1975). Nomenclature follows Bailey *et al.* (1970).

Species diversity. Species diversity (D) was calculated for phytoplankton, zooplankton, benthos, and fishes using the following equation:

$$D = -\sum_{i=1}^{n} p_i \log_2 p_i,$$

(Shannon and Weaver 1949) where p_i = fraction of total individuals (N) belonging to the ith species.

Species richness was calculated from the difference between the calculated diversity and equitability ($D \div \log_2 N$).

Other vertebrates. No specific attempts were made to collect samples of non-fish vertebrates. Rather, notes of species observed were made by all

personnel on trips to the project area. Results of these observations were combined with published and unpublished records to produce the inventory tables presented later in this report. Principal sources are as follows:

Amphibians:	Smith (1961)
Reptiles:	Smith (1961)
	Anderson (1965)
Birds:	Hanselmann (1966)
	Anonymous (1967)
	Bellrose (1968, 1976)
	Carney, Sorensen, and Martin (1975)
	National Audubon Society (1975)
Mammals:	Schwartz and Schwartz (1959)
	Porath and Torgerson (1975)
	Sampson (1975a, 1975b)

Supplemental additions to the bird inventory were obtained from unpublished aerial censuses of waterfowl conducted from 1972 through 1975 by Drs. Frank C. Bellrose, Glen Sanderson, and Mr. Robert Crompton, Illinois Natural History Survey. Mr. Paul L. Heye kindly reviewed and suggested additions to the bird list presented in the draft of this inventory. His 21 years of experience with the avifauna of southeast Missouri added 66 species to the final checklist of birds.

TERRESTRIAL COMMUNITIES

Three urban and nine non-urban wildlife habitat types, defined as follows, were recommended for discussion in this biological inventory:

Urban habitat types

1. *City* - associated with biological communities located within an urban setting and having at least 80% of the area devoid of vegetative cover.
2. *Suburban* - associated with biological communities located within an urban setting and having from 20% to 79% of the area devoid of vegetative cover.
3. *Exurban* - associated with biological communities located within an urban setting and having from 0% to 19% of the area devoid of vegetative cover.

Non-urban habitat types

1. *Agricultural* - associated with communities of substitute vegetation devoted to agricultural use.
2. *Old field* - associated with communities of early succession vegetation resulting from abandoned farming operations.
3. *Upland forest* - associated with communities of forest or brushland located in upland areas.
4. *Floodplain forest* - associated with biological communities of forest or brushland located in floodplain areas.
5. *Lakes and ponds* - lentic habitats with open water greater than 50% of the surface acreage.
6. *Rivers and streams* - lotic communities with their associated biological communities.
7. *Pond bars and mudflats* - largely barren habitats which undergo periodic inundation.
8. *Marshes and wetlands* - lentic habitats with open water less than 50% of the surface area; largely associated with communities of floating or emergent vegetation.
9. *Other* - habitats which do not conform readily to the above criteria, *e. g.*, park areas, estates, and wildlife refuges.

For consistency in this report it was necessary to modify several non-urban habitat types. Floodplain forest was present both as flooded swamp and as riparian forest. The flooded habitat is here designated *wooded swamp* (wetland type 7). Although located in the floodplain of Cape La Croix Creek, riparian forest was essentially upland forest in terms of the majority of the biota. Organisms utilizing this habitat primarily because of its riparian characteristics are included under the habitat *Cape La Croix Creek and tributaries*. Other habitat re-designations are as follows: (1) lakes and ponds become *open fresh marsh*; (2) rivers and streams are subdivided into *Cape La Croix Creek and tributaries* and *Mississippi River*; and (3) marshes and wetlands become *shallow and deep fresh marsh*. A new category, *backwaters and oxbows*, was added to the aquatic habitats.

The Cape La Croix Creek watershed is approximately 21.2% urban habitat (2,998.4 acres) and 78.8% non-urban habitat (11,101.6 acres). Only a small portion of the watershed is classified as wetlands, approximately 0.6% of the project area (84.5 acres).

Urban areas. The urban areas were notable for the extreme variability in

plant material, variable in both diversity and abundance. Tracts ranged from the complete absence of all vegetation to wooded tracts where only the understory vegetation appeared to be controlled by mowing. In the exurban areas, limited irregular clusters of dwellings occurred, encroaching upon predominantly agricultural areas. Encroachment would be expected to continue as urban expansion continues.

As the dominant vegetative features in the urban landscape, trees exhibited great species diversity, primarily through the establishment of exotics. While silver maples (*Acer saccharinum*), sugar maples (*Acer saccharum*), numerous oaks (*Quercus* spp.), sweet gum (*Liquidambar styraciflua*), and tulip trees (*Liriodendron tulipifera*) were frequent and abundant, numerous exotic species and cultivars were also present. Understory trees in early spring were dominated by redbud (*Cercis canadensis*), flowering dogwood (*Cornus florida*), and numerous varieties of crabapples (*Malus* spp.) and magnolias (*Magnolia* spp.) (Table 4).

City

City habitat, 2.3% of the study area (328.3 acres), is located entirely within Cape Girardeau. Two principal habitat concentrations exist: along U. S. highway 61 in the western portion of the city and along Missouri highway 34 in the eastern portion of the city. The largest block of city habitat, 246.4 acres, is located along U. S. highway 61 south of its junction with Missouri highway 34. Construction of numerous shopping centers in this area insures expansion of city habitat, mostly in a corridor along highway 61.

Of the 381 non-fish vertebrates listed in this inventory as known or likely to occur in the project area, only 14 are recorded as likely to occur in city habitat. These include six species of birds (Table 5) and eight of mammals (Table 6). Among the birds, nighthawks, rock doves (pigeons), and house sparrows are best adapted to city habitat and are considered common. Nighthawks feed upon night-flying insects attracted to the city lights and find flat, bare rooftops ideal nesting areas. Rock doves and house sparrows feed upon a great variety of natural foods and especially upon the edible fraction of man's litter and refuse. Nesting of these species occurs in the heart of even the largest of cities.

Among the mammals, only house mice and Norway rats can be considered as abundant in city habitat. Although normally associated with dilapidated sections of cities and warehouse districts, these ubiquitous mammals will be abundant wherever sufficient cover and food permit. Surprising as members of the city fauna are three species of bats. These mammals also feed upon night-flying insects attracted to the city limits. Roosting occurs commonly in chimneys and under window ledges.

City habitat is unsuitable for nearly all of the terrestrial vertebrates occurring in the project area. Principal factors in creating this dearth of species include the lack of natural cover, a food supply which may be abundant, but which is not diverse, and constant intrusion of living space by humans. It should be noted, however, that lack of

Table 4. Predominant plants observed during spring in the Cape La Croix Creek watershed.

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
ACERACEAE												
Acer negundo L.[2]												
Box elder		U	U			R			A	U		U
Acer rubrum L.[2]												
Red maple		U	U			U	U					
Acer saccharinum L.[2]												
Silver maple	A	A	A				U		C	C		U
Acer saccharum Marsh.[2]												
Sugar maple	A	A	A			A						C
ANACARDIACEAE												
Toxicodendron radicans (L.) Kuntze.[2]												
Poison ivy			U	U	U	C	C		A	C		U
ANNONACEAE												
Asimina triloba (L.) Dunal.[2]												
Pawpaw						A						R
APOCYNACEAE												
Vinca minor L.[2]												
Common periwinkle		A	A									R

A= Abundant, readily observed
C= Common, usually readily observed
U= Uncommon, but likely to be observed
R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 4. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
ARACEAE												
Acorus calamus L.[2] Sweet flag								R			R	
Arisaema dracontium (L.) Schott.[2] Green dragon						A						
Peltandra virginica (L., Kunth.[2] Arrow arum							A	U			A	
ASCLEPIADACEAE												
Asclepias spp. L.[2] Milkweed		C	C	U	C				U	R		U
BALSAMINACEAE												
Impatiens spp. L.[2] Jewel-weed; touch-me-not									C	U		U
BERBERIDACEAE												
Podophyllum peltatum L.[2] Mayapple						A						R
BETULACEAE												
Betula nigra L.[2] River birch									U			

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BETULACEAE (concluded)												
Carpinus caroliniana Walt.[2] Blue beech									R			
Corylus americana Walt.[2] Hazelnut					R	C						U
Ostrya virginiana (Mill.) K. Koch[2] Hop hornbeam						A						
BIGNONIACEAE												
Campsis radicans (L.) Seem.[2] Trumpet creeper		U	C	C	C	C			C	C		C
Catalpa sp. Scop.[2] Catalpa		U	U			U			R			R
CAPRIFOLIACEAE												
Lonicera japonica Thunb.[2] Japanese honeysuckle		U	C		A	A						C
Sambucus canadensis L.[2] Elderberry			U		C	U			C			R
Viburnum prunifolium L.[2] Black haw					R	U			R			

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CARYOPHYLLACEAE												
Silene stellata (L.) Ait. f.[2] Starry campion						C			U			
COMPOSITAE												
Ambrosia spp. L.[2] Ragweed		U	U	C	C				C	C		U
Aster spp. L.[2] Aster		C	A	C	A				U	U		U
Erigeron annuus (L.) Pers.[2] Common fleabane			C	C	C				U	U		U
Erigeron philadelphicus L.[2] Marsh fleabane			U	U	C				C			U
Erigeron strigosus Muhl.[2] Daisy fleabane			C	C	C					U		U
Lactuca sp. L.[2] Lettuce						U			U			
Senecio aureus L.[2] Golden ragwort; squaw-weed					U				C	C	U	U
Silphium perfoliatum L.[2] Cup-plant				U	U				C	R		

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COMPOSITAE (concluded)												
Taraxacum officinale Weber[2]												
Common dandelion	A	A	A	C	C							U
CONVOLVULACEAE												
Convolvulus arvensis L.[2]												
Field bindweed				U	U				C			
Ipomoea sp. L.[2]												
Morning glory		U	U	U	C	U						
CORNACEAE												
Cornus drummondii C. A. Mey.[2]												
Rough-leaved dogwood									R			
Cornus florida L.[2]												
Flowering dogwood	R	C	C			C						
CUPRESSACEAE												
Juniperus virginiana L.[2]												
Red cedar		C	C			U						
CYPERACEAE												
Carex cephaloidea Dewey[2]												
Sedge								R			R	

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CYPERACEAE (concluded)												
Carex hystricina Muhl.[2] Sedge								R			R	
Carex lurida Wahlenb.[2] Sedge								U			U	
Carex squarrosa L.[2] Sedge								U			C	
Carex spp. L.[1] Sedge						U		C	U		C	
Scirpus atrovirens Willd.[2] Bulrush								U			C	
Scirpus pendulus Muhl.[2] Bulrush								U			C	
DIOSCOREACEAE												
Dioscorea quaternata (Walt.) J. F. Gmel.[2] Wild yam						U						
EBENACEAE												
Diospyros virginiana L.[2] Common persimmon						C						U

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FAGACEAE												
Fagus grandifolia Ehrh.[2] Beech						U			U			
Quercus alba L.[2] White oak	R	U	U			C						U
Quercus imbricaria Michx.[2] Shingle oak		U	U			C			U			U
Quercus michauxii Nutt.[2] Basket oak									R			
Quercus muhlenbergii Engelm.[2] Yellow chestnut oak		U	U			C			U			U
Quercus palustris Muenchh.[2] Pin oak	R	C	C						U			U
Quercus prinus L.[2] Rock chestnut oak						C			U			
Quercus rubra L.[2] Red oak	R	U	U			C						
Quercus shumardii Buckley[2] Shumard's oak						R						
Quercus velutina Lam.[2] Black oak	R	U	U			C			U			U

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GERANIACEAE												
Geranium maculatum L.[2]												
Wild geranium					U				U			
GRAMINEAE												
Elymus virginicus L.[2]												
Virginia wild rye				C	C				U			
Poa pratensis L.[2]												
Kentucky bluegrass	C	C	C	U	C	U						C
HAMAMELIDACEAE												
Liquidambar styraciflua L.[2]												
Sweet gum	C	C	C			C			U			C
IRIDACEAE												
Iris shrevei Small[2]												
Wild blue iris								R			U	
JUGLANDACEAE												
Carya cordiformis (Wang.) K. Koch[2]												
Bitternut hickory						C			U			U
Carya glabra (Mill.) Sweet[2]												
Pignut hickory						U						

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JUGLANDACEAE (concluded)												
Carya ovalis (Wang.) Sarg.[2] Sweet pignut hickory						C						
Carya ovata (Mill.) K. Koch[2] Shagbark hickory						C			U			U
Carya tomentosa (Poir.) Nutt.[2] Mockernut hickory						C						
Juglans nigra L.[2] Black walnut	C	C	C			C			U			C
JUNCACEAE												
Juncus effusus L. var. *solutus* Fern. & Wieg.[2] Soft rush											A	
Juncus spp. L.[2] Rush									U		C	
LAURACEAE												
Sassafras albidum (Nutt.) Nees[2] Sassafras				R	C	C			C			
LEGUMINOSAE												
Cercis canadensis L.[2] Redbud	C	C	C			A			U			C

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LEGUMINOSAE (concluded)												
Gleditsia triacanthos L.[2] Honey locust	U	C	C			U			C			U
Melilotus alba Desr.[2] White sweet clover		U	U	U	C							C
Melilotus officinalis (L.) Lam.[2] Yellow sweet clover		U	U	U	C							C
Trifolium spp. L.[2] Clover	U	C	C	U	C							C
LEMNACEAE												
Lemna spp. L.[2] Duckweed							A	C			A	
Spirodela polyrhiza (L.) Schleiden[2] Duckweed							A	U			A	
Wolffia sp. Horkel[2] Water meal							A	U			A	
Wolffiella floridana (J. D. Smith) Thompson[2] Duckweed							A	U			A	

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LILIACEAE												
Allium spp. L.[2]												
Wild onion				C	A	C			C			
Polygonatum commutatum (Schult.) A. Dietr.[2]												
Solomon's seal						C			U			
Smilacina racenosa (L.) Desf.[2]												
False Solomon's seal						C			U			
Trillium spp. L.[2]												
Wake robin						A						
MAGNOLIACEAE												
Liriodendron tulipifera L.[2]												
Tulip tree	R	U	U			C						U
MENISPERMACEAE												
Menispermum canadense L.[2]												
Moonseed						C						
MORACEAE												
Maclura pomifera (Raf.) Schneider[2]												
Osage orange				U	U							
Morus rubra L.[2]												
Red mulberry						C			C			

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NYMPHAEACEAE												
Nuphar luteum L. ssp. *macrophyllum* (Small) Beal.[2] Yellow pond lily								C			A	
OLEACEAE												
Fraxinus americana L.[2] White ash	U	C	C			C	U		C	U		
Fraxinus pennsylvanica Marsh. var. *subintegerrima* (Vahl) Fern.[2] Green ash	U	C	C			U	U		C	U		
ONAGRACEAE												
Ludwigia palustris (L.) Ell. var. *americana* (DC.) Fern. & Grisc.[2] Marsh purslane								C			A	
OPHIOGLOSSACEAE												
Botrychium virginianum (L.) Sw.[2] Rattlesnake fern						U						
OXALIDACEAE												
Oxalis dillenii Jacq.[2] Yellow wood sorrel		U	U	U	C	U						

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PAPAVERACEAE												
Sanguinaria canadensis L.[2]												
Bloodroot						A						
PLANTAGINACEAE												
Plantago spp. L.[2]												
Plantains	A	A	A	C	C	U			C			U
PLATANACEAE												
Platanus occidentalis L.[2]												
Sycamore		C	C			U			U	U		U
POLEMONIACEAE												
Phlox divaricata L.[2]												
Blue phlox						C			A			
Polemonium reptans L.[2]												
Jacob's-ladder					U	U			U			
POLYGONACEAE												
Polygonum spp. L.[2]												
Smartweed				U	C	R	C				A	
Rumex crispus L.[2]												
Curly dock				U	C							

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POLYGONACEAE (concluded)												
Rumex verticillatus L.[2] Swamp dock				U	C						C	
POLYPODIACEAE												
Cystopteris fragilis (L.) Bernh.[2] Fragile fern						U						
Dryopteris sp. Adans.[2] Shield fern						U						
RANUNCULACEAE												
Clematis virginiana L.[2] Virgin's bower									C			
ROSACEAE												
Crataegus spp. L.[2] Hawthorn	U	U	U			C			C			
Prunus avium L.[2] Sweet cherry		C	C	U		U			U			
Prunus serotina Ehrh.[2] Wild black cherry						C			U			
Pyrus communis L.[2] Pear		C	C	U		U						

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ROSACEAE (concluded)												
Rosa palustris Marsh.[2] Swampy rose							C				C	
Rubus spp. L.[2] Blackberry				C	C	U						
RUBIACEAE												
Cephalanthus occidentalis L.[2] Buttonbush							C	U			C	
Galium aparine L.[2] Goosegrass				U	U	U		C	C			
Galium circaezans Michx.[2] Wild licorice					R	C		U				
Galium obtusum Bigel. Wild madder						U		U				
Galium triflorum Michx.[2] Sweet-scented bedstraw						U		U				
SALICACEAE												
Populus deltoides Marsh.[2] Cottonwood									C	A	C	

A= Abundant, readily observed
C= Common, usually readily observed
U= Uncommon, but likely to be observed
R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 4. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	CUT FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
SALICACEAE (concluded)												
Salix nigra Marsh.[2]												
Black willow							A		C	A	A	
SAURURACEAE												
Saururus cernuus L.[2]												
Lizard's-tail							C	C			A	
SCROPHULARIACEAE												
Verbascum spp. L.[2]												
Mullens		C	C	C	C							
SIMAROUBACEAE												
Ailanthus altissima (Mill.) Swingle[2]												
Tree-of-heaven	U	U	U									
SMILACACEAE												
Smilax bona-nox L.[2]												
Catbrier				U	U	C			U			
Smilax hispida Muhl.[2]												
Bristly catbrier					U				C			
Smilax spp. L.[2]												
Catbrier						C			U			

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Table 4. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
TAXODIACEAE												
Taxodium distichum (L.) Rich.[2]												
Bald cypress		R	R				R					
TYPHACEAE												
Typha latifolia L.[2]												
Cat-tail								C			A	
ULMACEAE												
Celtis occidentalis L.[2]												
Hackberry		U	U			C			A			
Ulmus alata Michx.[2]												
Winged elm		U	U			C			U			
Ulmus americana L.[2]												
American elm					U	U			C			
Ulmus rubra Muhl.[2]												
Slippery elm		U	U			C			A			
UMBELLIFERAE												
Chaerophyllum procumbens (L.) Crantz[2]												
Wild chervil					U	U			U			
Sanicula spp. L.[2]												
Snakeroot					U	C			U			

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Table 4. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
UMBELLIFERAE (concluded)												
Torilis japonica (Houtt.) DC.[2]												
Hedge parsley				U	U				U			
URTICACEAE												
Urtica dioica L.[2]												
Stinging nettle						U			C	U		
VIOLACEAE												
Viola striata Ait.[2]												
Cream violet						C			C			
Viola spp. L.[2]												
Violet		U	U			A			A	C		
VITACEAE												
Parthenocissus quinquefolia (L.) Planch.[2]												
Virginia creeper					U	A			U	U		
Vitis aestivalis Michx.[2]												
Summer grape						U						
Vitis riparia Michx.												
Riverbank grape									R	R		
Vitis vulpina L.[2]												
Frost grape									C	C		

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Table 4. (concluded).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
VITACEAE (concluded)												
Vitis spp. L.[2]												
Wild grape						C			C	C		

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Table 5. Birds known or likely to occur in the Cape La Croix Creek watershed.

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
ACCIPITRIDAE												
Accipiter cooperii (Bonaparte) Cooper's Hawk				R	R	R						
Accipiter gentilis (Linnaeus) Goshawk						R						
Accipiter striatus Vieillot Sharp-shinned Hawk				U	U	U						
Aquila chrysaetos (Linnaeus) Golden Eagle										R		
Buteo jamaicensis (Gmelin)[1] Red-tailed Hawk			U	C	C	C	C		C			U
Buteo lagopus (Pontoppidan) Rough-legged Hawk				U	U							
Buteo lineatus (Gmelin)[1] Red-shouldered Hawk				U	U	U	C		C			
Buteo platypterus (Vieillot)[1] Broad-winged Hawk				C	C							
Circus cyaneus (Linnaeus)[1] Marsh Hawk				C	C						C	

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
ACCIPITRIDAE (concluded)												
Haliaeetus leucocephalus alascanus Townsend[1] Bald Eagle (Northern)						R	R		R	R		
Ictinia misisippiensis (Wilson)[1] Mississippi Kite		R	R	R	R	R	R	R	R	R	R	
ALAUDIDAE												
Eremophila alpestris (Linnaeus)[1] Horned Lark				C	C							
ALCEDINIDAE												
Megaceryle alcyon (Linnaeus)[1] Belted Kingfisher								C	C	C		
ANATIDAE												
Aix sponsa (Linnaeus)[2] Wood Duck								C	C	C		
Anas acuta Linnaeus[1] Pintail								C		C		
Anas americana Gmelin[1] American Wigeon								U		U		
Anas clypeata (Linnaeus)[1] Northern Shoveler								U		U	U	

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
ANATIDAE (continued).												
Anas crecca carolinensis Gmelin[1] Green-winged Teal								U		U	U	
Anas discors Linnaeus[1] Blue-winged Teal								C		C	C	
Anas platyrhynchos Linnaeus[1] Mallard								C		C	C	
Anas rubripes Brewster[1] Black Duck								U		U	U	
Anas strepera Linnaeus[1] Gadwall								U		U	U	
Anser albifrons (Scopoli) White-fronted Goose										U		
Aythya affinis (Eyton)[1] Lesser Scaup								C		C	C	
Aythya americana (Eyton)[1] Redhead								U		U		
Aythya collaris (Donovan)[1] Ring-necked Duck								C		C		
Aythya valisineria (Wilson)[1] Canvasback								U		U	U	

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
ANATIDAE (continued)												
Branta canadensis (Linnaeus)[1] Canada Goose								A		A	A	
Bucephala albeola (Linnaeus)[1] Bufflehead								U		U	U	
Bucephala clangula (Linnaeus)[1] Common Goldeneye								R		C	R	
Chen caerulescens (Linnaeus)[1] Snow Goose								A		A	A	
Lophodytes cucullatus (Linnaeus)[1] Hooded Merganser								R		R		
Mergus merganser Linnaeus[1] Common Merganser								R		R		
Mergus serrator Linnaeus Red-breasted Merganser								U		U		
Olor columbianus (Ord) Whistling Swan								R				
Oxyura jamaicensis (Gmelin)[1] Ruddy Duck								R		R	R	

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
APODIDAE												
Chaetura pelagica (Linnaeus)[2] Chimney Swift	C	C	C	C	C			C	C	C		C
ARDEIDAE												
Ardea herodias Linnaeus[1] Great Blue Heron								U	U	U	U	
Botaurus lentiginosus (Rackett) American Bittern								U			U	
Bubulcus ibis (Linnaeus) Cattle Egret				U				U	U	U	U	
Butorides virescens (Linnaeus)[2] Green Heron								C	C	C	C	
Casmerodias albus (Linnaeus)[1] Great Egret								U	U	U	U	
Egretta thula (Molina)[1] Snowy Egret								R	R	R	R	
Florida caerulea (Linnaeus)[1] Little Blue Heron								U	U	U	U	
Hydranassa tricolor (Müller) Louisiana Heron								R	R	R	R	

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
ARDEIDAE (concluded)												
Ixobrychus exilis (Gmelin) Least Bittern										C	C	
Nyctanassa violacea (Linnaeus)[1] Yellow-crowned Night Heron		U	U			U	U	U	U	U	U	
Nycticorax nycticorax (Linnaeus) Black-crowned Night Heron							U	U	U	U	U	
BOMBYCILLIDAE												
Bombycilla cedrorum Vieillot[1] Cedar Waxwing		U	U		U							U
CAPRIMULGIDAE												
Caprimulgus carolinensis Gmelin[1] Chuck-will's-widow		U	U			U						
Caprimulgus vociferus Wilson[1] Whip-poor-will						U			U			
Chordeiles minor (Forster)[2] Common Nighthawk	C	C	C	C	C	C						C
CATHARTIDAE												
Cathartes aura (Linnaeus)[2] Turkey Vulture				C	C	C						

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
CATHARTIDAE (concluded)												
Coragyps atratus (Bechstein)												
Black Vulture				R	R	R			R			
CERTHIIDAE												
Certhia familiaris Linnaeus[1]												
Brown Creeper						C						
CHARADRIIDAE												
Charadrius semipalmatus Bonaparte												
Semipalmated Plover								U	U	U	U	
Charadrius vociferus Linnaeus[2]												
Killdeer		C	C	C	C			C	C	C	C	
Pluvialis dominica (Müller)[1]												
American Golden Plover										U	U	
CICONIIDAE												
Mycteria americana Linnaeus												
Wood Stork								R	R		R	
COLUMBIDAE												
Columba livia Gmelin[2]												
Rock Dove	C	C	C	C								C

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
COLUMBIDAE (concluded)												
Zenaida macroura (Linnaeus)[2]												
Mourning Dove		C	C	C	C				C	C		C
CORVIDAE												
Corvus brachyrhynchos Brehm[2]												
Common Crow		U	U	C	C	C			C	U	U	
Corvus ossifragus Wilson[1]												
Fish Crow									R	R		
Cyanocitta cristata (Linnaeus)[2]												
Blue Jay		C	C	U		C			U			C
CUCULIDAE												
Coccyzus americanus (Linnaeus)[1]												
Yellow-billed Cuckoo							C		C	C		
Coccyzus erythropthalmus (Wilson)												
Black-billed Cuckoo							U		U	U		
FALCONIDAE												
Falco peregrinus Tunstall												
Peregrine Falcon					R	R						
Falco sparverius Linnaeus[2]												
American Kestrel (Sparrow Hawk)			C	C	C							

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
FRINGILLIDAE												
Ammodramus savannarum (Gmelin) Grasshopper Sparrow			U	U	U							
Ammospiza leconteii (Audubon) LeConte's Sparrow						R						
Calcarius lapponicus (Linnaeus) Lapland Longspur					R							
Cardinalis cardinalis (Linnaeus)[2] Cardinal		C	C	C		C						C
Carpodacus purpureus (Gmelin)[1] Purple Finch		R	U			U						U
Chondestes grammacus (Say)[1] Lark Sparrow				U	U							
Guiraca caerulea (Linnaeus)[1] Blue Grosbeak			U			U						
Hesperiphona vespertina (Cooper)[1] Evening Grosbeak			U			U						
Junco hyemalis (Linnaeus)[1] Dark-eyed Junco		C	A		C							C

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
FRINGILLIDAE (continued)												
Melospiza georgiana (Latham)[2] Swamp Sparrow					U		U		U		C	
Melospiza lincolnii (Audubon) Lincoln's Sparrow						R						
Melospiza melodia (Wilson)[1] Song Sparrow		U	C	C	C							
Passerculus sandwichensis (Gmelin) Savannah Sparrow					R							
Passerina cyanea (Linnaeus)[1] Indigo Bunting				C	C	C			C			
Passerella iliaca (Merrem) Fox Sparrow						C			U			
Pheucticus ludovicianus (Linnaeus)[1] Rose-breasted Grosbeak		U	U	U		U						
Pipilo erythrophthalmus (Linnaeus)[1] Rufous-sided Towhee		R	U	C	C							
Pooecetes gramineus (Gmelin) Vesper Sparrow					R							
Spinus pinus (Wilson)[1] Pine Siskin		R	R			R						

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
FRINGILLIDAE (concluded)												
Spinus tristis (Linnaeus)[1] American Goldfinch		U	C	C	C							U
Spiza americana (Gmelin)[1] Dickcissel			C	C	C							
Spizella arborea (Wilson)[1] Tree Sparrow			C		C							C
Spizella passerina (Bechstein)[1] Chipping Sparrow		C	C	C		C						
Spizella pusilla (Wilson)[1] Field Sparrow				U	C							
Zonotrichia albicollis (Gmelin)[1] White-throated Sparrow		U	U	U	C							U
Zonotrichia leucophrys (Forster)[1] White-crowned Sparrow			U	C	C							U
Zonotrichia querula (Nuttall)[1] Harris' Sparrow						R						
GAVIIDAE												
Gavia immer (Brünnich)[1] Common Loon								R		R		

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
GAVIIDAE (concluded)												
Gavia stellata (Pontoppidan) Red-throated Loon								R		R		
HIRUNDINIDAE												
Hirundo rustica Linnaeus[2] Barn Swallow			U	C	C							
Iridoprocne bicolor (Vieillot)[1] Tree Swallow									U			
Petrochelidon pyrrhonota (Vieillot) Cliff Swallow									U	U		
Progne subis (Linnaeus)[1] Purple Martin		C	C	C								
Riparia riparia (Linnaeus) Bank Swallow									U	U		
Stelgidopteryx ruficollis (Vieillot)[1] Rough-winged Swallow									U	U		
ICTERIDAE												
Agelaius phoeniceus (Linnaeus)[2] Redwinged Blackbird			C	A	A						A	

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
ICTERIDAE (concluded)												
Dolichonyx oryzivorus (Linnaeus)[1] Bobolink			U		U							
Euphagus carolinus (Müller) Rusty Blackbird									R			
Euphagus cyanocephalus (Wagler)[1] Brewer's Blackbird											R	
Icterus galbula (Linnaeus)[1] Northern Oriole		R	U			U						
Icterus spurius (Linnaeus)[1] Orchard Oriole		U	U	U		U						
Molothrus ater (Boddaert)[1] Brown-headed Cowbird		U	C	C	C	U						C
Quiscalus quiscula (Linnaeus)[2] Common Grackle		U	C	A	A							A
Sturnella magna (Linnaeus)[2] Eastern Meadowlark			C	A	A							
Sturnella neglecta Audubon[1] Western Meadowlark				U	U							

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
LANIIDAE												
Lanius ludovicianus Linnaeus[1]												
Loggerhead Shrike				U	U							
LARIDAE												
Chilidonias niger (Linnaeus)												
Black Tern										C		
Larus argentatus Pontoppidan[1]												
Herring Gull								C		C		
Larus delawarensis Ord[1]												
Ring-billed Gull								C		C		
Larus philadelphia (Ord)												
Bonaparte's Gull								R		R		
Sterna albifrons Pallas												
Least Tern										C		
Sterna hirundo Linnaeus												
Common Tern										C		
MELEAGRIDIDAE												
Meleagris gallopavo Linnaeus[1]												
Turkey					U	U			U			

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
MIMIDAE												
Dumatella carolinensis (Linnaeus)[1] Gray Catbird		U	C		C							
Mimus polyglottos (Linnaeus)[2] Mockingbird		U	C	C	C							
Toxostoma rufum (Linnaeus)[1] Brown Thrasher		U	C	C	C	C						
MOTACILLIDAE												
Anthus spinoletta (Linnaeus) Water Pipit									R			
PANDIONIDAE												
Pandion haliaetus (Linnaeus)[1] Osprey						R	R		R	R		
PARIDAE												
Parus atricapillus Linnaeus Black-capped Chickadee		R	R			R						R
Parus bicolor Linnaeus[1] Tufted Titmouse		C	C			C						C
Parus carolinensis Audubon[1] Carolina Chickadee		C	C			C						C

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
PARULIDAE												
Dendroica castanea (Wilson) Bay-breasted Warbler						U	U		U			
Dendroica cerulea (Wilson) Cerulean Warbler						C	C		C			
Dendroica coronata (Linnaeus)[1] Yellow-rumped (Myrtle) Warbler		U	U			U			U			
Dendroica discolor (Vieillot) Prairie Warbler						U	U		U			
Dendroica dominica (Linnaeus)[1] Yellow-throated Warbler						U	U		U			
Dendroica fusca (Müller) Blackburnian Warbler						C	C		C			
Dendroica magnolia (Wilson) Magnolia Warbler						C	C		C			
Dendroica palmarum (Gmelin)[1] Palm Warbler						U	U		U			
Dendroica pensylvanica (Linnaeus)[1] Chestnut-sided Warbler						U	U		U			
Dendroica petechia (Linnaeus)[1] Yellow Warbler						U	U		U			

A= Abundant, readily observed
C= Common, usually readily observed
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R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
PARULIDAE (continued)												
Dendroica pinus (Wilson)[1] Pine Warbler						R						
Dendroica striata (Forster)[1] Blackpoll Warbler						U						
Dendroica tigrina (Gmelin) Cape May Warbler						C	C		C			
Dendroica virens (Gmelin)[1] Black-throated Green Warbler						C	C		C			
Geothlypis trichas (Linnaeus)[2] Common Yellowthroat					C				C		C	
Helmitheros vermivorus (Gmelin) Worm-eating Warbler						U	U		U			
Icteria virens (Linnaeus)[1] Yellow-breasted Chat						C	C		C			
Limnothlypis swainsonii (Audubon) Swainson's Warbler						R	R		R			
Mniotilta varia (Linnaeus)[1] Black-and-white Warbler						R						

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
PARULIDAE (continued)												
Oporornis formosus (Wilson)[1] Kentucky Warbler						U	U		U			
Oporornis philadelphia (Wilson) Mourning Warbler					U							
Parula americana (Linnaeus)[1] Northern Parula Warbler						C	C		C			
Protonotaria citrea (Boddaert)[1] Prothonotary Warbler									C			
Seiurus aurocapillus (Linnaeus) Ovenbird						C	C		C			
Seiurus motacilla (Vieillot)[1] Louisiana Waterthrush							U		U			
Seiurus noveboracensis (Gmelin)[1] Northern Waterthrush							U		U			
Setophaga ruticilla (Linnaeus)[1] American Redstart			R	U	U							
Vermivora celata (Say) Orange-crowned Warbler						U	U		U			
Vermivora chrysoptera (Linnaeus)[1] Golden-winged Warbler					U							

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
PARULIDAE (concluded)												
Vermivora peregrina (Wilson)[1] Tennessee Warbler						U	U		U			
Vermivora pinus (Linnaeus) Blue-winged Warbler						U	U		U			
Vermivora ruficapilla (Wilson) Nashville Warbler						C	C		C			
Wilsonia canadensis (Linnaeus) Canada Warbler						U	U		U			
Wilsonia citrina (Boddaert) Hooded Warbler						U	U		U			
Wilsonia pusilla (Wilson) Wilson's Warbler						U	U		U			
PELECANIDAE												
Pelecanus erythrorhynchos Gmelin White Pelican								R		R		
PHALACROCORACIDAE												
Phalacrocorax auritus (Lesson) Double-crested Cormorant								R		R		

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
PHALAROPODIDAE												
Steganopus tricolor Vieillot												
Wilson's Phalarope										R	R	
PHASIANIDAE												
Colinus virginianus (Linnaeus)[2]												
Bobwhite		U	C	C	C							C
PICIDAE												
Centurus carolinus (Linnaeus)[1]												
Red-bellied Woodpecker		U	C			C	C		C			
Colaptes auratus (Linnaeus)[1]												
Common Flicker		C	C	U	C	C	U		U			
Dendrocopos pubescens (Linnaeus)[1]												
Downy Woodpecker		C	C	U		C	U		U			
Dendrocopos villosus (Linnaeus)[1]												
Hairy Woodpecker		U	C	U		C	U		U			
Dryocopus pileatus (Linnaeus)[1]												
Pileated Woodpecker		U	U			R	R		R			
Melanerpes erythrocephalus (Linnaeus)[1]												
Red-headed Woodpecker		R	U			C	C		C			

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAFE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
PICIDAE (concluded)												
Sphyrapicus varius (Linnaeus)[1] Yellow-bellied Sapsucker		R	U			C	C		C			
PLOCEIDAE												
Passer domesticus (Linnaeus)[2] House Sparrow	C	A	A	A	A							A
PODICIPEDIDAE												
[illegible] (Linnaeus) Horned Grebe								R		R		
Podilymbus podiceps (Linnaeus)[1] Pied-billed Grebe								C		C	R	
RALLIDAE												
Fulica americana Gmelin[1] American Coot								A		C	A	
Gallinula chloropus (Linnaeus) Common Gallinule								U			U	
Porphyrula martinica (Linnaeus) Purple Gallinule								R			R	
Porzana carolina (Linnaeus)[1] Sora											U	

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
RALLIDAE (concluded)												
Rallus elegans Audubon King Rail											U	
Rallus limicola Vieillot Virginia Rail											R	
RECURVIROSTRIDAE												
Recurvirostra americana Gmelin American Avocet												
SCOLOPACIDAE												
Actitis macularia (Linnaeus)[1] Spotted Sandpiper									C	C		
Bartramia longicauda (Bechstein) Upland Sandpiper										U	U	
Calidris alpina (Linnaeus) Dunlin								U	U	U		
Calidris fuscicollis (Vieillot) White-rumped Sandpiper									R	R	R	
Calidris mauri (Cabanis) Western Sandpiper										R	R	

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
SCOLOPACIDAE (concluded)												
Calidris melanotos (Vieillot)[1] Pectoral Sandpiper										C	C	
Calidris minutilla (Vieillot) Least Sandpiper										U	U	
Limnodromus griseus (Linnaeus) Short-billed Dowitcher									C	C		
Gallinago gallinago (Linnaeus)[2] Common Snipe									C	C	C	
Philohela minor (Gmelin)[1] American Woodcock				U	U				U		U	
Tringa flavipes (Gmelin)[1] Lesser Yellowlegs										U	U	
Tringa melanoleuca (Gmelin)[1] Greater Yellowlegs									U	U	U	
Tringa solitaria Wilson Solitary Sandpiper										U	U	
SITTIDAE												
Sitta canadensis (Linnaeus) Red-breasted Nuthatch		U	U			U						U

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
SITTIDAE (concluded)												
Sitta carolinensis Latham												
White-breasted Nuthatch		C	C			C						C
STRIGIDAE												
Asio flammeus (Pontoppidan)												
Short-eared Owl					U							
Bubo virginianus (Gmelin)[1]												
Great Horned Owl				U	U	U	U		U			
Otus asio (Linnaeus)												
Screech Owl			U	C	C	C			C			
Strix varia Barton[1]												
Barred Owl				U		C			C		C	
STURNIDAE												
Sturnus vulgaris Linnaeus[2]												
Starling	U	A	A	C	C							A
SYLVIIDAE												
Polioptila caerulea (Linnaeus)[1]												
Blue-gray Gnatcatcher						C			C			
Regulus calendula (Linnaeus)[1]												
Ruby-crowned Kinglet			U			U						U

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
SYLVIIDAE (concluded)												
Regulus satrapa Lichtenstein[1]												
Golden-crowned Kinglet			U			U						U
THRAUPIDAE												
Piranga olivacea (Gmelin)[1]												
Scarlet Tanager		U	U	U								
Piranga rubra (Linnaeus)[1]												
Summer Tanager		U	U	U								
THRESKIORNITHIDAE												
Eudocimus albus (Linnaeus)												
White Ibis											R	
Plegadis falcinellus (Linnaeus)												
Glossy Ibis											R	
TROCHILIDAE												
Archilochus colubris (Linnaeus)[1]												
Ruby-throated Hummingbird		R	U	U	U	U			U			
TROGLODYTIDAE												
Cistothorus platensis (Latham)												
Short-billed Marsh Wren							U		U			

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
TROGLODYTIDAE (concluded)												
Telmatodytes palustris (Wilson) Long-billed Marsh Wren							U		U			
Thryomanes bewickii (Audubon)[1] Bewick's Wren						R						
Thryothorus ludovicianus (Latham)[1] Carolina Wren		U	C		C	C						
Troglodytes aedon Vieillot[1] House Wren		C	C		C							
Troglodytes troglodytes (Linnaeus) Winter Wren									U			
TURDIDAE												
Catharus fuscescens (Stephens) Veery						U						
Catharus guttatus (Pallas)[1] Hermit Thrush						C			C			
Catharus minimus (Lafresnaye)[1] Gray-cheeked Thrush						U						
Catharus ustulatus (Nuttall)[1] Swainson's Thrush						U						

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
TURDIDAE (concluded)												
Hylocichla mustelina (Gmelin)[1]												
Wood Thrush			U			C			C			
Sialia sialis (Linnaeus)[1]												
Eastern Bluebird		R	U	C	C							
Turdus migratorius Linnaeus[2]												
American Robin	U	A	A	U								A
TYRANNIDAE												
Contopus virens (Linnaeus)[1]												
Eastern Wood Pewee						C			C			
Empidonax flaviventris (Baird & Baird)[1]												
Yellow-bellied Flycatcher						U	U		U			
Empidonax minimus (Baird & Baird)												
Least Flycatcher						C	C		C			
Empidonax traillii (Audubon) complex												
Traill's Flycatcher					U							
Empidonax virescens (Vieillot)[1]												
Acadian Flycatcher						C	C		C			
Muscivora forficata (Gmelin)												
Scissor-tailed Flycatcher					R							

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Table 5. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
TYRANNIDAE (concluded)												
Myiarchus crinitus (Linnaeus)[1]												
Great Crested Flycatcher					U	U			U			
Nuttalornis borealis (Swainson)												
Olive-sided Flycatcher						C			C			
Sayornis phoebe (Latham)[2]												
Eastern Phoebe						C						
Tyrannus tyrannus (Linnaeus)[1]												
Eastern Kingbird				C	C							
Tyrannus verticalis Say												
Western Kingbird				R	R							
TYTONIDAE												
Tyto alba (Scopoli)												
Barn Owl				R	R							
VIREONIDAE												
Vireo bellii Audubon[1]												
Bell's Vireo						R	R		R			
Vireo flavifrons Vieillot[1]												
Yellow-throated Vireo						U	U		U			

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Table 5. (concluded).

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VIREONIDAE (concluded)												
Vireo gilvus (Vieillot)[1]												
Warbling Vireo						C	C		C			
Vireo griseus (Boddaert)[2]												
White-eyed Vireo				U	C	C			U	C		
Vireo olivaceus (Linnaeus)[1]												
Red-eyed Vireo						C	C	C	C			
Vireo philadelphicus (Cassin)												
Philadelphia Vireo						U	U		U			

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Table 6. Mammals known or likely to occur in the Cape La Croix Creek watershed.

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
CANIDAE												
Canis latrans Say[1]												
Coyote				R	R							
Urocyon cinereoargenteus (Schreber)[1]												
Gray fox					R	R	R		R			
Vulpes fulva (Desmarest)[1]												
Red fox				U	U	R	R		R			R
CASTORIDAE												
Castor canadensis Kuhl[1]												
Beaver							C	C	U	U	U	
CERVIDAE												
Odocoileus virginianus (Zimmermann)[2]												
White-tailed deer			R	U	U	C			C			C
CRICETIDAE												
Microtus ochrogaster (Wagner)												
Prairie vole				C	C							
Neotoma floridana (Ord)												
Eastern wood rat					U	R					R	
Ondatra zibethicus (Linnaeus)[2]												
Muskrat							C	A	A	C	A	

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[2]Presence verified during this inventory

Table 6. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
CRICETIDAE (concluded)												
Oryzomys palustris (Harlan) Rice rat					U	U			C		C	
Peromyscus leucopus (Rafinesque) White-footed mouse			R	U	U	A			A		C	
Peromyscus maniculatus (Wagner) Deer mouse			U	U	A							
Peromyscus nuttalli (Harlan) Golden mouse					R				C		*U*	
Pitymys pinetorum (LeConte) Pine vole					R	R			R			R
Reithrodontomys megalotis (Baird) Western harvest mouse			U	C	C						U	
Sigmodon hispidus Say & Ord Common cotton rat				U	U							
Synaptomys cooperi Baird Southern bog lemming				R	R				U		U	
DIDELPHIDAE												
Didelphis marsupialis Linnaeus[2] Opossum		U	C	C	A	C	R		A			A

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Table 6. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
FELIDAE												
Lynx rufus (Schreber)[1]												
Bobcat						R	R		R		R	
LEPORIDAE												
Sylvilagus aquaticus (Bachman)												
Swamp rabbit							R	R	R	R	R	
Sylvilagus floridanus (Allen)[2]												
Eastern cottontail		C	A	A	A	U			U		U	A
MURIDAE												
Mus musculus Linnaeus												
House mouse	A	A	A	A	C							
Rattus norvegicus (Berkenhout)[2]												
Norway rat	A	C	C	A	U							
Rattus rattus (Linnaeus)												
Black rat	R	R										
MUSTELIDAE												
Lutra canadensis (Schreber)												
River otter								R		R		
Mephitis mephitis (Schreber)[1]												
Striped skunk			U	C	C	C		C	C			

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Table 6. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
MUSTELIDAE (concluded)												
Mustela frenata Lichtenstein												
Long-tailed weasel					R	R						
Mustela vison Schreber[1]												
Mink				R	R		R	U	U	U		
Spilogale putorius (Linnaeus)												
Spotted skunk				R	R							
PROCYONIDAE												
Procyon lotor (Linnaeus)[2]												
Raccoon		R	U	A	C	C	C	C	C	C	U	C
SCIURIDAE												
Glaucomys volans (Linnaeus)												
Southern flying squirrel						U			R			U
Marmota monax (Linnaeus)[2]												
Woodchuck		U	C	A	A	U						U
Sciurus carolinensis Gmelin[2]												
Eastern gray squirrel	R	A	A	A		C			A			A
Sciurus niger Linnaeus[2]												
Eastern fox squirrel	R	A	A	A		A			C			A

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Table 6. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
SCIURIDAE (concluded)												
Tamias striatus (Linnaeus)												
Eastern chipmunk			R	R	R	U						U
SORICIDAE												
Blarina brevicauda (Say)												
Short-tailed shrew		U	C	C	A	C			A			A
Cryptotis parva (Say)												
Least shrew				U	C	U			U		U	U
TALPIDAE												
Scalopus aquaticus (Linnaeus)												
Eastern mole		U	C	A	A	A			A			C
VESPERTILIONIDAE												
Corynorhinus rafinesqueii (Lesson)												
Western lump-nosed bat*				R	R	R	R		R			R
Eptesicus fuscus (Beauvois)												
Big brown bat		U	U	C	C	C	C	C	C	C	C	U
Lasionycteris noctivagans (LeConte)												
Silver-haired bat					U	C	C	U	C	U	U	C
Lasiurus borealis (Müller)												
Red bat	U	U	U	C	C	C	C	C	C	C	C	U

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*Schwartz and Schwartz (1959) separate this into *C. rafinesqueii* and *C. macrotis*, both occurring in the project area.

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[2]Presence verified during this inventory

Table 6. (concluded).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
VESPERTILIONIDAE (concluded)												
Lasiurus cinereus (Beauvois) Hoary bat				R	R	R	R	R	R			R
Myotis grisescens Howell Gray bat		U	C	C	C	R	R	C	C	C	C	U
Myotis keenii (Merriam) Keen's bat		R	R	U	U	R	R	U	U	U	U	R
Myotis lucifugus (LeConte) Little brown bat	U	C	A	A	A	U	U	A	A	A	A	C
Myotis sodalis Miller & Allen Indiana bat				R	R			R	R	R	R	
Myotis subulatus (Say) Least bat				R	R			R	R	R	R	
Nycticeius humeralis (Rafinesque) Evening bat		R	R	R	R	U	U		U			U
Pipistrellus subflavus (Cuvier) Eastern pipistrel	U	U	U	C	C	C	C	C	C	C	C	U
ZAPODIDAE												
Zapus hudsonius (Zimmermann) Meadow jumping mouse					R						R	

A- Abundant, readily observed
C- Common, usually readily observed
U- Uncommon, but likely to be observed
R- Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

competition and predators have allowed the more tolerant city species to maintain large populations.

City habitat presently is being expanded rapidly west and southwest of Cape Girardeau, mainly along U. S. highway 61. It is interesting to note that habitat succession in the Cape Girardeau area from agricultural to exurban to suburban apparently does not climax in city habitat. Rather, a second series of stages (agricultural to old field to city) produces city habitat. It should be stated that the old field stage at best lasts two or three years.

Suburban

Suburban habitat, 14.6% of the project area (2,063.6 acres), exists principally as one more-or-less contiguous block of 1,788.7 acres in the city of Cape Girardeau. Additional major habitat concentrations are west and south of the city proper.

Suburban habitat is suitable for a greater number of vertebrates than is city habitat. This inventory records 73 species as known or likely to occur in suburban habitat, including one amphibian, two reptiles, 52 birds, and 18 mammals.

Among the amphibians (Table 7), only toads are adapted to the generally dry conditions of suburban habitat. Their activities are noticed especially on warm, rainy spring evenings.

Garter snakes are the only reptiles common in suburban habitat (Table 8). They are especially abundant in vacant lots and in accumulations of rubble in waste areas.

Birds are abundant in suburban habitat (Table 5). In fact, some species, such as the robin and starling, utilize this as their prime habitat and can be very abundant. Most other species, however, are associated with backyard areas where open areas of lawn alternate with shrubs and trees, producing a forest-edge effect.

This forest-edge effect also is attractive to most of the mammals occurring in suburban areas (Table 6), especially the squirrels and cottontail. Only the house mouse and the rats move into man's dwellings.

Bratton (1974) states that the land west and northwest from Cape Girardeau is most suitable for expansion of this urban habitat. It was noted by us that urban development is, in fact, spreading to these lands. Suburban habitat is the end product of habitat succession from agricultural to exurban to suburban. This succession apparently reduces habitat diversity as fewer numbers of species of all groups of terrestrial vertebrates exist here than in agricultural habitat. Numbers of species alone, however, do not clearly reflect the extent of habitat change. Suburban habitat is essentially forest edge habitat. As such, many of the species included here are different from those occupying agricultural habitat. The change, then, is qualitative as well as quantitative.

Table 7. Amphibians known or likely to occur in the Cape La Croix Creek watershed.

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
AMBYSTOMATIDAE												
Ambystoma maculatum (Shaw) Spotted salamander							C	U	C		C	
Ambystoma opacum (Gravenhorst) Marbled salamander							C	U	C		C	
Ambystoma talpoideum (Holbrook) Mole salamander							R		R		R	
Ambystoma texanum (Matthes) Small-mouthed salamander							R	U	R		R	
Ambystoma tigrinum tigrinum (Green) Eastern tiger salamander							R	U	R		R	
BUFONIDAE												
Bufo americanus charlesmithi Bragg Dwarf american toad					R	R	R		R			
Bufo woodhousei fowleri Hinckley Fowler's toad		C	A	A	A	A	A		A			A
HYLIDAE												
Acris crepitans blanchardi Harper Blanchard's cricket frog							C	A	A	A	A	

A= Abundant, readily observed
C= Common, usually readily observed
U= Uncommon, but likely to be observed
R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 7. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
HYLIDAE (concluded)												
Hyla vivosa avivoca Viosca Western bird-voiced treefrog							R		R		R	
Hyla cinerea (Schneider) Green treefrog							R	U	R		U	
Hyla crucifer crucifer Wied Northern spring peeper							A	C	A		C	
Hyla versicolor versicolor LeConte Eastern gray treefrog							C	U	C		C	
Pseudacris triseriata feriarum (Baird) Upland chorus frog						U	C	A	C	C	A	
PELOBATIDAE												
Scaphiopus holbrooki (Harlan) Eastern spadefoot				U	U		U		U			
PLETHODONTIDAE												
Desmognathus fuscus conanti Rossman Dusky salamander						C	C		C			
Eurycea longicauda longicauda (Green) Long-tailed salamander						U	R		R			

A= Abundant, readily observed
C= Common, usually readily observed
U= Uncommon, but likely to be observed
R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 7. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
PLETHODONTIDAE (concluded)												
Eurycea lucifuga Rafinesque Cave salamander						U	R		R			
Plethodon cinereus (Green) Red-backed salamander						R						
Plethodon glutinosus glutinosus (Green) Slimy salamander							C		C			
PROTEIDAE												
Necturus maculosus maculosus (Rafinesque) Mud puppy								C	C	C	U	
RANIDAE												
Rana areolata circulosa Rice & Davis Gopher frog					R				R	R		
Rana blairi Mecham, Littlejohn, Oldham, Brown, & Brown Leopard frog								U	U	U	U	
Rana catesbeiana Shaw[2] Bullfrog							C	A	A	A	A	
Rana clamitans melanota (Rafinesque) Green frog								U			U	

A= Abundant, readily observed
C= Common, usually readily observed
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Table 7. (concluded).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
RANIDAE (concluded)												
Rana palustris LeConte												
Pickerel frog								U			U	
Rana sylvatica sylvatica LeConte												
Eastern wood frog						R	R		R			
Rana utricularia Harlan[2]												
Southern leopard frog				U	C		U	A	A	A	A	
SALAMANDRIDAE												
Diemictylus viridescens louisianensis (Wolterstorff)												
Central newt							U	U	U		U	
SIRENIDAE												
Siren intermedia nettingi Goin[2]												
Western lesser siren								U			U	

A= Abundant, readily observed
C= Common, usually readily observed
U= Uncommon, but likely to be observed
R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 8. Reptiles known or likely to occur in the Cape La Croix Creek watershed.

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
ANGUIDAE												
Ophisaurus attenuatus attenuatus Cope												
Western slender glass lizard			R	R	R	R						
CHELYDRIDAE												
Chelydra serpentina serpentina (Linnaeus)												
Common snapping turtle								C	C	C	C	
Macroclemys temminckii (Troost)												
Alligator snapping turtle								R		R	R	
COLUBRIDAE												
Carphophis amoenus vermis (Kennicott)												
Western worm snake					C	C						
Coluber constrictor flaviventris Say												
Eastern yellow-bellied racer; blue racer				C	C	C						
Coluber constrictor priapus Dunn & Wood												
Southern black racer				U	U	U		U	U			
Diadophis punctatus arnyi Kennicott												
Prairie ringneck snake				C	A	A						
Diadophis punctatus stictogenys Cope[1]												
Mississippi ringneck snake					U	U						

A= Abundant, readily observed
C= Common, usually readily observed
U= Uncommon, but likely to be observed
R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 8. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
COLUBRIDAE (continued)												
Elaphe guttata emoryi (Baird & Girard) Great plains rat snake						U			R			
Elaphe obsoleta obsoleta (Say)[1] Black rat snake			C	C	C	C			U			
Elaphe obsoleta spiloides Duméril, Bibron, & Duméril Gray rat snake						R			R			
Farancia abacura reinwardti Schlegel Western mud snake											R	
Heterodon platyrhinos Latreille Eastern hognose snake			U	C	C	C			C			
Lampropeltis calligaster calligaster (Harlan) Prairie king snake			U	C	C	C						
Lampropeltis getulus holbrooki Stejneger Speckled king snake				U	U	U			R			
Lampropeltis triangulum suspila (Cope) Red milk snake			R	R	R	R						
Masticophis flagellum flagellum (Shaw) Eastern coachwhip					R	R			R			

A= Abundant, readily observed
C= Common, usually readily observed
U= Uncommon, but likely to be observed
R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 8. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
COLUBRIDAE (continued)												
Natrix cyclopion cyclopion (Duméril, Bibron, & Duméril) Green water snake								R	R	R		
Natrix erythrogaster flavigaster Conant Yellow-bellied water snake								R	R	R		
Natrix grahami (Baird & Girard) Graham's water snake								U	U	U		
Natrix rhombifera rhombifera (Hallowell)[1] Diamond-backed water snake								C	U	U	C	
Natrix sipedon confluens Blanchard Broad-banded water snake								C	C	C	U	
Natrix sipedon pleuralis Cope Midland water snake								C	U	U	C	
Opheodrys aestivus (Linnaeus)[2] Rough green snake				U	U	U		C	C		C	
Storeria dekayi wrightorum Trapido Midland brown snake		U	U	U	U	U			U			U
Storeria occipitomaculata occipitomaculata (Storer) Northern red-bellied snake						U			U			

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[2]Presence verified during this inventory

Table 8. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
COLUBRIDAE (concluded)												
Tantilla gracilis hallowelli Cope Northern flat-headed snake						U			R			
Thamnophis sauritus sauritus (Say) Western ribbon snake								U	U	U	U	
Thamnophis sirtalis sirtalis (Linnaeus) Eastern garter snake		C	A	A	A			U	U	U	U	C
Virginia striatula (Linnaeus) Rough earth snake						U						
Virginia valeriae elegans Kennicott Western earth snake						R			R			
CROTALIDAE												
Agkistrodon contortrix contortrix (Linnaeus)[1] Southern copperhead					R	R			R			
Agkistrodon contortrix mokeson (Daudin) Northern copperhead						C						
Agkistrodon piscivorus leucostoma (Troost) Western cottonmouth							U	U	U	U	U	
Crotalus horridus atricaudatus Latreille Canebrake rattlesnake							R				R	

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R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 8. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
CROTALIDAE (concluded)												
Crotalus horridus horridus Linnaeus												
Timber rattlesnake						U						
IGUANIDAE												
Crotaphytus collaris collaris (Say)												
Eastern collared lizard						R						
Sceloporus undulatus hyacinthinus (Green)[1]												
Northern fence lizard				U	U	U						
KINOSTERNIDAE												
Kinosternon flavescens hippocrepis Gray												
Mississippi mud turtle								U	U	U	U	
Sternothaerus odoratus (Latreille)[1]												
Stinkpot								U	U	U	U	
SCINCIDAE												
Eumeces anthracinus pluvialis Cope												
Southern coal skink									U			
Eumeces fasciatus (Linnaeus)												
Five-lined skink			R	U	U	C			U			
Eumeces laticeps (Schneider)												
Broad-headed skink			U			U			U			

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C= Common, usually readily observed
U= Uncommon, but likely to be observed
R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 8. (continued).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
SCINCIDAE (concluded)												
Leiolopisma laterale (Say)												
Ground skink						C			U			
TEIIDAE												
Cnemidophorus sexlineatus (Linnaeus)												
Six-lined racerunner				R	R	C						
TESTUDINIDAE												
Chrysemys picta belli (Gray)												
Western painted turtle								C	U	C	C	
Chrysemys picta dorsalis (Agassiz)												
Southern painted turtle								A	C	C	A	
Chrysemys scripta elegans (Wied)[1]												
Red-eared turtle								U	U	R	U	
Deirochelys reticularia miaria Schwartz												
Western chicken turtle								U	U		U	
Graptemys geographica (LeSueur)												
Map turtle								U	U	R		
Graptemys kohni Carr												
Mississippi map turtle								U	U	U	U	

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[1]*Known to occur*, documented sightings
[2]Presence verified during this inventory

Table 8. (concluded).

SPECIES	CITY	SUBURBAN	EXURBAN	AGRI-CULTURE	OLD FIELD	UPLAND FOREST	WOODED SWAMP	OPEN FRESH MARSH	CAPE LA CROIX CREEK & TRIBS.	MISS. RIVER	SHALLOW/ DEEP FRESH MARSH	OTHER
TESTUDINIDAE (concluded)												
Graptemys pseudogeographica ouachitensis Cagle Ouachita map turtle								R	U	R	R	
Pseudemys concinna hieroglyphica (Holbrook) Slider								C	C	R	C	
Pseudemys floridana hoyi (Agassiz) Missouri slider								U	U	R	R	
Terrapene carolina triunguis (Agassiz)[1] Three-toed box turtle			U	U	U	U	C		C			U
Terrapene ornata ornata (Agassiz) Ornate box turtle			U	U	C	C						C
TRIONYCHIDAE												
Trionyx mutica mutica LeSueur Smooth soft-shelled turtle									U	U		
Trionyx spinifer hartwegi Conant & Goin[1] Western spiny soft-shelled turtle								C	C	C		

A= Abundant, readily observed
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Exurban

Exurban habitat, 2.4% of the Cape La Croix Creek watershed (336.5 acres), exists principally as new housing developments north, south, and west of Cape Girardeau. The largest block of exurban habitat, 54.9 acres, is in the vicinity of Arena Park.

Exurban habitat is transitional, a step in the conversion of native habitat to the forest-edge conditions of suburbia. In the Cape La Croix Creek watershed, this transition generally is agricultural to exurban to suburban. As a result, the fauna of the exurban areas contains elements of both agricultural and suburban habitats. This inventory lists one amphibian (Table 7), 11 reptiles, mostly snakes (Table 8), 69 birds (Table 5), and 23 mammals (Table 6) as known or likely to occur in exurban habitat.

In spite of the transitional nature of exurban habitat, continued expansion of suburban areas virtually assures the existence of a belt of exurban habitat separating agricultural from suburban habitat. Because of its limited extent, however, it is unlikely that exurban habitat contributes substantially to the ecological diversity of the project area.

Other

Within Cape Girardeau a number of parks, estates, cemeteries, and high school and university campuses represent a distinct "urban" habitat. In this report, the non-urban category *other* is moved to the urban classification to represent these areas. Essentially, they represent most of the tree stratum of upland forest, thinned, and without or with a highly modified understory. Cape Girardeau contains 270.0 acres of this habitat, 1.9% of the watershed. This habitat appears mostly as a "patchwork" within suburban habitat, the largest block including Fairmont, Lorimer, and St. Marys cemeteries and Notre Dame High School (139.9 contiguous acres).

As would be expected, this wildlife habitat type contains a faunal element having many similarities with the upland forest. This inventory lists 56 vertebrates from parks, estates, cemeteries, and campuses, including one amphibian (Table 7), four reptiles (Table 8), 27 birds (Table 5), and 24 mammals (Table 6). The number for bird species is certainly low and probably could be increased with more intensive year-long study.

Non-urban areas. The following discussion considers the remaining wildlife habitat types observed in the project area. Although six of these habitats are aquatic or are associated with aquatic communities, they are discussed below as they relate to the adjacent terrestrial community. Only the non-fish vertebrate fauna will be considered at this time.

Agricultural and Old Field

The intensive agriculture of the project area precludes old field habitat in the watershed. Old field in a classic sense includes a long period of succession through well-documented vegetative stages. Abandoned

fields do not exist, in this sense, in the project area All available land is either under cultivation, pastured, or lying fallow as mowed fields. Vegetation associated with old field areas, or early successional stages, was observed primarily in roadside ditches, along abandoned railroad right-of-ways, and ditch banks. In the city and suburban areas, old field vegetation was characteristic of lots or tracts awaiting construction. These areas were only temporarily old fields.

Old field habitat, though included in the inventory tables, is probably too ephemeral to contribute much to the ecology of the area and is not plotted separately on the habitat map (Fig. 3). Rather, it is included with *agricultural* habitat. Together they represent 56.7% of the Cape La Croix Creek watershed (7,992.1 acres) in a more-or-less contiguous belt around Cape Girardeau. Most of this habitat is northwest of the city.

In the early spring the dominant herbaceous vegetation in these areas consisted of milkweeds (*Asclepias* spp.), ragweeds (*Ambrosia* spp.), asters (*Aster* spp.), fleabanes (*Erigeron* spp.), graminoids, and, in the moister areas, golden ragwort (*Senecio aureus*) was, by far, the predominant herb. Poison ivy (*Toxicodendron radicans*) was ubiquitous in waste areas. Most roadsides, however, were maintained by mowing.

As field work was accomplished early in the growing season, many of the noxious weeds associated with agricultural areas (obvious later in the growing season) were not apparent. In fact, spring planting was continuing or had recently been completed throughout much of the project area.

As would be expected for such an extensive habitat, many vertebrate species are listed as known or likely to occur here. This report includes 153 such species, nearly one-half (40%) of the total non-fish vertebrates reported for the entire watershed.

Five species of amphibians are associated with these habitats (Table 7). Especially abundant are toads and, in moist meadows, leopard frogs. Twenty-one species of reptiles are known or likely to occur in agricultural and old field habitats (Table 8). Most numerous among these are the snakes, especially the small constrictors, which undoubtedly take a heavy toll from the large rodent populations. Also present are a few lizards and box turtles, but these are most commonly restricted to fencerows and advanced old field succession.

Birds are numerically the most abundant vertebrates in agricultural and old field habitats (Table 5). This inventory lists 84 species as known or likely to occur in such areas. Again, because of the large number of rodents present and also because of the lack of tree cover, predatory species are abundant. Fifteen species of hawks and owls are likely to occur here, many in quite large numbers considering the solitary nature of most species. Also abundant are sparrows (20 species), and blackbirds and their relatives (7 species), probably due to the seeds and insects, respectively, provided by man's agricultural activities.

Mammal species are especially abundant in agricultural and old field habitats (Table 6). This inventory lists 43 species as known or likely to occur, 86% of the total number of mammal species present in the watershed.

Especially abundant among these are the rodents and bats. Numerically, house mice, Norway rats, and several species of field mice (Cricetidae) predominate the mammalian fauna of these habitats. Many of the larger mammals which occur in agricultural and old field habitat, such as fox, deer, raccoons, and opossum, probably forage nocturnally in cultivated or open areas and retreat to brushy fencerows or small woodlots during the day.

Agricultural land represents the most important wildlife habitat in the project area. This determination is based upon the extent of agricultural habitat, the large number of species which inhabit it, and the amount of sportsman-hunter/wildlife interaction which occurs there. Because of the intensity of agriculture, virtually all suitable land is under cultivation or maintained as pasture. Hence, expansion of agricultural habitat is unlikely. In fact, expansion of urban habitats presently is reducing the amount of agricultural habitat.

Food and cover may be limiting to wildlife in agricultural habitat. Monoculture of row crops produces large amounts of food which may be suitable to only a few wildlife species. In addition, intensive cultivation reduces the amount of idle land. Hence, the food which exists may be largely unavailable to species which are reluctant to venture far from cover.

Upland Forest

Upland forest exists in extensive tracts north of the Cape La Croix Creek watershed. One such tract extends into the northernmost portion of the study area and covers 1,424.0 acres of the watershed. In all, 21.5% of the project area (3,025.0 acres) is covered by upland forest habitat. This forest is essentially an oak-hickory-elm association with tulip trees and sweet gum becoming important in ravines in the highly dissected southern margin of the Ozark Uplands region. Several forest areas on the lowlands south of Cape Girardeau are clearly upland in species composition in spite of their location on the floodplain. These are considered upland forest in this biological inventory. Floodplain forest typically is a biological community which shows evidence of periodic and/or prolonged inundation. Classification of this type of forest in the project area was described above.

As described above, the Ozark Uplands is a highly dissected plateau which is separated from the Southeastern Lowlands by a narrow and distinct bluff line. The alluvial plain of the lowlands extends upstream along many of the area streams creating a broad transition zone between the two physiographic regions.

Because of the thin, somewhat unproductive soils and rugged terrain, the Ozark Uplands is, in general, the least intensively cultivated section of Missouri. Extensive areas have never been under cultivation or have been allowed to revert to natural states. Consequently, deciduous forest covers most of the dissected part of the Ozark Uplands and much of the undissected part (Pflieger 1971).

This is especially apparent from Figure 5. Upland forest comprised 21.5% of the Cape La Croix Creek watershed acreage. Mixed oak and hickory forests predominated with sugar maple (*Acer saccharum*), hackberry (*Celtis occidentalis*), tulip tree (*Liriodendron tulipifera*), and sweet gum (*Liquidambar styraciflua*) being common, especially in areas of increasing elevation adjacent to streams.

In the vegetation transects sampled, transects A-A', C-C', and D-D' typified such stands. Locations of these stands are illustrated in Figure 1 and described in Table 2. Results are summarized by transect in Tables 9, 10, and 11 for transects A-A', C-C', and D-D', respectively.

These upland forest tracts were characterized by species of oaks and hickories. Because of specific irregularities in topography, a variety of microclimates determined by moisture, light, and temperature were observed among the three tracts sampled. These differences were expressed as differences in species composition since species composition integrates various climatological and ecological differences into an obvious condition-their presence or absence.

In these stands the upper or canopy layer was predominantly occupied by sugar maple (*Acer saccharum*) which was the most important species in total numbers and percent cover in stands A-A', C-C', and D-D'. Of additional importance were species of (1) hickories, including shagbark (*Carya ovata*), pignut (*C. glabra*), and mockernut (*C. tomentosa*); (2) oaks, including white (*Quercus alba*), rock chestnut (*Q. prinus*), red (*Q. rubra*), black (*Q. velutina*), shingle (*Q. imbricaria*); (3) elms, including American (*Ulmus americana*), slippery (*U. rubra*), and winged (*U. alata*).

One common feature in the three upland forest stands sampled was the species diversity observed. In transects A-A', C-C', and D-D', 20, 21, and 27 species of trees were observed. A total of 55 species was observed in the three transects sampled.

Other common tree species included sassafras (*Sassafras albidum*), sweet gum (*Liquidambar styraciflua*), tulip tree (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), hackberry (*Celtis occidentalis*), and hop hornbeam (*Ostrya virginiana*).

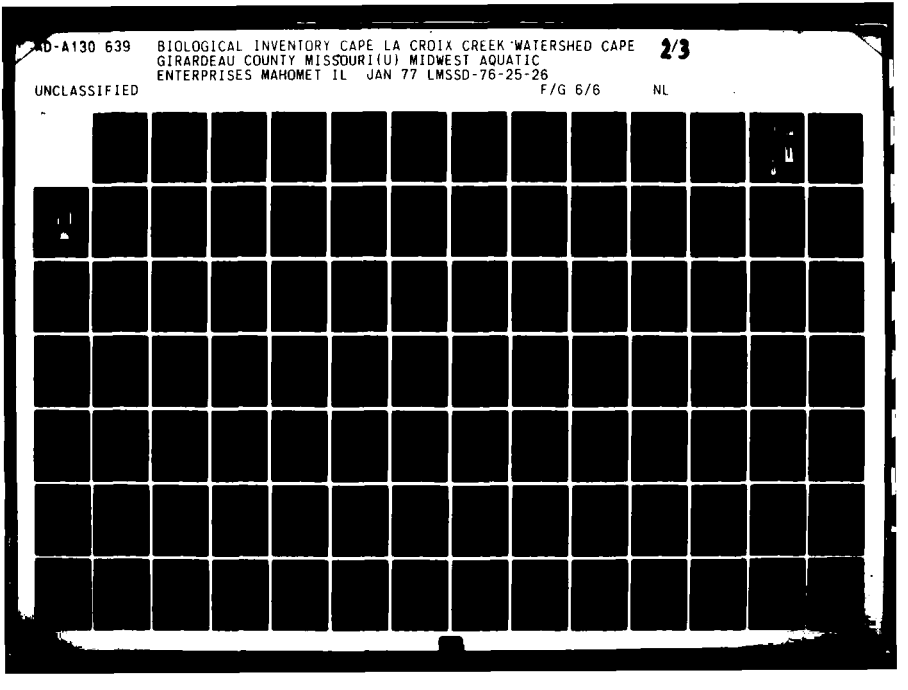
Pawpaw (*Asimina triloba*), redbud (*Cercis canadensis*), flowering dogwood (*Cornus florida*), sassafras, sugar maple, hickories, and hazelnut (*Corylus americana*) were obvious understory species. Of these, sugar maple hickories, and hazelnut comprised the chief understory species (Tables 9, 10, and 11).

The groundcover was composed of typical spring woodland species: bloodroot (*Sanguinaria canadensis*), mayapples (*Podophyllum peltatum*), wake robins (*Trillium* spp.), and green dragons (*Arisaema dracontium*). Virginia creeper (*Parthenocissus quinquefolia*) and poison ivy (*Toxicodendron radicans*) became locally abundant.

As with agricultural/old field habitat, upland forest habitat is extensive within the study area and supports a large number of [illegible] vertebrate species. This report lists [illegible]

AD-A130 639 BIOLOGICAL INVENTORY CAPE LA CROIX CREEK WATERSHED CAPE GIRARDEAU COUNTY MISSOURI(U) MIDWEST AQUATIC ENTERPRISES MAHOMET IL JAN 77 LMSSD-76-25-26 2/3

UNCLASSIFIED F/G 6/6 NL



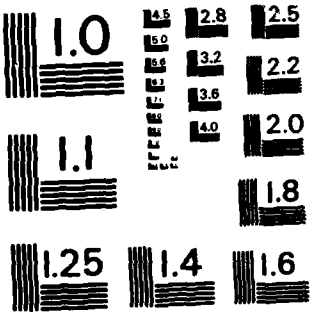


Table 9. Summary of the upland forest vegetation sampled on transect A-A' during May, 1976.

SPECIES	# TREES > 18 in. dbh	OVERSTORY #	OVERSTORY DOMINANCE (%)[1]	OVERSTORY GROUND COVERED (%)[2]	UNDERSTORY #	UNDERSTORY DOMINANCE (%)[1]	UNDERSTORY GROUND COVERED (%)[2]	GROUND COVER #	GROUND COVER DOMINANCE (%)[1]	GROUND COVER GROUND COVERED (%)[2]
Acer saccharum (sugar maple)	-	80	20.25	12.0	31	48.19	0.7	1050	3.91	5.3
Arisaema dracontium (green dragon)	-	-	-	-	-	-	-	13400	11.99	1.3
Asimina triloba (pawpaw)	-	-	-	-	19	16.64	0.5	50	0.20	0.3
Botrychium virginianum (rattlesnake fern)	-	-	-	-	-	-	-	200	0.18	0.1
Campsis radicans (trumpet creeper)	-	-	-	-	-	-	-	350	1.30	0.7
Carex spp. (sedge)	-	-	-	-	-	-	-	2800	2.50	<0.1
Carya cordiformis (bitternut hickory)	-	11	1.36	1.7	15	13.13	0.4	100	0.38	0.5
C. ovalis (sweet pignut hickory)	-	2	0.20	0.3	4	3.51	0.1	50	0.19	0.3
C. ovata (shagbark hickory)	-	4	14.93	0.5	1	0.87	<0.1	-	-	-
Carya spp. (hickory)	-	1	0.03	0.1	1	0.87	<0.1	250	0.93	1.3
Celtis occidentalis (hackberry)	-	1	0.06	0.1	-	-	-	150	0.56	0.8
Cercis canadensis (redbud)	-	2	0.70	0.2	1	0.40	<0.1	200	0.75	0.4
Cornus florida (flowering dogwood)	-	2	0.57	0.2	2	0.79	<0.1	-	-	-
Diospyros virginiana (persimmon)	-	1	0.17	0.1	1	0.87	<0.1	-	-	-
Fraxinus americana (white ash)	-	10	10.18	1.0	1	1.56	<0.1	-	-	-
Galium circaezans (wild licorice)	-	-	-	-	-	-	-	1500	1.34	<0.1
G. triflorum (sweet-scented bedstraw)	-	-	-	-	-	-	-	50	0.01	<0.1
Morus rubra (red mulberry)	-	4	0.31	0.5	-	-	-	-	-	-
Ostrya virginiana (hop hornbeam)	-	22	6.63	2.9	9	7.88	0.2	150	0.56	0.8
Oxalis dillenii (yellow wood sorrel)	-	-	-	-	-	-	-	100	0.09	0.1
Parthenocissus quinquefolia (creeper)	-	-	-	-	-	-	-	2800	2.50	0.3
Plantago spp. (plantain)	-	-	-	-	-	-	-	1550	5.78	1.6
Platanus occidentalis (sycamore)	-	1	0.60	0.1	-	-	-	-	-	-
Podophyllum peltatum (mayapple)	-	-	-	-	-	-	-	3200	11.93	12.8
Quercus alba (white oak)	-	1	0.14	0.2	3	2.64	0.1	-	-	-
Q. imbricaria (shingle oak)	-	3	3.92	0.9	-	-	-	-	-	-
Q. rubra (red oak)	-	5	8.23	1.5	2	1.78	0.1	-	-	-
Sanguinaria canadensis (bloodroot)	-	-	-	-	-	-	-	13950	51.99	27.9
Sanicula spp. (snakeroot)	-	-	-	-	-	-	-	1600	1.43	0.3
Sassafras albidum (sassafras)	1	1	11.38	0.4	1	0.87	<0.1	-	-	-
Smilax spp. (catbrier)	-	-	-	-	-	-	-	150	0.13	<0.1
Toxicodendron radicans (poison ivy)	-	-	-	-	-	-	-	100	0.38	0.2
Trillium spp. (wakerobin)	-	-	-	-	-	-	-	350	0.38	<0.1
Ulmus alata (winged elm)	-	28	10.09	3.6	-	-	-	-	-	-
U. americana (American elm)	-	5	3.24	0.7	-	-	-	-	-	-
U. rubra (slippery elm)	-	9	7.02	1.2	-	-	-	-	-	-
Ulmus spp. (elm)	-	-	-	-	-	-	-	50	0.20	0.2
Viola spp.	-	-	-	-	-	-	-	450	0.40	<0.1
TOTAL	1	193	100.00	28.2	91	100.00	2.1	44600	100.00	55.2

[1]Percent composition based upon basal area: [(total basal area of given species) ÷ (total basal area of all species)] x 100.
[2]Based upon total area sampled, 1000 m^2.

Table 10. Summary of the upland forest vegetation sampled on transect C-C' during May, 1976.

SPECIES	# TREES > 18 in. dbh	OVERSTORY			UNDERSTORY			GROUND COVER		
		#	DOMINANCE (%)	GROUND COVERED (%)	#	DOMINANCE (%)	GROUND COVERED (%)	#	DOMINANCE (%)	GROUND COVERED (%)
Acer negundo (box elder)	-	-	-	-	3	2.38	<0.1	-	-	-
A. saccharum (sugar maple)	-	48	11.09	7.2	33	29.63	0.7	100	2.69	0.5
Asimina triloba (pawpaw)	-	5	0.08	0.8	56	24.57	1.4	-	-	-
Campsis radicans (trumpet creeper)	-	-	-	-	-	-	-	300	1.95	1.5
Carya tomentosa (mockernut hickory)	-	14	5.11	2.1	20	8.76	0.5	-	-	-
Carya spp. (hickory)	-	-	-	-	-	-	-	450	12.10	2.3
Celtis occidentalis (hackberry)	-	5	1.33	0.8	12	5.25	0.3	-	-	-
Cercis canadensis (redbud)	-	13	0.57	1.3	11	2.18	0.2	-	-	-
Cornus florida (flowering dogwood)	-	10	0.84	1.0	18	3.57	<0.1	-	-	-
Corylus americana (hazelnut)	-	4	0.06	0.6	29	5.75	1.5	-	-	-
Crataegus spp. (hawthorn)	-	-	-	-	1	0.40	0.2	-	-	-
Diospyros virginiana (persimmon)	-	2	4.20	0.2	-	-	-	-	-	-
Fraxinus americana (white ash)	-	5	2.23	0.8	-	-	-	-	-	-
Gleditsia triacanthos (honey locust)	-	1	1.88	0.1	-	-	-	-	-	-
Ipomoea spp. (morning glory)	-	-	-	-	-	-	-	250	1.34	0.3
Juniperus virginiana (red cedar)	-	-	-	-	1	0.20	<0.1	-	-	-
Liquidambar styraciflua (sweet gum)	-	11	5.69	1.7	-	-	-	-	-	-
Liriodendron tulipifera (tulip tree)	2	5	24.65	1.4	1	0.40	<0.1	-	-	-
Menisperman canadense (moonseed)	-	-	-	-	-	-	-	50	0.27	<0.1
Morus rubra (red mulberry)	-	1	0.02	0.1	-	-	-	-	-	-
Parthenocissus quinquefolia (creeper)	-	-	-	-	-	-	-	6050	3.26	6.1
Podophyllum peltatum (mayapple)	-	-	-	-	-	-	-	950	0.51	4.8
Prunus serotina (wild black cherry)	-	1	0.11	0.1	1	0.40	0.2	-	-	-
Quercus alba (white oak)	-	6	0.16	0.9	3	1.29	<0.1	-	-	-
Q. imbricaria (shingle oak)	-	3	0.81	0.5	1	0.40	<0.1	-	-	-
Q. prinus (rock chestnut oak)	1	14	11.38	1.9	8	3.47	0.2	150	4.03	0.8
Q. rubra (red oak)	1	5	18.35	0.7	-	-	-	-	-	-
Q. velutina (black oak)		4	2.99	0.7	4	1.78	0.1	-	-	-
Sanicula spp. (snakeroot)	-	-	-	-	-	-	-	2400	1.29	<0.1
Sassafras albidum (sassafras)	-	21	7.55	3.2	10	4.36	0.2	100	2.69	0.5
Smilacina racenosa (false solomon's seal)	-	-	-	-	-	-	-	150	0.08	<0.1
Smilax spp. (catbrier)	-	-	-	-	-	-	-	50	0.03	<0.1
Toxicodendron radicans (poison ivy)	-	-	-	-	-	-	-	11900	64.02	23.8
Ulmus americana (American elm)	-	5	0.90	0.8	-	-	-	-	-	-
Ulmus spp. (elm)	-	-	-	-	8	3.47	0.2	200	5.38	1.0
Urtica dioica (stinging nettle)	-	-	-	-	-	-	-	650	0.35	<0.1
Viburnum prunifolium (black haw)	-	-	-	-	4	1.74	0.1	-	-	-
Vitis spp. (wild grape)	-	-	-	-	-	-	-	200	0.01	<0.1
TOTAL	4	183	100.00	26.9	224	100.00	5.8	23950	100.00	41.6

[1]Percent composition based upon basal area: [(total basal area of given species) ÷ (total basal area of all species)] x 100.
[2]Based upon total area sampled, 1000 m^2.

Table 11. Summary of the upland forest vegetation sampled on transect D-D' during May, 1976.

SPECIES	# TREES > 18 in. dbh	OVERSTORY #	OVERSTORY DOMINANCE (%)[1]	OVERSTORY GROUND COVERED (%)[2]	UNDERSTORY #	UNDERSTORY DOMINANCE (%)[1]	UNDERSTORY GROUND COVERED (%)[2]	GROUND COVER #	GROUND COVER DOMINANCE (%)[1]	GROUND COVER GROUND COVERED (%)[2]
Acer saccharum (sugar maple)	-	44	7.28	7.6	28	39.83	0.8	725	3.04	4.8
Allium spp. (wild onion)	-	-	-	-	-	-	-	175	0.18	<0.1
Arisaema dracontium (green dragon)	-	-	-	-	-	-	-	350	0.35	<0.1
Asimina triloba (pawpaw)	-	4	0.14	0.7	27	38.42	0.9	300	1.26	2.0
Campsis radicans (trumpet creeper)	-	-	-	-	-	-	-	100	0.42	0.3
Carex spp. (sedge)	-	-	-	-	-	-	-	4400	4.42	<0.1
Carya ovalis (sweet pignut hickory)	-	3	7.27	0.5	-	-	-	-	-	-
C. ovata (shagbark hickory)	-	5	20.96	0.9	-	-	-	-	-	-
C. tomentosa (mockernut hickory)	-	1	0.04	0.2	-	-	-	-	-	-
Carya spp. (hickory)	-	-	-	-	1	0.80	<0.1	100	0.42	0.7
Catalpa sp. (catalpa)	-	1	0.04	0.2	-	-	-	-	-	-
Celtis occidentalis (hackberry)	-	9	1.33	1.6	1	0.80	<0.1	-	-	-
Cercis canadensis (redbud)	-	2	0.15	0.3	-	-	-	-	-	-
Cornus florida (flowering dogwood)	-	-	-	-	1	0.36	<0.1	-	-	-
Corylus americana (hazelnut)	-	1	0.04	0.2	-	-	-	-	-	-
Cystopteris fragilis (fragile fern)	-	-	-	-	-	-	-	225	0.23	0.2
Diospyros virginiana (persimmon)	-	2	1.49	0.3	-	-	-	-	-	-
Erigeron spp. (fleabane)	-	-	-	-	-	-	-	325	0.33	0.2
Fraxinus americana (white ash)	-	26	2.79	4.5	-	-	-	-	-	-
F. pennsylvanica var. *subintegerrima* (green ash)	-	2	0.22	0.3	-	-	-	-	-	-
Galium aparine (goosegrass)	-	-	-	-	-	-	-	450	0.45	<0.1
G. circaezans (wild licorice)	-	-	-	-	-	-	-	300	0.30	<0.1
Graminoids (grasses)	-	-	-	-	-	-	-	4700	4.73	<0.1
Juglans nigra (black walnut)	-	6	0.21	1.0	-	-	-	-	-	-
Liquidambar styraciflua (sweet gum)	-	1	0.57	0.2	-	-	-	-	-	-
Liriodendron tulipifera (tulip tree)	-	4	0.35	0.7	1	0.80	<0.1	-	-	-
Lonicera japonica (Japanese honeysuckle)	-	-	-	-	-	-	-	8775	36.44	11.7
Morus rubra (red mulberry)	-	5	1.55	0.9	2	1.59	0.1	50	0.21	0.3
Parthenocissus quinquefolia (creeper)	-	-	-	-	-	-	-	3650	3.67	4.9
Platanus occidentalis (sycamore)	1	2	12.30	0.7	-	-	-	-	-	-
Podophyllum peltatum (mayapple)	-	-	-	-	-	-	-	1600	6.70	8.5
Polygonum spp. (smartweed)	-	-	-	-	-	-	-	250	1.05	0.3
Prunus avium (sweet cherry)	-	3	0.11	0.5	1	0.36	<0.1	-	-	-
P. serotina (wild black cherry)	-	7	0.42	1.2	5	1.81	0.1	50	0.21	0.3
Pyrus communis (pear)	-	6	1.35	1.0	-	-	-	-	-	-
Quercus alba (white oak)	1	5	20.79	1.3	5	4.01	0.2	150	0.63	1.0
Q. imbricaria (shingle oak)	-	4	0.14	0.7	1	0.80	0.1	-	-	-
Q. prinus (chestnut oak)	-	2	0.07	0.3	-	-	-	-	-	-
Sanguinaria canadensis (bloodroot)	-	-	-	-	-	-	-	6600	27.64	17.6
Sanicula spp. (snakeroot)	-	-	-	-	-	-	-	200	0.20	<0.1
Silene stellata (starry campion)	-	-	-	-	-	-	-	1650	1.66	<0.1
Smilax spp. (catbrier)	-	-	-	-	-	-	-	75	0.08	<0.1
Trillium spp. (wake robin)	-	-	-	-	-	-	-	500	0.50	<0.1
Toxicodendron radicans (poison ivy)	-	-	-	-	-	-	-	475	1.99	1.3
Ulmus alata (winged elm)	-	5	0.77	0.9	-	-	-	100	0.42	0.7
U. americana (American elm)	-	24	16.75	4.2	-	-	-	-	-	-
U. rubra (slippery elm)	-	24	2.83	4.2	-	-	-	-	-	-
Ulmus spp. (elm)	-	1	0.04	0.2	13	10.42	0.4	-	-	-
Urtica dioica (stinging nettle)	-	-	-	-	-	-	-	1000	1.01	0.1
Viola spp. (violet)	-	-	-	-	-	-	-	325	1.36	<0.1
Vitis spp. (wild grape)	-	-	-	-	-	-	-	100	0.10	<0.1
TOTAL	2	199	100.00	35.3	86	100.00	2.6	37700	100.00	54.9

[1] Percent composition based upon basal area: [(total basal area of given species) ÷ (total basal area of all species)] x 100.
[2] Based upon total area sampled, 750 m^2.

likely to occur in upland forest habitat.

Eight amphibian species typically are taken in upland forest habitat, including toads and a few salamanders and frogs (Table 7). Many of the salamanders are restricted to the bases of woody bluffs, and so would be limited in distribution even within the upland forest.

Reptiles are represented in upland forest habitat by 31 species in the Cape La Croix Creek watershed (Table 8). These include many of the snakes, all but one of the lizards, and both of the box turtles known or likely to occur in the study area. Again, a number of these species would be restricted to bluffs or rock-outcrop areas. Thus, not all of these species would be widely distributed.

This inventory lists 102 species of birds as known or likely to occur in upland forest habitats (Table 5). Especially abundant are hawks and owls (10 species), sparrows and relatives (12 species), woodpeckers (7 species), and warblers (28 species). It should be noted that the method of bird inventory from Christmas counts is especially insensitive for listing upland forest species. Many transients and summer visitors use these upland forests for cover and food during migration stopovers or for breeding. Many additional thrashers, flycatchers, and, especially, warblers are included here because of the availability of annual data.

This report lists 31 species of mammals as known or likely to occur in upland forest habitats (Table 6). Only 9 of these species are rodents, a substantial reduction in species from the agricultural/old field habitat mainly through a reduction in the Cricetidae. Upland forest habitat is important living space for most of the large carnivores listed as rare in this inventory.

Upland forest habitat in the project area represents a major wildlife resource. The extent of this habitat and the large number of species which utilize it form the basis for this statement. Especially significant is the magnitude of some upland forest tracts in the northern portion of the project area. Many of the larger forest mammals require such large areas because of their large home ranges.

The forest edge, here considered to be an interface between upland forest and agricultural habitat, is especially important. Numerous species listed as members of the upland forest habitat are more or less confined to this region. Typically the forest edge represents slow successional stages of the regrowth of cleared land to the climax condition. To the forest edge species, closing of the forest canopy brings a gradual reduction of suitable foods and cover and their numbers are reduced. The highly dissected margins of the upland forest tracts in the project area, coupled with the intensive agriculture on adjacent cleared areas, insures the continued existence of this valuable wildlife habitat.

Floodplain Forest and Wooded Swamp

Wooded swamp, type 7 wetland, was represented in the study area by a single small tract of woodland (25.0 acres) southeast of the junction

of U. S. highway 61 and Missouri highway 74. Type 7 wetland represented 0.2% of the Cape La Croix Creek watershed.

Floodplains may vary from narrow strips to wide expanses up to a few miles wide. These wider areas are generally considered to be swamp phases of bottomland forests. Voigt and Mohlenbrock (1964) describe communities which illustrate the developmental stages in bottomland hardwood forests as being related developmentally through decreased hydrophytism: the dominating influence of the degree of soil saturation is gradually replaced by increased shading in later developmental stages.

The remaining two transects sampled typified the two extremes described above. The floodplain forest tract, summarized as transect B-B' in Table 12, characterized the thin band of forest adjacent to streams in the Ozark Uplands, reasonably well drained and densely shaded. The wooded swamp tract, summarized as transect E-E' in Table 13, was a remnant of what had been extensive wetland forests prior to drainage of the Southeastern Lowlands. Locations of these two transects are illustrated in Figure 1 and described in Table 2.

The floodplain forest illustrated by transect B-B' was dominated by box elder (*Acer negundo*) and ash (*Fraxinus* spp.). Although American elms (*Ulmus americana*) occurred sporadically throughout the tract, their largest concentration was within 10 m of the bank of Cape La Croix Creek. The elms, in fact, were one of the predominant tree species at the edge of the stream.

Beyond the band of elms, however, was the virtually impenetrable thicket of sapling box elders and ash, young trees averaging 9 to 12 ft tall. They occurred in an area of partial inundation throughout the year. Ash, especially green ash, is considered a pioneer in succession, often following willow and cottonwood communities (Voigt and Mohlenbrock 1964). It is often found in association with other pioneering species like box elder, as evidenced in this stand, or silver and red maples, pin oak, and sweet gum.

Predominant ground cover species included field bindweed (*Convolvulus arvensis*), poison ivy (*Toxicodendron radicans*), cup-plant (*Silphium perfoliatum*), marsh fleabane (*Erigeron philadelphicus*), and wild onion (*Allium* spp.). The edges of this stand were overgrown with a thick mantle of Japanese honeysuckle (*Lonicera japonica*).

At the opposite extreme, the wooded swamp of transect E-E' typified the constantly inundated areas of the watershed. In its original condition, the Southeastern Lowlands region was heavily timbered with cypress, ash, and gum as the predominant species (Pflieger 1971). Serious drainage efforts have virtually eliminated swamps, leaving only a few isolated remnants such as the stand sampled here. Even so, the species composition has been changed. In transect E-E', the overstory consisted of black willow (*Salix nigra*) and ash (*Fraxinus* sp.). Although reproduction was occurring among the willows, the large ash trees were virtually all dead, only a branch or two remaining alive on the individuals tallied. It would appear that an abrupt change occurred in the water regime of this wetland within the last few years to have seriously affected the ash.

Table 12. Summary of floodplain forest vegetation sampled on transect B-B' during May, 1976.

SPECIES	# TREES > 18 in. dbh	OVERSTORY #	OVERSTORY DOMINANCE (%)[1]	OVERSTORY GROUND COVERED (%)[2]	UNDERSTORY #	UNDERSTORY DOMINANCE (%)[1]	UNDERSTORY GROUND COVERED (%)[2]	GROUND COVER #	GROUND COVER DOMINANCE (%)[1]	GROUND COVER GROUND COVERED (%)[2]
Acer negundo (box elder)	-	2190	56.33	46.0	-	-	-	1190	1.91	0.3
A. saccharinum (silver maple)	-	10	0.26	0.5	-	-	-	125	0.20	<0.1
Allium spp. (wild onion)	-	-	-	-	-	-	-	36125	11.61	<0.1
Campsis radicans (trumpet creeper)	-	-	-	-	-	-	-	125	0.20	0.2
Carex spp. (sedge)	-	-	-	-	-	-	-	61000	1.96	0.1
Chaerophyllum procumbens (wild chervil)	-	-	-	-	-	-	-	1625	0.06	0.4
Clematis virginiana (Virgin's bower)	-	-	-	-	-	-	-	2375	3.82	0.6
Convolvulus arvensis (field bindweed)	-	-	-	-	-	-	-	75000	24.09	7.5
Erigeron philadelphicus (marsh fleabane)	-	-	-	-	-	-	-	7200	11.57	1.9
Fraxinus spp. (ash)	-	1210	31.12	24.2	-	-	-	320	0.51	0.1
Galium aparine (goosegrass)	-	-	-	-	-	-	-	1875	0.30	0.4
Geranium maculatum (wild geranium)	-	-	-	-	-	-	-	250	0.40	<0.1
Graminoids (grasses)	-	-	-	-	-	-	-	111875	3.60	0.2
Impatiens spp. (jewel weed)	-	-	-	-	-	-	-	2500	4.02	0.7
Juglans nigra (black walnut)	-	1	0.03	<0.1	-	-	-	-	-	-
Plantago spp. (plantain)	-	-	-	-	-	-	-	1000	1.61	0.3
Prunus serotina (wild black cherry)	-	10	0.23	0.4	-	-	-	-	-	-
Sanicula spp. (snakeroot)	-	-	-	-	-	-	-	1000	0.16	<0.1
Silphium perfoliatum (cup-plant)	-	-	-	-	-	-	-	1750	12.05	3.5
Torilis japonica (hedge parsley)	-	-	-	-	-	-	-	625	0.02	0.1
Toxicodendron radicans (poison ivy)	-	-	-	-	-	-	-	2250	21.69	0.5
Ulmus americana (American elm)	-	38	12.03	3.0	-	-	-	110	0.19	0.2
Viola spp. (violet)	-	-	-	-	-	-	-	500	0.03	0.3
TOTAL	-	3459	100.00	74.1	-	-	-	308820	100.00	17.3

[1]Percent composition based upon basal area: [(total basal area of given species) ÷ (total basal area of all species)] x 100.
[2]Based upon total area sampled, 1000 m^2.

Table 13. Summary of wooded swamp vegetation sampled on transect E-E' during May, 1976.

SPECIES	# TREES > 18 in. dbh	OVERSTORY			UNDERSTORY			GROUND COVER		
		#	DOMINANCE (%)[1]	GROUND COVERED (%)[2]	#	DOMINANCE (%)[1]	GROUND COVERED (%)[2]	#	DOMINANCE (%)[1]	GROUND COVERED (%)[2]
Acer rubrum (red maple)	-	1	0.13	0.2	-	-	-	-	-	-
A. saccharinum (silver maple)	-	2	1.38	0.6	-	-	-	-	-	-
Cephalanthus occidentalis (buttonbush)	-	-	-	-	16	38.10	1.2	-	-	-
Fraxinus sp. (ash)	-	59	33.73	5.9	-	-	-	-	-	-
Peltandra virginica (arrow arum)	-	-	-	-	-	-	-	15350	81.89	51.2
Polygonum spp. (smartweed)	-	-	-	-	-	-	-	700	0.24	0.2
Rosa palustris (swamp rose)	-	-	-	-	24	57.14	2.4	-	-	-
Salix nigra (black willow)	3	20	64.76	4.0	2	4.76	0.2	-	-	-
Saururus cernuus (lizard's-tail)	-	-	-	-	-	-	-	52250	17.75	13.8
Toxicodendron radicans (poison ivy)	-	-	-	-	-	-	-	35u	0.12	0.1
TOTAL	3	82	100.00	10.7	42	100.00	3.8	68656	100.00	65.3

[1]Percent composition based upon basal area: [(total basal area of given species) ÷(total basal area of all species)] x 100.
[2]Based upon total area sampled, 1000 m^2.

Buttonbush (*Cephalanthus occidentalis*) and swamp rose (*Rosa palustris*) comprised the shrubby understory layer. Cover of these species was low, 3.6%. These species constitute the most frequently observed shrubs of deep swamps in this area (Voigt and Mohlenbrock 1964).

Arrow arum (*Peltandra virginica*) and lizard's-tail (*Saururus cernuus*) formed the predominant ground cover species. These species may be characterized as typical of heavy-wet (littoral-amphibious) habitats (Voigt and Mohlenbrock 1964). Duckweed formed virtually a complete mat over the surface of the water. Water depth throughout the swamp varied from only a few centimeters at the edge of the swamp to nearly 1 m in the central areas.

Although technically a wetland, wooded swamp habitat in the project area has many faunal differences from the other wetland types. This inventory lists 204 species of non-fish vertebrates from floodplain forest along Cape La Croix Creek and tributaries and 98 from wooded swamp. Twenty-two of 29 total species of amphibians are known or likely to occur in this habitat. Most abundant here are a number of tree frogs (Hylidae) (Table 7).

Reptiles are less abundant in wooded swamps than in other wetland types. The principal group not present is the turtles (1 species). A number of lizards (4 species), however, enter wetlands only in this habitat (Table 8).

One hundred three species of birds are recorded for floodplain forest along Cape La Croix Creek and tributaries and 54 from wooded swamp (Table 5). Major wetland groups present in low numbers of species are ducks and herons. Warblers, however, are especially abundant during summer.

A remarkably large number of mammal species are known or likely to occur in this habitat (Table 6). Thirty-five species are listed in this inventory for floodplain forest along Cape La Croix Creek and tributaries with 19 from wooded swamp. Bats and rodents predominated.

Wooded swamp existed formerly throughout much of the Southeastern Lowlands south of Cape Girardeau. The single tract noted in the study area represents a relict natural area and a refuge for many wooded swamp species which do not exist elsewhere in the project area. The small size of the tract, however, precludes the existence of many animal species which require large ranges. Rather, species characteristic of wooded swamps are represented by numerous invertebrate and a few small and secretive vertebrate species. In practical terms, this wooded swamp contributes little to the overall ecology of the area and has value mainly as an important relict natural area.

Inland Shallow and Deep Fresh Marshes

Inland shallow fresh marsh (type 3 wetland) was represented by one small 5.0-acre tract northeast of the junction of U. S. highway 61 and Missouri highway 74. This constituted less than 0.1% of the study area. Inland deep fresh marsh (type 4 wetland) was present as two small tracts of approximately 8.0 acres southwest of Cape Girardeau along U. S. highway 61. This represented 0.1% of the study area.

Within the aquatic community a series or sequence of plant communities occurs proceeding from the open water area toward the shore and beyond, extending up a considerable gradient. The development of aquatic vegetation and the succession of species toward the climax is referred to as a hydrosere. The generalized succession of hydrosere in and adjacent to southern Illinois has been demonstrated to include six distinct stages: (1) a submerged stage; (2) a floating leaf stage with either free-floaters or attached floaters; (3) an amphibious stage; (4) the wet meadow stage; (5) a shrub stage; and (6) a tree stage (Voigt and Mohlenbrock 1964).

Figure 4 illustrates the succession of aquatic vegetation observed from the "open water" or central area toward shore along transect F-F'; Figure 5, the succession of aquatic vegetation from shore to shore along transect G-G'. In these two type 4 wetlands sampled, the floating leaf and amphibious stages were present. Transect F-F', however, represented a type 4 wetland portion of a larger wetland which included a shrub swamp comprised almost exclusively of young willows (*Salix*) as a transition zone between F-F' and the wooded swamp, transect E-E'.

The floating leaf stage had duckweed (*Lemna*), a free floater, in transect F-F', and yellow pond lily (*Nuphar luteum macrophyllum*), an attached floater, in transect G-G'. However, along transect F-F', the floating leaf and amphibious stages occurred simultaneously with arrow arum (*Peltandra virginica*) and lizard's-tail (*Saururus cernuus*) occurring as the predominant, conspicuous amphibious representatives.

Along transect G-G', yellow pond lily occupied the central deeper areas of the wetland while lizard's-tail occurred in the shallower, marginal areas with occasional buttonbushes (*Cephalanthus occidentalis*) pioneering the shrub stage. Thus, along G-G' the attached floating and amphibious stages occupied distinct zones, while the amphibious and shrub stages occurred in the same zone.

Species diversity in the amphibious stage was greater in the wetland sampled by transect F-F' than in G-G'. Five species became numerically important along transect F-F'. These included bullrush (*Scirpus atrovirens*), soft rush (*Juncus effusus* var. *solutus*), cat-tail (*Typha latifolia*), swamp dock (*Rumex verticillatus*), and smartweed (*Polygonum* spp.).

Successive stages were not observed in either wetland sampled. The wetland sampled by transect F-F' was surrounded by encroaching agriculture and highways 61 and 74. Transect G-G' was bordered by highway 61 and suburban development.

Arrow arum was the predominant plant along transect F-F' and yellow pond lily along G-G'. Both species are adapted to exist in swampy areas: (1) shoot production occurs best when the rhizomes are virtually deprived of oxygen and (2) seed germination may be stimulated by reduced oxygen tension and low redox potential. In fact, the rhizomes and corms of yellow pond lily (*Nuphar*), sweet flag (*Acorus*), arrow arum (*Peltandra*), cat-tail (*Typha*), and bullrush (*Scirpus*) could live anaerobically for long periods of time. The ability to utilize anaerobic metabolism earned yellow pond lily its nickname "brandy bottle" because the ethanol is an obvious odor of the plant tissues (Hutchinson 1975).

Figure 4. Aquatic macrophytes observed along transect F-F' (as number of stems per m^2).

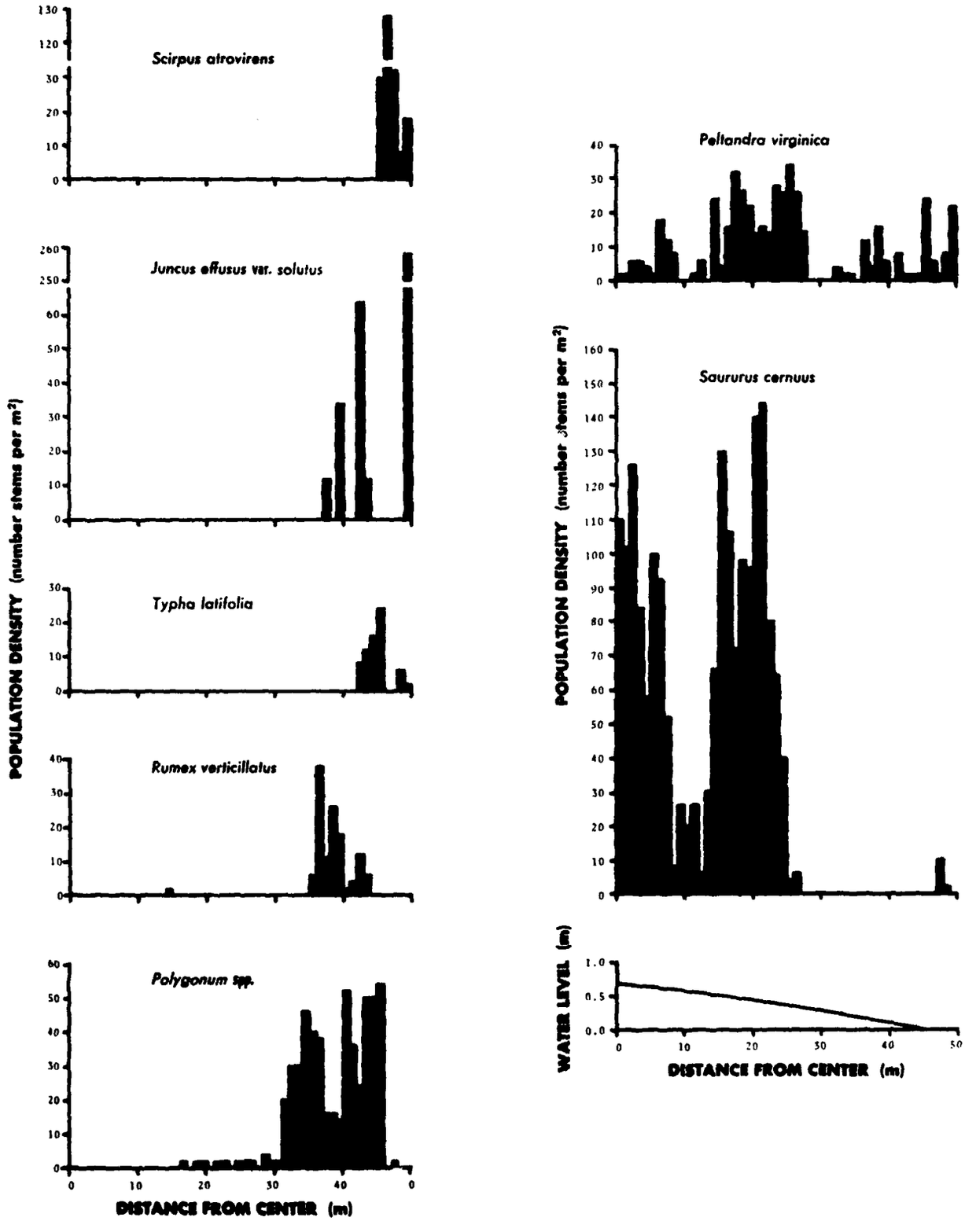
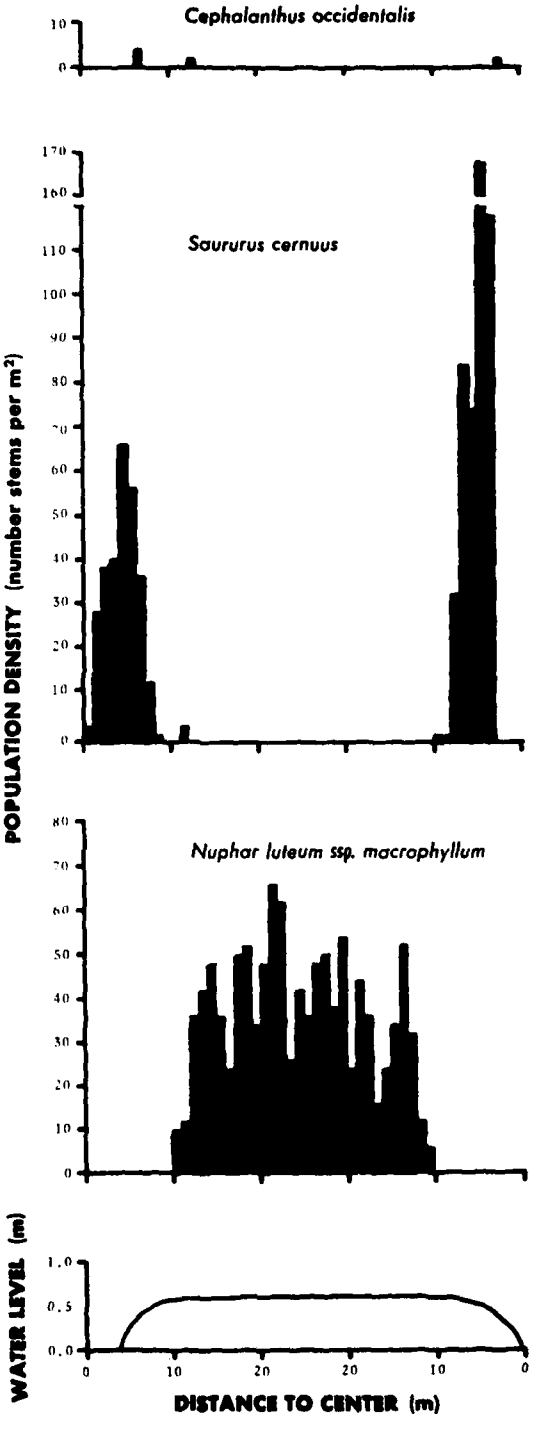

Scirpus atrovirens
Juncus effusus var. solutus
Typha latifolia
Rumex verticillatus
Polygonum spp.
Peltandra virginica
Saururus cernuus
POPULATION DENSITY (number stems per m²)
WATER LEVEL (m)
DISTANCE FROM CENTER (m)

Figure 5. Aquatic macrophytes observed along transect G-G' (as number of stems per m^2).


Cephalanthus occidentalis
10
0
Saururus cernuus
170
160
110
100
90
80
70
60
50
40
30
20
10
0
POPULATION DENSITY (number stems per m²)
Nuphar luteum ssp. macrophyllum
80
70
60
50
40
30
20
10
0
WATER LEVEL (m)
1.0
0.5
0.0
0
10
20
20
10
0
DISTANCE TO CENTER (m)

The non-fish vertebrate fauna of shallow and deep fresh marshes are sufficiently similar to permit a common discussion. This inventory lists 119 species as known or likely to occur in the marshes and wetlands. Among these are nearly two-thirds of all amphibians listed for the Cape La Croix Creek watershed (19 of 29 species) (Table 7). Especially abundant are the cricket and chorus frogs and the "true" frogs (*Rana*).

Among the reptiles, only turtles (12 species) and snakes (9 species) occur in shallow and deep fresh marshes, turtles being especially abundant (Table 8). Two species of venomous snakes, the cottonmouth and the canebrake rattlesnake, probably occur in the wetlands south of Cape Girardeau. This area would represent the northernmost limits of the ranges of these southern species.

Fifty-six species of birds are listed in this inventory for shallow and deep fresh marsh habitats (Table 5). Migratory waterfowl (13 species of Anatidae), herons and egrets (11 species of Ardeidae), and several groups of smaller shorebirds and wading birds being especially abundant, although the abundance of waterfowl fluctuates greatly with season.

Mammals are represented in the shallow and deep fresh marshes by 23 species, including nine species each of bats and rodents (Table 6). Muskrats are among the most conspicuous of these species, although some of the smaller rodents are much more abundant.

The extent of these wetland habitats is so small that their importance to the overall ecology of the project area might be overlooked. Their contribution is as a refuge for many small species, especially among the amphibians and turtles, which do not exist elsewhere in the watershed.

There is some question as to the origin of the type 3 wetland immediately northeast of the junction of U. S. highway 61 and Missouri highway 74. Both highways are elevated above grade and drainage is routed through culverts and ditches. These ditches converge in a low area which forms the wetland. A drainage ditch then carries the water from the wetland to Cape La Croix Creek. It is likely that conditions suitable for wetland development were created when the highway gradework and drainage were completed.

Inland Open Fresh Marsh

Inland open fresh marsh (type 5 wetland) was represented in the study area by several lakes and numerous small ponds. A total of 46.0 acres of type 5 wetland existed there, representing 0.3% of the watershed. Nearly one-half of this acreage was contained in Lake Hollenbeck northwest of Cape Girardeau.

The flora of this habitat was remarkably similar to inland shallow and deep fresh marshes in areas where emergent vegetation developed. Deep water areas were practically devoid of vegetation. Intermediate depths developed a characteristic flora (Table 4).

The non-fish vertebrate fauna of these lakes and ponds is similar

to that of the shallow and deep fresh marshes of the project area. A total of 111 species are listed in this inventory, including 17 species of amphibians (Table 7), 25 species of reptiles (Table 8), 52 species of birds (Table 5), and 17 species of mammals (Table 6). Notable differences from shallow and deep fresh marshes include a greater number of ducks and geese (22 species of Anatidae compared to 13 for shallow and deep fresh marshes) and a smaller number of rodents (2 species compared to 9 for the shallow and deep fresh marshes).

A more complete discussion of this habitat will be deferred to the section on aquatic communities. It should be stated here, however, that the small acreage of this habitat type and the predominant location of small ponds (generally in open pastureland) may preclude much of their usefulness to many terrestrial wildlife species. Cape La Croix Creek and its tributaries are more uniformly dispersed in the project area and provide ample cover in the form of riparian vegetation.

Cape La Croix Creek and Tributaries

Cape La Croix Creek and its tributaries contain 57.7 mi (92.9 km) of flowing water habitat. Table 14 summarizes the morphology of the drainage net. The trellis-like drainage pattern evident in Figure 1 is reflected clearly by the large number of order 4 links. Although Horton-Strahler classification designated Cape La Croix Creek as an order 4 stream, $\log_2$ analysis of order 1 links would make the stream order 5 downstream from the junction of Walker Creek. Log_2 analysis is appropriate for non-dendritic drainages such as the study stream.

Sand bars and mudflats are not plotted on the map of wildlife habitats (Fig. 3). Only small strips of this habitat existed, always within the banks of Cape La Croix Creek and its tributary streams. This habitat type is grouped with Cape La Croix Creek in the inventory tables as they share common non-fish vertebrate fauna.

The riparian vegetation is discussed above under floodplain forest and wooded swamp. Aquatic vegetation is limited principally to attached microflora in Cape La Croix Creek and its tributaries. Rooted macrophytes were notably absent. The sand bar and mudflat flora consisted principally of willows (*Salix* spp.), emergent and overhanging grasses, and invading annuals from riparian areas.

Two hundred four species are listed in this inventory for the wildlife habitat Cape La Croix Creek and tributaries including 25 amphibians (Table 7), 41 reptiles (Table 8), 103 birds (Table 5), and 35 mammals (Table 6). As stated above, this discussion is limited to organisms utilizing this habitat mainly because of its riparian characteristics. Aquatic species will be discussed in the section on aquatic communities. In spite of this distinction, the "terrestrial" organisms to be considered here divide conveniently into two categories: those which interact on a more or less continuous basis with the aquatic components of this habitat type (as a source of food, cover, or nesting sites) and those which merely occupy riparian habitat and which utilize the stream itself at most as a source of drinking water. Most of the species listed fall into this latter category (122 of

Table 14. Morphology of the Cape La Croix Creek drainage net.

HORTON-STRAHLER ORDER[1]	NUMBER OF LINKS	LENGTH (km)				TOTAL
		MAX.	MIN.	MEAN	S. D.	
1	38	3.15	0.75	1.547	0.655	58.80
2	17	2.75	0.25	0.797	0.594	13.55
3	7	1.50	0.20	0.857	0.514	6.00
4	13	1.75	0.10	1.115	1.137	14.50

[1]Following Strahler (1954, 1957).

the 204 species).

Among amphibians, perhaps seven species utilize the stream as a source of food and cover. Frogs, especially cricket and bullfrogs, predominate among these. The remaining species listed, mostly salamanders, seek the moist conditions of the floodplain forest rather than the relatively dry upland forest. Still portions of the stream such as backwaters and pools may serve as spawning sites for all of the amphibians listed.

Of the 41 reptiles listed for this habitat type, most (26 species) utilize the stream as a source of food and cover. Turtles have the greatest number of species occupying the creek and sand bar/mudflat habitats. Fourteen are listed in this inventory. Snakes represent the remaining reptiles from these habitats, especially the genus *Natrix*, having six species. Snakes also comprise the bulk of the reptiles occupying riparian habitat, but not interacting significantly with the aquatic components of the community.

One hundred three species of birds are recorded as known or likely to occur in these wildlife habitats. Among the semi-aquatic species, perhaps 32, small wading birds are important species feeding almost exclusively upon larger aquatic organisms such as frogs, fishes, and crayfishes. The bulk of the bird species, however, are many of the smaller species associated with riparian forests (*e. g.*, Parulidae).

Seventeen of the 41 species of mammals are associated with creek and sand bar/mudflat habitats. Most of these are bats (10 species) which feed heavily upon emerging aquatic insects. Of the remaining, only muskrat and beaver occur regularly in open waters. The remaining semi-aquatic species utilize the stream banks as hunting grounds and prey upon both terrestrial and aquatic organisms. The terrestrial component of riparian mammals includes species associated with riparian forests as well as transient species which utilize this habitat as cover while moving between patches of other habitats.

Cape La Croix Creek and its tributaries, and associated sand bars and mudflats, represent the principal water resource in the strict confines of the project watershed. These habitats will be most affected by proposed water resource developments. A discussion of the aquatic communities these habitats represent will be deferred to a later section of this report. The present discussion will be limited to the role these habitats play in the terrestrial ecosystem.

Three factors contribute to Cape La Croix Creek as part of the terrestrial ecosystem. Its riparian community provides cover and nesting sites for many species of terrestrial wildlife and is especially important as a corridor for wildlife movement. Many wildlife species are wary of open areas and rely upon these corridors as avenues for dispersal and movement. In the upper and extreme lower reaches of the watershed, this vegetation has been little disturbed by man. It has developed in areas, which for reasons of access, slope, and/or flooding, are unsuited for other uses. It is absent or very sparse in the middle reaches along the creek due to urban development. Elsewhere in the watershed, streamside clearing has produced a discontinuous band of riparian vegetation, thereby limiting its use as a wildlife corridor.

The aquatic community of Cape La Croix Creek may be as productive per unit area as adjacent agricultural land. In the presence of an agriculture limited to two or three principal crops, the diversity in available food provided by the creek's fishes, crayfishes, and, especially emerging aquatic insects is attractive to many species of terrestrial wildlife. Virtually all groups contain common species which depend upon these food sources.

Finally, Cape La Croix Creek and its tributaries are important to the terrestrial community as a source of drinking water. As stated above, many species of terrestrial wildlife are wary of open areas. Hence, ponds in pastureland are unsuitable and will not be utilized by these species. The presence of tributaries in all parts of the watershed and the relatively intact band of riparian vegetation along these streams provide good watering areas for most wildlife species.

Mississippi River

A last wildlife habitat, the Mississippi River, is included here although it is not strictly within the bounds of this project area. The rationales for inclusion are (1) that many aquatic species will penetrate upstream from the river into the lower reaches of Cape La Croix Creek; (2) adults of many aquatic insects dispersing from the river will reach the creek; and (3) migratory waterfowl following the river will pass over and perhaps rest and feed in the project area.

Table 7 lists seven species of amphibians as inhabitants of the Mississippi River and associated habitats. Frogs are the predominant members of this fauna. All species are common to creek and river habitats and a continuous interchange of fauna is likely in the downstream portions of the project area.

Twenty-three species of reptiles are listed in this inventory for the Mississippi River habitat (Table 8). Predominant among these are the turtles and watersnakes (*Natrix* spp.). All but one species also occurs in Cape La Croix Creek and its tributaries. Snakes are relatively sedentary in habit, but many turtles exhibit a regular pattern of seasonal movements. It is during these periods that a significant exchange between river and creek faunas may occur. At these times turtles are likely to be killed while crossing roads.

Seventy-six species of birds are associated with Mississippi River habitat (Table 5). Included here are large numbers of migratory waterfowl (22 species of Anatidae), herons and egrets (10 species of Ardeidae), numerous other wading birds (18 species), six species of gulls and terns, and all of the larger accipiters, including two species of eagles, the Mississippi kite, and the osprey.

Table 6 lists 15 species of mammals which utilize Mississippi River habitat. Bats predominate with nine species. They are commonly observed in the evening feeding over the river on emerging aquatic insects. In general, however, most of the remaining mammals are confined to the banks of the river. Exceptions venturing into open water areas include the river

otter, muskrat, and beaver.

Wildlife habitats, as discussed above, are illustrated in Figure 3. For convenience, the areas of the various wildlife habitats and the per cent of the watershed each constitutes have been summarized in Table 15.

Table 15. Summary of the extent of various wildlife habitat types in the Cape La Croix Creek watershed.

HABITAT TYPE	AREA (acres)[1]	% WATERSHED[2]
Urban:		
City	328.3	2.3
Suburban	2,063.6	14.6
Exurban	336.5	2.4
Other	270.0	1.9
Non-Urban:		
Agricultural/Old Field	7,992.1	56.7
Upland Forest	3,025.0	21.5
Wetlands		
Type 3 (Inland Shallow Fresh Marsh)	5.0	0.1
Type 4 (Inland Deep Fresh Marsh)	8.0	0.1
Type 5 (Inland Open Fresh Marsh)	46.0	0.3
Type 7 (Wooded Swamp)	25.0	0.2
Cape La Croix Creek & Tributaries/ Sand Bars & Mudflats	57.7 mi	-
Mississippi River/Sand Bars & Mudflats	-	-

[1]Units are area in acres unless otherwise indicated.
[2]Based upon a total watershed acreage of 14,100 acres.

Species in habitats. Non-fish vertebrates known or likely to occur in the Cape La Croix Creek watershed are listed as abundance by habitat in Tables 5 through 8. The following discussion considers the principal species in general terms.

Amphibians

Twenty-nine species and subspecies of amphibians are known or likely to occur in the project area. These include 13 species of salamanders and 16 species of frogs and toads. These species are listed and relative abundance of each is illustrated by habitat in Table 7.

Although most are terrestrial organisms, the amphibians are tied closely to the aquatic and wetland habitats. Reproduction and the development of larval forms (tadpoles) occurs in water. Further, many species require an extremely moist habitat for proper elimination of nitrogenous wastes and for gas exchange through the integument. Some species, such as the mudpuppy and siren, are totally aquatic. Notable exceptions are a few frogs (*Rana*) which will feed in damp pastures, and, especially, the toads (*Bufo*) which often are found far from water. Although the habitat preference for the eastern spadefoot indicates that it is found in agricultural areas, presumably dry, it should be noted that this species lies dormant, buried for most of the year. It emerges only with the spring and early summer rains to reproduce in rain-filled pools.

A conspicuous southern species of salamander entering the project area as a northern limit of its range is the siren. This species is limited to the wetlands of the Southeastern Lowlands south of Cape Girardeau.

The most visible of the Amphibia are the toads, especially during early summer when their young have left the water to begin terrestrial existence. Toads occur abundantly throughout the project area. Numerous larger frogs (Ranidae) may be found by walking through the wetlands south of Cape Girardeau. Although not recorded during field portions of this inventory, chorus and peeper frogs (Hylidae) are probably the most abundant amphibian in the wetland areas. During early spring, tremendous numbers should be found calling from these wetlands.

Reptiles

Fifty-eight species and subspecies of reptiles are known or thought to occur in the Cape La Croix Creek watershed. These include eight species of lizards, 17 taxa of turtles, and 33 taxa of snakes, five of which are venomous (Crotalidae) (Table 8).

Most of the reptiles known or thought to occur in the project area are not associated with water or wetland areas. Exceptions are the turtles (all but the box turtles, *Terrapene*), and a few groups of snakes (*Natrix*, *Thamnophis*, and *Agkistrodon piscivorous*). Although *Natrix* and *Thamnophis* could occur quite far upstream, the preferred habitat for most of the aquatic reptiles would be the lower portions of Cape La Croix Creek, adjacent wetlands, and the many lakes and ponds in the watershed.

All of the lizards occurring in the project area are uncommon or rare in most of the available habitats. Exceptions are two skinks and the racerunner, which may be common in some upland forest situations.

Many of the turtles listed in Table 8 are designated as uncommon or rare in the project area. Most of these are species more common in southern regions which reach their northern limits in the marshes south of Cape Girardeau. During the field portions of this investigation, it was noted that a substantial number of turtles were killed while attempting to cross highways through the wetland areas. Highway deaths could represent a major factor in the ecology of the lowland turtle populations.

Among the reptiles, snakes are the most diverse. A total of 33 species and subspecies are recognized as possible inhabitants of the project area. Most, if not all, of the venomous snakes of the study area are uncommon or rare. A possible exception would be the northern copperhead. This species could be locally common on rocky hillsides in the upland forest habitat.

Birds

Table 5 lists 247 species of birds known or likely to occur in the Cape La Croix Creek watershed. Specific references to the watershed are unavailable and the list was drawn mainly from field studies and from published records from adjacent areas including the National Audubon Society's annual Christmas bird census for Horseshoe Lake and Union County, Illinois, Mingo National Wildlife Refuge, Missouri, and the personal observations of Mr. Paul L. Heye of Cape Girardeau, Missouri. Although the adjacent areas provide a greater diversity of habitats than the project area, their proximity and the great mobility of birds makes it reasonable to assume similarities in avifauna. Nomenclature used in this report follows the recommendation of the American Ornithologist's Union (1957, 1973).

As part of the Mississippi River waterfowl census for the U. S. Army Corps of Engineers, forested areas in the river bottom were surveyed from the air during 1973 to 1975 for colonies of breeding herons and egrets. Dr. Richard R. Graber, Wildlife Specialist of the Illinois Natural History Survey has made available data for 18 survey flights. His data indicate that no nesting colonies occur near the project area.

Prior to 1972, only limited aerial surveys had been made of the waterfowl resources of the Mississippi River adjacent to southern Illinois and southern Missouri. At the request of the U. S. Army Corps of Engineers, Wildlife Specialists Drs. Frank C. Bellrose and Glenn C. Sanderson and Mr. Robert Crompton, all of the Illinois Natural History Survey, undertook a series of aerial censuses to determine the use of this area by waterfowl. A total of 30 survey flights, at approximately 2-week intervals, were flown from 15 November 1972 through 21 March 1973, 6 December 1973 through 2 April 1974, 4 December 1974 through 26 March 1975, and 19 November through 17 December 1975. Results of these surveys have been summarized by Drs. Bellrose and Sanderson and their data have been made available to us.

The entire area censused extended from the confluence of the Mississippi and Ohio Rivers upstream along the Mississippi River to St. Louis, Missouri. Two of their subdivisions occur within the project area: one, extending from Grand Tower, Illinois, to Cape Girardeau, Missouri, and the second, from Cape Girardeau to Cairo, Illinois. Results of these censuses are summarized in Table 16.

In 1952 the U. S. Fish and Wildlife Service began a questionnaire survey of waterfowl harvest for each administrative flyway. This survey was expanded in 1961 to include wing collections for verification as well as provision for county-by-county breakdown of harvest. Results of this survey (Carney, Sorensen, and Martin 1975) yield the following combined average annual harvest of waterfowl for Alexander county, Illinois, and Cape Girardeau county, Missouri. These data are combined with the summarized results of the aerial census program of the Illinois Natural History Survey in Table 17.

When a prey species is abundant in a habitat, it does not necessarily form an important part of the diet of the predator which eats it. Predators are, to some extent, selective in what they eat. The same relationship exists for the hunter-prey interaction of man and migratory waterfowl. Detailed studies of fish feeding have led to the formulation of an "electivity" index or availability factor. This concept is summarized by Hynes (1970). Essentially, the index is the ratio of the percentage of that species in the harvest to its percentage in the fauna. When this ratio is 1.0, there is no selection, but if it is more than or less than 1.0, the species is being selected or rejected, respectively. Ease in locating and killing and palatability are principal among many factors contributing to this index.

Table 17 gives electivity indices for all species having paired observations. Significantly, wood ducks ranked high (third) among species harvested, but were not detected by the aerial census technique. These data indicate very high selection for green-winged teal and pintail and moderate selection for gadwall and Canada goose. Rejection clearly was indicated for the coot which ranked third in abundance, but was not taken by hunters.

Mammals

Table 6 lists mammals known or thought to occur in the Cape La Croix Creek watershed. Fifty species are included in this list. Especially evident on the list are the rodents (rats, mice, and squirrels) and the bats, representing 21 and 12 species, respectively, or approximately two-thirds of all species of mammals. The following discussion considers important mammals of the project area. Harvest data are taken from Schwartz and Schwartz (1959), Porath and Torgerson (1975), and Sampson (1975a, 1975b). Their summaries, especially those of Porath, Torgerson, and Sampson for 1974, indicate hunter and trapper success in Missouri.

The data of Porath and Torgerson (1975) and Sampson (1975a) are summarized by county in the original publications. Data from Sampson

Table 16. Waterfowl observed along the Mississippi River from Grand Tower to Cairo, Illinois, by aerial censuses from 13 December 1972 through 17 December 1975.

SPECIES	1972 12/13	1973 01/09	01/24	02/08	02/21	03/07	03/21	12/06	12/21	1974 01/09
American merganser	-	105	22	-	5	-	-	17	-	58
Black duck	15	1075	180	110	95	135	33	65	115	59
Blue & Snow geese	-	-	-	-	-	-	-	-	-	-
Blue-winged teal	-	-	-	-	-	-	-	-	-	-
Canada goose	-	24500	30000	21500	30700	1550	30	-	690	304
Canvasback	-	-	-	-	-	-	-	-	-	-
Common goldeneye	15	230	53	-	39	-	-	9	38	43
Coot	-	-	-	-	-	-	-	40	-	-
Gadwall	-	-	-	-	-	-	-	-	-	-
Green-winged teal	-	-	-	-	-	-	-	-	-	-
Lesser scaup	-	-	-	-	-	-	11	-	-	-
Mallard	55	16800	5600	2500	3900	6000	194	410	590	217
Pintail	-	-	-	-	-	150	-	-	-	-
Redhead	-	-	-	-	-	-	-	-	-	-
Ring-necked duck	-	-	-	-	-	-	-	-	-	-
Ruddy duck	-	-	-	-	-	-	-	-	-	-
Shoveler	-	-	-	-	-	-	6	-	-	-
Wigeon	-	-	-	-	-	-	-	-	-	-
TOTAL SPECIES	3	5	5	3	5	4	5	5	4	5
TOTAL INDIVIDUALS	85	42710	35855	24110	34739	7835	274	541	1433	681

Table 16. (continued).

SPECIES	1974								1975	
	01/23	02/07	02/20	03/07	03/19	04/02	12/04	12/17	01/02	01/14
American merganser	64	47	48	-	42	-	-	4	-	33
Black duck	70	117	193	26	126	104	57	65	40	99
Blue & Snow geese	-	-	33	-	330	39	16	-	57	-
Blue-winged teal	-	-	-	-	27	139	-	-	-	-
Canada goose	1065	16500	6200	21	330	139	43	30	1615	301
Canvasback	-	-	-	45	92	49	-	-	-	-
Common goldeneye	29	43	113	-	26	-	8	22	9	63
Coot	-	-	445	77	2525	695	163	61	33	27
Gadwall	-	-	-	-	-	55	-	-	-	-
Green-winged teal	-	-	-	-	-	92	80	-	-	-
Lesser scaup	-	-	405	21	1018	620	77	-	-	-
Mallard	320	2925	2675	145	2580	735	635	435	374	728
Pintail	-	44	239	-	116	82	82	-	-	-
Redhead	-	-	46	-	125	9	-	-	-	-
Ring-necked duck	-	-	122	11	371	96	-	-	-	-
Ruddy duck	-	-	-	-	-	-	-	-	-	-
Shoveler	-	-	-	-	106	81	8	-	-	-
Wigeon	-	80	141	-	508	73	42	31	-	-
TOTAL SPECIES	5	7	12	7	15	15	11	7	6	6
TOTAL INDIVIDUALS	1548	19756	10660	346	8322	3008	1211	648	2128	1251

Table 16. (concluded).

SPECIES	1975 01/27	02/10	02/27	03/11	03/26	11/19	12/02	12/17
American merganser	27	79	37	30	6	-	7	6
Black duck	98	151	254	197	114	20	42	75
Blue & Snow geese	39	53	238	100	148	3	-	8
Blue-winged teal	-	-	-	-	550	-	-	-
Canada goose	1815	4425	12100	8850	706	22	17	72
Canvasback	85	73	120	138	223	-	80	-
Common goldeneye	27	99	63	39	22	-	24	22
Coot	220	81	483	435	875	91	69	106
Gadwall	-	-	-	40	77	-	-	-
Green-winged teal	-	-	-	-	105	14	-	43
Lesser scaup	43	161	358	593	455	3	72	17
Mallard	1340	2525	7025	4610	2647	59	181	451
Pintail	-	19	207	383	1175	6	17	26
Redhead	-	-	-	-	-	-	-	-
Ring-necked duck	-	-	69	109	223	16	12	4
Ruddy duck	-	-	-	-	38	-	-	-
Shoveler	-	-	-	22	97	-	-	7
Wigeon	41	104	111	162	2625	18	37	39
TOTAL SPECIES	10	11	12	14	17	10	11	13
TOTAL INDIVIDUALS	3735	7770	21065	15708	10086	252	558	876

Table 17. Migratory waterfowl ranked by abundance from aerial censuses, numbers taken by waterfowl hunters, and the electivity index of the hunter-prey relationship.

SPECIES	ABUNDANCE[1] RANK	ABUNDANCE[1] NUMBER	HARVEST[2] RANK	HARVEST[2] NUMBER	ELECTIVITY INDEX[3]
Canada goose	1	163,525	1	8,102	1.35
Mallard	2	66,656	2	575	0.24
Coot	3	6,426	-	-	-
Wigeon	4	4,012	5	63	0.43
Lesser scaup	5	3,854	8	18	0.13
Black duck	6	3,730	11	3	0.02
Pintail	7	2,546	4	198	2.12
Blue & Snow geese	8	1,064	9	10	0.26
Common goldeneye	9	1,036	-	-	-
Ring-necked duck	10	1,033	7	29	0.77
Canvasback	11	905	-	-	-
Blue-winged teal	12	716	12	3	0.11
American merganser	13	637	-	-	-
Green-winged teal	14	334	6	39	3.18
Shoveler	15	327	-	-	-
Redhead	16	180	-	-	-
Gadwall	17	172	10	10	1.58
Ruddy duck	18	38	-	-	-
Wood duck	-	-	3	458	-
Bufflehead	-	-	13	3	-

[1]Determined from aerial census program of the Illinois Natural History Survey, Grand Tower to Cairo, Illinois.

[2]Numbers from Alexander county, Illinois, and Cape Girardeau county, Missouri (Carney, Sorensen, and Martin 1975).

[3]See text for explanation.

(1975b) are from the north and east Ozark border wildlife management unit and were scaled down to Cape Girardeau county by a percentage of area method.

A single marsupial, the opossum, occurs in the project area. This animal is common to abundant in exurban and rural areas in both open and forest situations. Sampson (1975a) report a 1974 harvest of approximately 1210 in Cape Girardeau county. Although there is some fur value to the opossum, most hunting is for meat or sport. The project area should support a good population of opossum with a bag limit being the only control necessary to insure continued production.

The white-tailed deer is the only native ungulate known to occur in the Cape La Croix Creek watershed. It is common in forest-edge habitat in bottomland and upland situations, frequently venturing into agricultural and exurban habitats. Porath and Torgerson (1975) report a harvest of 80 individuals from Cape Girardeau county in 1974, indicating that the deer are important game animals as well as an asset to the aesthetics of the area. Effective management requires knowledge of the age and sex of harvested animals in addition to numbers taken.

Two species of rabbits occur in the study area. Of these, the swamp rabbit, restricted to wetland areas, is rare. The cottontail is common or abundant in nearly all terrestrial habitats except for the commercial districts of cities. Sampson (1975b) reports a county harvest of nearly 24000 in 1974. Clearly the cottontail is an important game animal. Suitable cottontail habitat exists throughout the project area and substantial populations are present. Again, bag limit is the principal management tool to insure continued yield.

The order Insectivora is represented in the project area by two species of shrews and one species of mole. All species are common or abundant in terrestrial habitats and some occur in wetlands as well. All are voracious predators feeding upon anything which can be overpowered. Moles may be a problem because of their tunneling activities, but perform a service by aerating the soil.

Four groups of carnivores occur or are likely to occur in the project area, including the raccoon, one native cat, three native dogs, and five weasels and skunks. The raccoon is an important upland game species and Schwartz and Schwartz (1959) report that nearly 100,000 were taken annually during 1957 and 1958. Nearly three-fourths of those were taken by hunters with hounds. Sampson (1975a, 1975b) reports a 1974 harvest of 1730 raccoon by trappers and 4625 by hunters from Cape Girardeau county. Raccoons are valuable fur bearers and do provide sport and meat. They are common or abundant throughout the project area and, no doubt, can withstand considerable hunting pressure.

The bobcat is considered as rare and possibly occurring in the project area, especially in heavily forested areas. Schwartz and Schwartz (1959) reported an annual harvest of three per year from Missouri in 1957 and 1958. Sampson (1975a) reports a harvest of five in 1974 from Cape Girardeau county, alone. It is unfortunate that this species is considered undesirable by many as large predators play an important role in maintaining

the populations of many smaller animals. Bobcat also have an aesthetic value in that their persistence in an area reflects a sense of "wildness".

Schwartz and Schwartz (1959) reported an annual harvest of about 400 each of red and gray fox, mostly by pelt hunters and trappers. Sampson (1975a, 1975b) reported a countywide harvest of 103 red fox and 29 gray fox in 1974. In addition, eight coyotes were reported.

Of the five species of weasels and skunks known or likely to occur in the project area, Schwartz and Schwartz (1959) reported an annual harvest for four species. The river otter, not on their list, is now considered endangered and is protected. They reported an annual harvest of 30 long-tailed weasels in 1957 and 1958. This species is now considered rare and is also protected. The remaining species (mink, spotted skunk, and striped skunk) presumably are still important fur bearers in Missouri, although the spotted skunk is rare throughout much of its range. Sampson (1975a) reported a countywide harvest of 110 mink and 7 striped skunk in 1974.

The remaining mammals, 21 species of rodents and 12 species of bats, are ubiquitous, with at least some representatives in all wildlife habitats. Of these, only five rodents are considered game or fur bearers. Gray and fox squirrels are hunted primarily for sport and food. The 1957 and 1958 annual harvest for these species (combined) was over 2 million in Missouri. Muskrats were next in numbers harvested, with nearly 47,000 per year being taken in the state. Schwartz and Schwartz (1959) noted that this was considerably lower than the 140,000 taken annually 10 years earlier. Beaver and woodchuck were also taken as game and fur bearers, but in lesser numbers.

Muskrat are still important fur bearers in the project area. Sampson (1975a) reported a harvest of 1,068 from Cape Girardeau county in 1974. In addition, two beaver were taken.

AQUATIC COMMUNITIES

Limitations of time and funding imposed upon this study precluded detailed analyses of all components of the aquatic communities comprising all the aquatic habitats in the project area. The following discussion was organized by major community (*i. e.*, phytoplankton, zooplankton, benthos, and fishes). For the phytoplankton, zooplankton, and benthos, the discussion was restricted to results of collections made during the field portions of this inventory. However, the availability of supplemental published ecological information for Missouri fishes encouraged the discussion of fishes by general aquatic habitats observed in the project area.

The physical characteristics of the stream stations at the time of sampling are summarized in Table 18 and discussed below. These data typify the habitat separations of Ozark Uplands and Southeastern Lowlands regions, the transitional zone between them, and the wetland areas. The Mississippi River and associated backwater areas were not sampled and are not included in the table.

Phytoplankton. Three species and three genera of blue-green algae (Cyanophyta), nine species and 10 genera of green algae (Chlorophyta), three species and four genera of euglenoids (Euglenophyta), three species and two genera of cryptomonads (Pyrrophyta, Cryptophyceae), and 62 species and 21 genera of diatoms (Chrysophyta) were identified from phytoplankton collections from the six aquatic sampling stations in the Cape La Croix Creek watershed. In all, 80 species and 40 genera were identified. All species and genera enumerated from these collections are summarized in Table 19, along with calculations of species diversity and species richness. Individual station summaries of phytoplankton samples are presented in Appendix 1. General aquatic habitat descriptions representative of the sampling sites at the time of sampling are summarized in Table 18.

All stations demonstrated a relatively high species diversity (Table 19), due principally to diatoms, which yielded the greatest number of species at all stations.

Small streams typically do not develop a rich phytoplankton. In its place, an attached community called *Aufwuchs* or periphyton develops on virtually all available substrates. Sloughing and scour continually replenish the stream's "plankton" as bits of periphyton become dislodged and are swept up into the water column.

Many diatoms are adapted to periphytic existence. This is clearly demonstrated by the results of samples taken at stations 1 and 5, which had bedrock and cobble, and gravel substrates, respectively. Stations 3 and 4, which did not have such suitable natural attachment surfaces, but rather had silt and clay substrates, did not yield large numbers of diatoms. Station 2, considered to be intermediate between the Ozark Uplands and the Southeastern Lowlands, also was intermediate in numbers of diatoms enumerated. This probably was due to the presence of a rubble riffle in the proximity of the bridge at this station. Compared to the stream stations, diatoms were fairly abundant in the wetland samples (station 6). Here, in

Table 18. General aquatic habitat descriptions representative of the seven aquatic sampling sites in the Cape La Croix Creek watershed during May and June, 1976.

PARAMETERS	STATIONS 1	2	3	4	5	6'	6
Mean width (m)	2.6	9	3.5	6.5	4	30	50
Depth (m)	0.3	0.8	0.6	1.5	0.3	0.3	0.8
Size (m^2)[1]	315	405	114	500	100	15	-
Bottom type	bedrock, cobble, gravel	silt, clay	silt, clay	silt, clay	silt, clay, gravel	silt, detritus	silt, detritus
Estimated velocity (m sec^{-1})	~1	<0.5	<0.5	<0.5	<0.5	0	0
Color and clarity	clear	tan, brown, turbid	tan, brown, turbid	tan, brown, turbid	grey-brown, slightly turbid	clear	clear
Percent of shore vegetation or other shading	30	90	50	10	75	0	50

[1]Area sampled for fishes.

Table 19. Phytoplankton collected at stations in the Cape Fear River watershed, May, 1976

TAXA	STATIONS 1	2	3	4	5	6
CYANOPHYTA						
Agmenellum quadruplicatum (Meneghini) Brébisson	-	-	-	-	-	765
Anacystis marina (Hansgirg) Drouet & Daily	-	-	-	-	-	5790
Schizothrix calcicola (Agardh) Gomont	2	-	-	1129.5	59.5	435
Unidentified Filamentous	-	-	19.5	79.5	-	-
CHLOROPHYTA						
Chlamydomonas spp. Ehrenberg	-	36.5	-	36.5	-	264
Chlorella spp. Beyerinck	-	-	-	-	-	993
Chlorogonium euchlorum Ehrenberg	-	-	-	-	-	2295
Closteriopsis spp. Kuetzing	+	-	-	-	-	-
Dictyococcus bicaudatus (Hansgirg) Boye-Petersen	22	-	-	-	-	1285
Monoraphidium contortum (Thuret) Komárková-Legnerová	-	-	19.5	-	-	382
M. dybowskii (Wolosz.) Hindak ex Komárková-Legnerová	-	36.5	-	-	-	-
M. minutum (Naegeli) Komárková-Legnerová	159.5	834	524	1121	-	4382
M. tortile (West & West) Komárková-Legnerová	-	-	-	-	-	1348
Pandorina morum (Muell.) Bory	-	-	-	-	116	-
Scenedesmus dimorphus (Turpin) Kuetzing	-	102.5	155	252.5	-	-
Schroederia setigera (Schroeder) Lemmermann	-	-	-	-	-	511
Spirogyra spp. Link	-	-	-	-	159.5	9071
EUGLENOPHYTA						
Euglena spp. Ehrenberg	-	95.5	195	36.5	-	-
Lepocinclis spp. Perty	-	-	-	-	-	21
Phacus curvicauda Swirenko	-	-	-	-	-	-
P. pleuronectes (Muell.) Dujardin	-	-	-	-	-	-
Trachelomonas volvocina Ehrenberg	-	-	-	-	-	140
PYRROPHYTA						
Chroomonas spp. Hansgirg	-	73	-	-	-	-
C. acuta Utermöhl Hansgirg	-	-	-	-	-	2500
Cryptomonas erosa Ehrenberg	22	-	331.5	-	-	135
C. ovata Ehrenberg	-	-	-	-	-	73
CHRYSOPHYTA						
Chrysophyceae						
Kallomonas spp. Perty	-	36.5	-	-	36.5	-
Sphaerocystium capitatum var. *longipes* (Moebius) Lemmermann	-	-	-	-	-	765
Bacillariophyceae						
Centrales						
Cyclotella spp. Kuetzing	-	11	1.5	-	-	-
C. meneghiniana Kuetzing	-	-	2.5	-	-	-
Melosira distans (Ehrenberg) Kuetzing	-	-	39	-	-	-
M. granulata var. *angustissima* (Grunow) Mueller	-	-	-	-	-	-
M. italica (Ehrenberg) Kuetzing	-	-	-	-	-	-
M. varians Agardh	460	-	-	-	1135	-
Stephanodiscus spp. Ehrenberg	-	70.5	25.5	-	-	-
S. astraea var. *minutula* (Kuetzing) Grunow	-	42	5.5	-	-	-
Unidentified Centrics	-	551.5	4	-	-	-
Pennales						
Achnanthes sp. Bory	264	-	-	-	10	530
A. hungarica (Grunow) Grunow	13.5	-	-	-	-	117
A. lanceolata var. *dubia* Grunow	40	-	6	11.5	85	-
A. linearis f. curta H. L. Sm.	262.5	-	-	-	125.5	-
A. minutissima (Kuetzing) Cleve	97.5	12.5	-	-	-	-
Amphora ovalis Kuetzing	-	-	-	-	10	-
Cocconeis placentula var. *euglypta* (Ehrenberg) Cleve	6	-	-	10	-	-
Cymatopleura solea (Brébisson) W. Smith	-	-	11	-	-	-
Cymbella tumida (Brébisson) Van Heurck	109.5	-	-	-	-	-
C. turgida (Gregory) Cleve	-	13.5	-	-	-	-
Fragilaria spp. Lyngbye	41.5	-	-	-	-	43
F. pinnata Ehrenberg	28	-	-	-	-	-
F. vaucheriae (Kuetzing) Peters.	-	127	-	-	-	-
Gomphonema spp. Agardh	7.5	-	-	-	-	-
G. angustatum (Kuetzing) Rabenhorst	1239	-	-	42	10	-
G. olivaceum (Lyngbye) Kuetzing	-	31	-	10.5	-	-
G. parvulum (Kuetzing) Grunow	-	-	-	-	-	95.5
G. sphaerophorum Ehrenberg	-	13.5	-	-	-	-
Gyrosigma scalproides (Rabenhorst) Cleve	-	-	11	-	-	-
Meridion circulare (Greville) Agardh	21	-	-	-	-	-
Nivicula spp. Bory	34	6	11	74	61	191
N. accomoda Hustedt	6	-	-	-	-	-
N. capitata var. *hungarica* (Grunow) Ross	-	-	-	-	-	95.5
N. cryptocephala Kuetzing	-	36.5	-	-	33.5	-
N. cryptocephala var. *veneta* (Kuetzing) Rabenhorst	-	-	-	20.5	95	-
N. gastrum Ehrenberg	-	-	-	-	-	95.5
Nivicula cf. *gracilloides* Mayer	7.5	-	-	-	-	-
N. heufleri var. *leptocephala* (Brébisson) Patrick	-	-	-	20.5	-	95.5
N. minima Grunow	13.5	-	11	-	-	-

Table 19. (concluded).

TAXA	STATIONS 1	2	3	4	5	6
Pennales (concluded)						
Navicula cf. *placentula* (Ehrenberg) Kuetzing	-	-	11.5	-	5	-
N. pelliculosa (Brébisson) Hilse	27	-	-	52	5	-
N. pupula Kuetzing	-	-	-	20.5	-	-
Navicula cf. *rhynocephala* Kuetzing		-	11	-	-	-
N. rhynocephala var. *germanii* (Wallace) Patrick		6	22	42	-	-
N. salinarum var. *intermedia* (Grunow) Cleve	35.5	-	-	-	-	-
N. secreta var. *apiculata* Patrick	-	-	-	-	48.5	-
Nitzschia spp. Hassall	112	51	40	94.5	212.5	212.5
N. acicularis Smith	-	13.5	6	74	10	-
N. amphibia Grunow	-	-	6	-	-	191
N. clausii Hantzsch	-		-	20.5	-	-
N. dissipata (Kuetzing) Grunow	45		6	20.5	33.5	191
N. filiformis (W. Smith) Hustedt	-	-	11	-	-	-
N. frustulum var. *perminuta* (Rabenhorst) Grunow	125	-	11	20.5	-	-
Nitzschia cf. *invisitata* Hustedt	117.5	-	-	-	33.5	-
N. kuetzingiana Hilse	55	-	126	137	356	-
Nitzschia cf. *linearis* W. Smith		-	-	-	67.5	-
N. microcephala Grunow		-	12.5	-	-	-
N. palea (Kuetzing) W. Smith		-	96.5	52.5	33.5	95.5
N. sigma (Kuetzing) W. Smith	-		6	-	-	-
N. sublinearis Hustedt	-	-	58.5	-	-	-
Pinnularia spp. Ehrenberg			12.5	-	-	-
Rhoicosphenia curvata (Kuetzing) Grunow	82.5	-	22	-	-	-
Stauroneis spp. Ehrenberg		-	-	-	-	289.5
S. anceps f. gracilis Rabenhorst	-	-	-	-	-	11
Surirella angusta Kuetzing	-	-	-	10	-	-
S. minuta Brébisson	-	-	-	20.5	-	-
S. ovata Kuetzing	173.5	107.5	65	190.5	101	-
S. ovata var. *pinnata* (W. Smith) Hustedt	27.5	-	22	-	17.5	-
Synedra rumpens Kuetzing		-	-	-	33.5	-
S. rumpens var. *meneghiniana* Grunow		-	12.5	-	-	-
S. tenera W. Smith	-	-	87.5	-	-	-
S. ulna (Nitzsch) Ehrenberg	-	-	-	-	-	21.5
Unidentified Pennates	104.5	77.5	19	-	-	871
TOTAL NUMBER OF SPECIES	32	22	35	29	27	37
TOTAL NUMBER OF INDIVIDUALS	3717.5	2188	2037	3609.5	2914.5	37541.5
SPECIES DIVERSITY	3.5	3.1	3.7	3.0	3.4	3.6
SPECIES RICHNESS	3.1	2.9	3.4	2.7	3.1	3.3

[1]Entries represent number of phytoplankters per liter; "+" = present in insufficient densities to establish accurate count.
Summaries of all phytoplankton collections are presented in Appendix .

the absence of a hard substrate, the diatoms were associated with the stems of the *Nuphar*.

Although the remaining groups of algae were present at nearly all of the stream stations and, in fact, developed fairly large populations, particularly at downstream sites, it was in the still waters of the wetlands that maximum development of these groups occurred. Blue-green algae, the cryptomonads, euglenoids, and especially the green algae proliferated. For example, green algae were the predominant forms there, representing over 63% of the total number of individuals counted.

Zooplankton. Nine species and eight genera of cladocerans, three species and three genera of copepods, and one species and 12 genera of rotifers were identified from zooplankton collections from the six aquatic sampling sites in the Cape La Croix Creek watershed (Appendix 2). These data are summarized in Table 20. Species diversity and species richness were calculated for each of the sampling stations and these data also appear in Table 20.

Zooplankton is never particularly abundant nor diverse in small streams. This fact is supported by data obtained in the present study (Table 20). At all stream stations, most taxa present occurred in insufficient densities to establish an accurate count. Those stream stations in proximity to large pools, as at station 4 and upstream from station 5, did yield sufficient densities of some taxa to permit accurate counting.

Despite generally poor representations of zooplankton populations at stream sites, some general observations are possible. In general, the rotifers predominated, with copepods comprising the balance of the community. Predominant forms included bdelloid rotifers and immature copepods (nauplii and copepodids).

The population density of zooplankton observed at station 6 reflected the obvious differences between lotic and lentic habitats. The density of zooplankton in the wetland was nearly 20 times that observed at any of the stream stations. Also, the community observed in the wetland was clearly the most diverse with 17 taxa reported. Nearly 75% of the zooplankton collected here, however, were immature copepods. Despite this numerical dominance by copepods, cladocerans represented more than 50% of the taxa identified.

Benthos. Results of replicate quantitative sampling of benthic macroinvertebrates are presented in Appendix 3. These data are summarized and supplemented with qualitative data in Table 21. This table also presents the results of species diversity and species richness calculations.

One hundred twenty-three taxa of benthic macroinvertebrates were identified from aquatic sampling stations 1 through 6. Especially abundant were aquatic beetles, aquatic oligochaete worms, and aquatic flies, representing 29.6%, 22.9%, and 22.0%, respectively, of the species found. It is significant to note that only two of the 35 species of aquatic beetles taken were collected by quantitative means, while all of the aquatic worms

Table 20. Zooplankton[1] observed at stations in the Cape La Croix Creek watershed, May, 1976.

TAXA	STATIONS 1	2	3	4	5	6
CLADOCERA						
Alona circumfimbriata Megard	-	-	-	+	-	-
A. guttata Sars	-	-	-	-	-	+
Bosmina spp. Baird (immature)	-	-	-	+	-	-
B. longirostris (O. F. Müller)	-	-	-	-	+	9.5
Ceriodaphnia spp. Dana (immature)	-	-	-	-	-	1.5
Chydorus sphaericus (O. F. Müller)	-	-	-	+	-	1
Daphnia spp. O. F. Müller (immature)	-	-	-	-	-	1.5
D. ambigua Scourfield	-	-	-	-	-	7
D. parvula Fordyce	-	-	-	-	-	2
Kurzia latissima (Kurz)	-	-	-	-	-	2
Pleuroxus denticulatus Birge	-	-	-	-	-	+
Simocephalus vetulus Schödler	-	-	-	-	-	+
COPEPODA						
Diaptomus pallidus Herrick	-	-	-	-	+	6
Eucyclops spp. Claus	-	-	-	+	-	-
E. agilis (Koch)	-	-	+	-	-	-
Tropocyclops prasinus (Fischer)	-	-	-	-	+	-
Nauplii	+	+	+	3	+	142
Calanoid Copepodids	-	-	-	-	-	1.5
Cyclopoid Copepodids	+	+	-	0.5	0.5	2.5
Harpacticoida	-	-	-	+	-	-
ROTIFERA						
Brachionus patulus Müller	-	-	-	-	-	6
Cephalodella spp. Bory de St. Vincent	-	+	+	5	1	-
Euchlanis spp. Ehrenberg	-	-	+	+	+	-
Gastropus spp. Imhof	-	-	-	-	+	-
Keratella spp. Bory de St. Vincent	-	-	-	-	-	10
Lecane spp. Nitzsch	-	+	-	-	-	+
Lepadella spp. Bory de St. Vincent	-	-	-	-	+	-
Monostyla spp. Ehrenberg	-	+	-	-	+	+
Notommata spp. Ehrenberg	-	-	+	-	-	-
Testudinella spp. Bory de St. Vincent	-	-	-	0.5	-	3.5
Trichocerca spp. Lamarck	-	-	-	0.5	2	+
Trichotria spp. Bory de St. Vincent	-	-	-	+	-	-
Bdelloid Rotifers	+	+	+	1	2	-
TOTAL NUMBER OF TAXA	1	5	5	11	10	17
TOTAL NUMBER OF INDIVIDUALS	-	-	-	10.5	5.5	196
SPECIES DIVERSITY	0	2.3	2.3	1.9	2.2	3.2
SPECIES RICHNESS	0	4.6	4.6	1.2	1.2	2.6

[1]Entries represent number of zooplankters per liter; "+" = present in insufficient densities to establish accurate count. Summaries of all zooplankton collections are presented in Appendix 2.

Table 21. Benthic macroinvertebrates observed at stations in the Cape La Croix Creek watershed, May and June, 1976.

TAXA	STATIONS 1	2	3	4	5	6
ANNELIDA						
Hirudinea						
Erpobdellidae						
Erpobdella punctata (Leidy)	-	-	8.6	-	-	-
Glossiphoniidae						
Helobdella punctata elrodi Moore	-	-	-	-	-	+
Placobdella multilineata Moore	-	-	-	-	-	+
Oligochaeta						
Lumbriculidae						
Lumbriculus variegatus (Müller)	-	-	-	-	-	8.6
Naididae						
Aulophorus furcatus (Müller)	-	-	-	-	-	68.8
Dero digitata (Müller)	-	-	-	-	-	77.4
D. nivea Aiyer		-	-	-	-	223.6
D. sawyeri d'Udekem		-	-	-	-	249.4
Nais communis Piguet		-	111.8	-	-	722.4
N. simplex Piguet		-	-	-	-	249.4
N. variabilis Piguet		-	25.8	-	-	86
Pristina acuminata Bourne		-	-	-	-	17.2
P. bilobata Bourne		4.4	-	8.6	-	154.8
P. longiseta (Ehrb.) Smith		-	-	-	-	34.4
P. plumaseta Turner		2.2	-	-	-	34.4
Slavina appendiculata d'Udekem		-	-	-	-	111.8
Stylaria lacustris (Linnaeus)		-	-	-	-	15.4
Tubificidae						
Branchiura sowerbyi Beddard	-	-	17.2	-	-	103.2
Limnodrilus spp. Claparède (immatures)	-	-	438.6	594.4	-	283.8
L. cervix Brinkhurst	-		77.4	8.6	-	-
L. claparedianus Ratzel	-	-	-	361.2	-	86
L. hoffmeisteri Claparède	-	4.4	541.8	1765	-	595.6
L. maumeensis Brinkhurst & Cook	-	-	-	35	-	111.8
L. udekemianus Claparède	-	4.4	94.6	258	-	103.2
Peloscolex spp. Leidy	-	-	-	68.8	-	-
P. ferox (Eisen)	-	-	-	-	-	206.4
P. freyi Brinkhurst	-	-	-	25.8	-	-
P. multisetosus (Smith)	-	-	-	-	-	146.2
P. variegatus Leidy	-	-	17.2	111.8	-	576.2
Potamothrix spp. Vejdovsky & Mrazek	-	-	-	34.4	-	-
P. bedoti (Hrabe)	-	-	51.6	86	-	645
Spirosperma nikolskyi Brinkhurst & Cook	-	-	17.2	25.8	-	34.4
Tubifex tubifex (Müller)		-	8.6	8.6	-	-
MALACOSTRACA						
Amphipoda						
Gammaridae						
Gammarus minus Say	-	-	-	-	28.6	-
G. pseudolimnaeus Bousfield	279.4	88	-	-	24.2	-
Talitridae						
Hyalella azteca (Saussure)	-	-	-	-	-	+
Isopoda						
Asellidae						
Asellus intermedius intermedius Forbes	90.2	13.2	8.6	-	35.2	-
INSECTA						
Ephemeroptera						
Baetidae						
Centroptilum spp. Eaton	+	132	-	-	11	-
Caenidae						
Caenis spp. Stephens	68.2	4.4	17.2	-	-	17.2
Ephemerellidae						
Ephemerella frisoni McDunnough	+	-	-	-	-	-
Heptageniidae						
Stenacron interpunctatum (Say)	6.6	-	-	-	-	-
Stenonema femoratum (Say)	2.2	-	+	-	-	-
S. tripunctatum (Banks)	35.2	13.2	+	-	-	+
Leptophlebiidae						
Paraleptophlebia mollis (McDunnough)	11	2.2	-	-	-	-
Plecoptera						
Perlidae						
Neoperla clymene (Newman)	6.6	4.4	-	-	-	-
Perlesta placida (Hagen)	-	2.2	-	-	-	-
Neuroptera						
Sisyridae						
Sisyra vicaria (Walker)	-	-	+	-	-	-
Coleoptera						
Dytiscidae						
Celina angulata Aubé	-	-	-	-	-	+
Copelatus chevrolati Aubé	+	-	-	-	-	-
C. glyphicus (Say)	-	-	-	-	-	+

Table 21. (continued).

TAXA	STATIONS 1	2	3	4	5	6
Dytiscidae (concluded)						
Coptotomus interrogatus (Fabricius)	+	-	+	-	-	-
Hydroporus cf. *consimilis* LeConte	-	-	+	-	-	-
H. vittatipennis Gemminger & Harold	-	-	-	-	-	+
Laccophilus proximus Say	-	-	-	-	-	+
Liodessus affinis (Say)	-	-	+	-	-	-
Thermonectes ornaticollis ornaticollis Aubé	-	-	+	-	-	+
Uvarus lacustris (Say)	-	-	+	-	-	+
Elmidae						
Dubiraphia sp. 1 Sanderson	+	-	-	-	-	-
Dubiraphia sp. 2 Sanderson	+	-	-	-	-	-
Macronychus glabratus (Say)	+	-	-	-	-	-
Stenelmis crenata (Say)	4.4	13.2	25.8	8.6	6.6	-
Haliplidae						
Peltodytes lunavani Young	-	-	-	-	-	+
P. muticus (LeConte)	-	-	-	-	-	+
P. sexmaculatus Roberts	-	-	-	-	-	+
Helodidae						
Prionocyphon sp. Redtenbacher	-	-	+	-	-	+
Hydrophilidae						
Berosus fraternus LeConte	+	-	-	-	-	+
B. infuscatus LeConte	+	-	+	-	-	-
B. pantherinus LeConte	-	-	-	-	-	+
B. peregrinus (Herbst)	-	-	-	-	-	+
Chaetarthria atra (LeConte)	+	-	-	-	-	-
Cymbiodyta cf. *blanchardi* Horn	+	-	+	-	-	-
Enochrus consortus Green	-	-	-	-	-	+
E. ochraceus (Melsheimer)	+	-	-	-	-	+
E. pygmaeus nebulosus (Say)	+	-	+	-	-	+
Helophorus spp. Fabricius	-	-	-	-	-	+
Hydrochara obtusata (Say)	+	-	-	-	-	-
Paracymus subcupreus (Say)	+	-	+	-	-	+
Tropisternus sp. Solier (immature)	+	-	-	-	-	-
T. lateralis nimbatus (Say)	-	-	+	-	-	+
Noteridae						
Hydrocanthus iricolor Say		-	-	-	-	+
Suphisellus bicolor (Say)	+	-	-	-	-	-
Psephenidae						
Psephenus herricki (DeKay)	1.1	2.2	-	-	-	-
Trichoptera						
Hydropsychidae						
Cheumatopsyche sp. Wallengren	+	2.2	-	-	8.8	-
C. pettiti (Banks)	+	-	+	-	-	+
Hydropsyche orris Ross		-	+	-	-	+
Potamyia flava (Hagen)		-	+	-		+
Leptoceridae						
Ceraclea transversus (Hagen)	-	-	+	-	-	+
Nectopsyche albida (Walker)	-	-	-	-	-	+
Oecetis inconspicua (Walker)	-	-	+	-	-	-
Philopotamidae						
Chimarra sp. Stephens	-	2.2	-	-	-	-
C. aterrima Hagen	+	-	-	-	-	-
C. feria Ross	+	-	-	-	-	-
C. obscura (Walker)	-	6.6	+	-	-	-
Psychomyiidae						
Cernotina zilcoa Ross	-	-	+	-	-	-
Neureclipsis crepuscularis (Walker)	-	-	+	-	-	-
Diptera						
Ceratopogonidae						
Palpomyia complex Meigen	-	-	-	-	-	8.6
Chaoboridae						
Chaoborus punctipennis (Say)	-	-	-	-	-	34.4
Chironomidae						
Tanypodinae						
Ablabesmyia sp. Johannsen		-	-	-	19.8	-
A. mallochi (Walley)		-			8.8	
Larsia sp.		-			4.4	-
Procladius spp. Skuse		6.6	8.6	-	2.2	-
P. bellus (Loew)	-	46.2	118.8	8.6	30.8	43
Pseudotanypus dyari (Coquillett)	-	-	-	-	8.8	-
Tanypus neopunctipennis Sublette	-		8.6	-	-	-
T. stellatus Coquillett		6.6		-	-	-
Thienemannimyia complex Fittkau	-	13.2	-	25.8	8.8	8.6
Orthocladiinae						
Cricotopus sp. Wulp	8.8	-	-	-	-	-
C. bicinctus (Meigen)	50.4		-	-	17.6	-
Corynoneura scutellata Winnertz	2.2	-	-	-	-	-
Chironominae						
Chironomus attenuatus (Walker)		-	34.4	-	136.4	-
C. riparius Meigen	-	77	43	-	6.6	-

Table 21. (concluded).

TAXA	STATIONS 1	2	3	4	5	6
Chironominae (concluded)						
Cryptochironomus fulvus Johannsen	-	30.8	43	-	50.6	-
Glyptotendipes lobiferus (Say)	-	8.8	-	-	33	-
Harnischia sp. Kieffer	-	-	-	-	11	-
Microtendipes pedellus (DeGeer)	-	4.4	-	-	8.8	-
Paratendipes albimanus (Meigen)	-	-	-	-	8.8	-
Polypedilum illinoense (Malloch)	-	-	-	-	4.4	-
P. scalaenum (Schrank)	-	15.4	133.6	-	13.2	-
Stenochironomus sp. Kieffer	-	2.2	-	-	2.2	-
Tanytarsus sp. Wulp	2.2	6.6	25.8	-	19.8	-
Simuliidae						
Simulium sp. Latreille	-	63.8	-	-	-	-
TOTAL NUMBER OF SPECIES (Quantitative)	14	29	23	17	25	30
TOTAL NUMBER OF INDIVIDUALS	580.8	822.8	1877.8	3818.4	510.4	4979.1
SPECIES DIVERSITY	2.7	3.4	3.3	2.6	3.8	1.2
SPECIES RICHNESS	2.4	5.1	3.0	2.3	3.4	3.8

[1]Entries represent numbers of benthic macroinvertebrates per m^2; "+" = collected during non-quantitative sampling. Summaries of all benthic collections are presented in Appendix 3.

and aquatic flies came from quantitative samples. Differences in vulnerability to quantitative sampling devices, such as is demonstrated here, illustrate the need for supplemental collecting in inventory studies.

The aquatic insect fauna of Missouri has not been studied intensively. Although several groups currently are under investigation, only the aquatic Heteroptera have been treated in publication, and then only as a portion of a larger study of the total Heteroptera fauna of the state (Froeschner 1962). Although few specific records for the Cape Girardeau area exist, overall distribution patterns for 41 species are such that they are either known or likely to occur in the Cape La Croix Creek watershed.

Results of sampling were especially interesting at stations 5 and 6 (Table 21). A total of 26 taxa were taken at station 5, 23 of which were midges (Diptera: Chironomidae). Most of these midges were represented by small tube-dwelling larvae attached to the gravel substrate which comprised the stream bed. Apparently other benthic taxa were unable to compete successfully or were limited by other ecological or water quality considerations. The midges were represented by only two taxa in the wetland samples.

The distribution of aquatic oligochaete worms corresponded inversely to the amount of silt in the substrate and, presumably, also to the amount of organic matter present. The soft organic sediments of station 6 permitted the development of a large number and great variety of aquatic worms (Table 21). Results of quantitative sampling illustrate a population with 97.8% of the numbers of individuals and 85.3% of the species being oligochaetes. This station perhaps best exhibits the value of supplemental collecting by qualitative means. An additional 29 species were added to the station 6 faunal list by this means (mostly aquatic beetles). These organisms were from portions of the habitat not sampled effectively by quantitative means or were present in numbers too low to permit adequate sampling by quantitative devices.

Fishes. Table 22 lists 121 species of fishes known or likely to occur in the Cape La Croix Creek watershed. Although the Mississippi River is adjacent to the drainage basin, Mississippi River fishes are included in the table. The fish faunas of both the state of Missouri and the Mississippi River are well known and a substantial literature exists detailing the precise sites where species have been taken. For this reason it is felt that the species list presented in Table 22 is quite complete. This table includes habitat preference and abundance data for all species.

Distribution patterns of the fishes of Missouri permit recognition of four primary faunal regions: Ozark, lowland, prairie, and big river. Precise boundaries of these regions generally do not exist. Rather, the faunal regions are separated by transition zones. Pflieger (1971) considers this zone of transition an "Ozark border" where fishes characterizing the Ozark, lowland, and prairie faunal regions meet and mix. He points out that actual species composition of the Ozark border varies markedly from one area to another and that it is best thought of as a broad ecotone rather than a distinct faunal region.

Table 22. Checklist of fishes known or likely to occur in the Cape La Croix Creek watershed.

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/ SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
ACIPENSERIDAE							
Scaphirhynchus albus (Forbes & Richardson)[1] Pallid sturgeon	R						
Scaphirhynchus platorynchus (Rafinesque)[1] Shovelnose sturgeon	U						
AMIIDAE							
Amia calva Linnaeus[1] Bowfin	R	C	R	U	U		
ANGUILLIDAE							
Anguilla rostrata (Lesueur)[1] American eel	U	U			R		
APHREDODERIDAE							
Aphredoderus sayanus (Gilliams) Pirate perch					R		
ATHERINIDAE							
Labidesthes sicculus (Cope)[1] Brook silversides	R						
CATOSTOMIDAE							
Carpiodes carpio (Rafinesque)[1] River carpsucker	A	C			R		

A= Abundant, readily observed
C= Common, usually readily observed
U= Uncommon, but likely to be observed
R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/ SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
CATOSTOMIDAE (continued)							
Carpiodes cyprinus (Lesueur)[1] Quillback carpsucker	A	C			C		
Catostomus commersoni (Lacépède)[2] White sucker	R				U	U	
Cycleptus elongatus (Lesueur) Blue sucker	R						
Erimyzon oblongus (Mitchill)[2] Creek chubsucker					R	R	
Hypentelium nigricans (Lesueur)[1] Hogsucker						U	U
Ictiobus bubalus (Rafinesque)[1] Smallmouth buffalo	U						
Ictiobus cyprinellus (Valenciennes) Bigmouth buffalo	A	A	A		C	U	
Ictiobus niger (Rafinesque)[1] Black buffalo	R						
Minytrema melanops (Rafinesque)[2] Spotted sucker					U	U	
Moxostoma erythrurum (Rafinesque) Silver redhorse	R						

A= Abundant, readily observed
C= Common, usually readily observed
U= Uncommon, but likely to be observed
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Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/ SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
CATOSTOMIDAE (concluded)							
Moxostoma carinatum (Cope) River redhorse					U		
Moxostoma duquesnei (Lesueur)[1] Black redhorse					R		
Moxostoma erythrurum (Rafinesque)[1] Golden redhorse	U				U	U	
Moxostoma macrolepidotum (Lesueur)[1] Shorthead redhorse	C				C		
CENTRARCHIDAE							
Ambloplites rupestris (Rafinesque) Rock bass					R	U	U
Centrarchus macropterus (Lacépède) Flier		U		U			
Lepomis cyanellus Rafinesque[2] Green sunfish	U	C	A		C	C	C
Lepomis gulosus (Cuvier)[1] Warmouth	U	U					
Lepomis humilis (Girard)[1] Orangespotted sunfish	C				C	C	C
Lepomis macrochirus Rafinesque[2] Bluegill	A	A	A	A	A	A	A

A= Abundant, readily observed
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Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/ SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
CENTRARCHIDAE (concluded)							
Lepomis megalotis (Rafinesque)[2] Longear sunfish						R	R
Micropterus dolomieui Lacépède[1] Smallmouth bass					U	U	U
Micropterus punctulatus (Rafinesque) Spotted bass	R						
Micropterus salmoides (Lacépède)[1] Largemouth bass	C	A	A	U	C	C	C
Pomoxis annularis Rafinesque[1] White crappie	A	A	A		A	C	U
Pomoxis nigromaculatus (Lesueur)[1] Black crappie	A	A	A		A	C	U
CLUPEIDAE							
Alosa alabamae Jordan & Evermann Alabama shad	R						
Alosa chrysochloris (Rafinesque)[1] Skipjack herring	U						
Dorosoma cepedianum (Lesueur)[1] Gizzard shad	A	A	A	U	U	R	
Dorosoma petenense (Günther)[1] Threadfin shad	R						

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[2]Presence verified during this inventory

Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/ SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
COTTIDAE							
Cottus carolinae (Gill)[1] Banded sculpin							R
CYPRINIDAE							
Campostoma anomalum (Rafinesque)[2] Stoneroller					C	C	A
Campostoma oligolepis Hubbs & Greene[1] Largescale stoneroller					R	R	U
Carassius auratus (Linnaeus) Goldfish			U	U	U	R	
Ctenopharyngodon idella (Valenciennes)[1] Grass carp	R						
Cyprinus carpio Linnaeus[1] Carp	A	A	A	A	A	A	A
Dionda nubila (Forbes)[2] Ozark minnow					R	C	C
Ericymba buccata Cope[1] Silverjaw minnow						R	R
Hybognathus argyritis Girard[1] Western silvery minnow	R						
Hybognathus nuchalis Agassiz[1] Silvery minnow	A						

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Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/ SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
CYPRINIDAE (continued)							
Hybognathus placitus Girard[1] Plains minnow	U						
Hybopsis aestivalis (Girard)[1] Speckled chub	C						
Hybopsis amblops (Rafinesque)[1] Bigeye chub						R	R
Hybopsis gelida (Girard)[1] Sturgeon chub	R						
Hybopsis gracilis (Richardson)[1] Flathead chub	C						
Hybopsis meeki Jordan & Evermann[1] Sicklefin chub	U						
Hybopsis storeriana (Kirtland)[1] Silver chub	C						
Hybopsis x-punctata Hubbs & Crowe[1] Gravel chub	R						
Nocomis biguttatus (Kirtland)[2] Hornyhead chub					U	C	C
Notemigonus crysoleucas (Mitchill)[1] Golden shiner	U	A	R		R	R	

A= Abundant, readily observed
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R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP; DEEP/SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
CYPRINIDAE (continued)							
Notropis atherinoides Rafinesque[1] Emerald shiner	A						
Notropis blennius (Girard)[1] River shiner	A						
Notropis boops Gilbert[1] Bigeye shiner					R	R	R
Notropis buchanani Meek[1] Ghost shiner	A						
Notropis chrysocephalus (Rafinesque)[1] Striped shiner					U	U	U
Notropis hudsonius (Clinton) Spottail shiner	R						
Notropis lutrensis (Baird & Girard)[2] Red shiner	A				A	A	A
Notropis shumardi (Girard)[1] Silverband shiner	U						
Notropis spilopterus (Cope)[1] Spotfin shiner					R	R	
Notropis stramineus (Cope)[2] Sand shiner	U				C	C	C

A= Abundant, readily observed
C= Common, usually readily observed
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R= Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
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Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/ SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
CYPRINIDAE (concluded)							
Notropis umbratilis (Girard)[2] Redfin shiner					U	U	U
Notropis venustus (Girard) Blacktail shiner					U	U	
Notropis volucellus (Cope) Mimic shiner	U						
Notropis whipplei (Girard) Steelcolor shiner					U	U	
Phenacobius mirabilis (Girard)[1] Suckermouth minnow	R				U	U	U
Phoxinus erythrogaster (Rafinesque) Southern redbelly dace						R	R
Pimephales notatus (Rafinesque)[2] Bluntnose minnow	U				C	C	C
Pimephales promelas Rafinesque Fathead minnow	U				R	R	
Pimephales vigilax (Baird & Girard)[1] Bullhead minnow	U				R	R	
Semotilus atromaculatus (Mitchill)[2] Creek chub					U	C	C

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Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP; DEEP/SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
CYPRINODONTIDAE							
Fundulus catenatus (Storer) Northern studfish					R	R	
Fundulus notatus (Rafinesque)[1] Blackstripe topminnow	U	C	C	C	C	C	C
Fundulus olivaceus (Storer)[2] Blackspotted topminnow					C	C	C
ESOCIDAE							
Esox americanus Lesueur[1] Grass pickerel			U		U	U	
HIODONTIDAE							
Hiodon alosoides (Rafinesque)[1] Goldeye	U						
Hiodon tergisus Lesueur[1] Mooneye	R						
ICTALURIDAE							
Ictalurus furcatus (Lesueur)[1] Blue catfish	U						
Ictalurus melas (Rafinesque)[2] Black bullhead			C	U	C	U	R

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SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
ICTALURIDAE (concluded)							
Ictalurus natalis (Lesueur)[1]							
Yellow bullhead	R	U	U		U	U	
Ictalurus punctatus (Rafinesque)[1]							
Channel catfish	A		U		C		
Noturus exilis Nelson[1]							
Slender madtom						R	R
Noturus flavus Rafinesque[1]							
Stonecat	R						
Noturus gyrinus (Mitchill)[1]							
Tadpole madtom	U					U	U
Noturus miurus Jordan							
Brindled madtom							U
Noturus nocturnus Jordan & Gilbert							
Freckled madtom							U
Pylodictis olivaris (Rafinesque)[1]							
Flathead catfish	U						
LEPISOSTEIDAE							
Lepisosteus osseus (Linnaeus)[1]							
Longnose gar	U	U	R				
Lepisosteus platostomus Rafinesque[1]							
Shortnose gar	A	A	R	R	C		

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Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
LEPISOSTEIDAE (concluded)							
Lepisosteus spatula Lacépède[1] Alligator gar	R	R					
PERCICHTHYIDAE							
Morone chrysops (Rafinesque)[1] White bass	A						
Morone mississippiensis Jordan & Eigenmann Yellow bass	R						
PERCIDAE							
Ammocrypta vivax Hay Scaly sand darter						R	R
Etheostoma asprigene (Forbes)[1] Mud darter		U					
Etheostoma blennioides Rafinesque Greenside darter						C	C
Etheostoma chlorosomum (Hay)[1] Bluntnose darter	U				U	U	
Etheostoma flabellare Rafinesque[1] Fantail darter							R
Etheostoma gracile (Girard)[1] Slough darter		U		U	R		

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Table 22. (continued).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/ SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
PERCIDAE (continued)							
Etheostoma nigrum Rafinesque[2] Johnny darter	U					U	U
Etheostoma proeliare (Hay) Cypress darter				R	R	R	
Etheostoma spectabile (Agassiz)[2] Orangethroat darter							C
[illegible] (Jordan) [illegible] darter							R
[illegible] (Rafinesque)[1] Log perch	U						
[illegible] (Girard)[1] Blackside darter					U		
Percina shumardi (Girard)[1] River darter	C						
Sander canadense (Smith)[1] Sauger	C						

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R= Rare, within the range of the species, but seldom observed

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Table 22. (concluded).

SPECIES	MISSISSIPPI RIVER	BACKWATERS/OXBOWS	OPEN FRESH MARSH	WOODED SWAMP, DEEP/SHALLOW FRESH MARSH	CAPE LA CROIX CR (SE LOWLANDS)	CAPE LA CROIX CR (TRANSITIONAL)	CAPE LA CROIX CR (OZARK UPLANDS)
PERCIDAE (concluded)							
Stizostedion vitreum (Mitchill)[1]							
Walleye	U						
PETROMYZONTIDAE							
Ichthyomyzon castaneus Girard[1]							
Chestnut lamprey	R						
Ichthyomyzon unicuspis Hubbs & Trautman							
Silver lamprey	U						
POECILIIDAE							
Gambusia affinis (Baird & Girard)[2]							
Mosquitofish	U	A	A	A	C	C	U
POLYODONTIDAE							
Polyodon spathula (Walbaum)[1]							
Paddlefish	U	U					
SCIAENIDAE							
Aplodinotus grunniens Rafinesque[1]							
Freshwater drum	A	U			U		

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C= Common, usually readily observed
U= Uncommon, but likely to be observed
R Rare, within the range of the species, but seldom observed

[1]Known to occur, documented sightings
[2]Presence verified during this inventory

Pflieger (1971, 1975) does not [illegible]
between the big river and other faunal [illegible]
tributary streams, any transition zone [illegible].

Based upon a map presented by [illegible]
county is entirely within the Ozark [illegible]
faunal region represented here by the [illegible].

Fishes were collected from the [illegible]
sults of these collections are presented [illegible]
below. Population density and standing [illegible]
by species and station in Table 23. The [illegible]
species diversity, and species richness [illegible]
Table 24.

Even casual analysis of the fish [illegible]
between stream populations, dominated [illegible]
comparatively high species diversity, [illegible]
mosquitofish (Table 24). A more thorough [illegible]
however, reveals good separation into [illegible]
regions and a transitional zone (Table [illegible].

[illegible]

Cape La Croix Creek and tributaries [illegible]
in this study by stations 1 and 5, were [illegible]
of the stream (Fig. 2). Stream order [illegible]
nificant factor in definition of this [illegible]
3 and 2, respectively), perhaps due to [illegible].
In considering the physical characteristics [illegible]
the only clear difference from other stations [illegible]
areas in the stream bed. These areas [illegible]
The water velocities necessary to maintain [illegible]
the high stream gradient.

The flora inhabiting Ozark Uplands streams [illegible]
algae (periphyton) which utilize scour[illegible] substrates [illegible]
in the water. Phytoplankton consists principally of [illegible]
species. Zooplankton is characteristically [illegible]
Among the benthic macroinvertebrates, [illegible]
especially those species which feed by [illegible].

Of the fishes listed in this report, [illegible]
occurring in Ozark Uplands streams [illegible]
characterized by high populations of [illegible]
creek chubs and blackspotted topminnows [illegible]
also be present if riffles and pools [illegible]
favoring the development of such a [illegible]
water velocity and a stream bed [illegible]
Both would be found in high-gradient [illegible].

Ozark Uplands streams probably [illegible]
resource in the project area. Perm[illegible]

Table 23. Population density (number of individuals ha^{-1}) and standing crop (kg ha^{-1}, in parentheses) of fishes at stations in the Cape La Croix Creek watershed, June, 1976.

TAXA	STATIONS 1	2	3	4	5	6
CATOSTOMIDAE						
Catostomus commersoni (white sucker)	-	-	175(0.13)	-	-	-
Erimyzon oblongus (creek chubsucker)	63(0.33)	-	-	-	-	-
Minytrema melanops (spotted sucker)	-	-	-	20(5.44)	-	-
CENTRARCHIDAE						
Lepomis cyanellus (green sunfish)	63(6.29)	-	-	20(1.19)	100(4.59)	-
L. macrochirus (bluegill)	-	-	-	20(0.50)	-	-
L. megalotis (longear sunfish)	63(0.19)	222(0.59)	-	-	-	-
CYPRINIDAE						
Campostoma anomalum (stoneroller)	6286(13.15)	25(0.08)	-	-	2000(1.52)	-
Dionda nubila (Ozark minnow)	-	-	88(0.07)	-	-	-
Nocomis biguttatus (hornyhead chub)	-	-	88(0.02)	-	-	-
Notropis lutrensis (red shiner)	285(0.62)	815(0.73)	2807(3.29)	140(0.20)	-	-
N. stramineus (sand shiner)	-	99(0.11)	-	-	-	-
N. umbratilis (redfin shiner)	-	5580(6.43)	3158(3.71)	3180(4.18)	-	-
Pimephales notatus (bluntnose minnow)	32(0.08)	25(0.05)	-	60(0.14)	-	-
Semotilus atromaculatus (creek chub)	190(0.03)	988(0.25)	-	-	18900(6.70)	-
CYPRINODONTIDAE						
Fundulus olivaceus (blackspotted topminnow)	476(1.20)	99(0.17)	88(0.18)	60(0.10)	2300(5.53)	-
ICTALURIDAE						
Ictalurus melas (black bullhead)	-	-	-	20(4.66)	-	-
PERCIDAE						
Etheostoma nigrum (johnny darter)	-	25(0.01)	-	-	-	-
E. spectabile (orangethroat darter)	381(0.49)	25(0.01)	-	-	-	-
POECILIIDAE						
Gambusia affinis (mosquitofish)	-	-	-	-	-	19333(17.13)
TOTAL NUMBER (TOTAL WEIGHT)	7839(22.38)	7903(8.43)	6404(7.40)	3520(16.41)	23300(18.34)	19333(17.13)

Table 24. Composition (% of total number), species diversity, and species richness of fishes observed in stream and marsh habitats in the Cape La Croix Creek watershed, June, 1976.

	STATION					
	1	2	3	4	5	6
Catostomidae	0.8	-	2.7	0.6	-	-
Centrarchidae	1.6	2.8	-	1.1	0.4	-
Cyprinidae	86.6	95.3	95.9	96.0	89.7	-
Cyprinodontidae	6.1	1.3	1.4	1.7	9.9	-
Ictaluridae	-	-	-	0.6	-	-
Percidae	4.9	0.6	-	-	-	-
Poeciliidae	-	-	-	-	-	100.0
Total (%)	100.0	100.0	100.0	100.0	100.0	100.0
Number of Specimens	247	320	73	176	233	29
Species Diversity	1.2	1.5	1.4	0.7	0.9	0.0
Species Richness	1.1	1.3	1.2	0.6	0.8	0.0

Cape La Croix Creek and its tributaries falls into this category. Using gradient as a general criterion for classification, streams located above 120 m above mean sea level (Fig. 2) may be considered Ozark Uplands.

The physical characteristics of most of these streams presently have been altered little by man and, as stated above, water quality is good. In these streams, the fish fauna is diverse. Results of sampling at station 5, while exhibiting components characteristic of the Ozark Uplands, show the effect of even minimal stream alteration. Fewer than one-half of the species taken at station 1 were taken here (Table 23). Station 5 was located in a public park in northern Cape Girardeau.

Proposed water resource developments are not likely to affect Ozark Uplands streams. Rather, the principal threat appears to be urbanization of the areas north and northwest of Cape Girardeau. Undesirable activities include removal of streamside cover, clearing of adjacent areas, diversion of stormwater, and the establishment of single-family septic fields.

Southeastern Lowlands

Cape La Croix Creek and tributaries (Southeastern Lowlands) are represented in this study by stations 3 and 4. Gradient is low (Fig. 2), as is water velocity (Table 18). The substrate consists of silt and clay. Both stations sampled were in order 4 portions of the stream (Table 14), but several order 1 tributaries were present which were also characteristic of the Southeastern Lowlands.

The virtually undetectable water velocity observed at these stations permitted the development of an abundant phytoplankton and zooplankton. Oligochaetes were significant members of the benthic macroinvertebrate community and reached high densities in the soft sediments.

Among the fishes, Southeastern Lowlands streams are characterized by the absence of stonerollers and darters, large populations of various minnows such as the red and redfin shiners, and presence of large-stream suckers (common and spotted) and black bullheads. Physical factors favoring the development of this type of community include low water velocity and a silt or sand stream bed. Riffles would be rare to absent. Low gradient areas such as this are provided by the Southeastern Lowlands west and south of Cape Girardeau.

Although its relatively high position in the altitudinal profile of Cape La Croix Creek (Fig. 2) suggested a tentative classification as transitional, similarities in composition of the fish population between stations 3 and 4 make it clear that station 3 must be considered as Southeastern Lowlands (Table 23). A total of 57 fish species are listed as representative of Southeastern Lowlands streams (Table 22).

Transitional

Cape La Croix Creek and tributaries (Transitional), represented in this study by station 2, are intermediate in gradient between Ozark Uplands

and Southeastern Lowlands. Station 2 is an order 3 stream (Table 14) and alternated between deep, wide pools (Table 18) and narrower riffle areas. These alternating habitats permitted simultaneous representation of elements of upland and lowland biota.

Most of the substrate in these transitional streams is silt and clay. Hence, they are not suitable for the development of periphyton, except where other hard substrates are present such as sticks and branches. Generally, the water is too turbid to permit an extensive phytoplankton, even in the larger pools. Zooplankton, too, is characteristically low in both abundance and diversity.

Among the benthic macroinvertebrates, species diversity is high because of the alternating upland and lowland habitat types with hard and soft substrates. Again, mayflies and midges were important groups and oligochaetes, which will predominate downstream, are beginning to appear.

As would be expected, this station shows fish components of both major zones. Stonerollers and darters are present, but in low numbers while large numbers of red and redfin shiners are present. The results of sampling Cape La Croix Creek fish populations (Table 23) clearly reflect the ecotonal nature of this station. A total of 53 fish species are listed as representative of such transitional habitats in the project area (Table 22).

Neither the transitional or Southeastern Lowlands portions of Cape La Croix Creek presently are valuable water resources. Extensive development of city habitat along the creek in upstream areas has affected severely riparian vegetation and bank and bed materials. Stormwater diversion no doubt produces rapid and extreme fluctuations in water level from these urban areas downstream. Although limited water quality data from this area (Table 3) do not give evidence of pollution, the potential exists for serious degradation of water quality.

Downstream from Cape Girardeau proper, past channel modifications have been directed toward removal of flood water. Activities have included channel straightening, removal of streamside vegetation, and cutting and removal of fallen trees.

In terms of implementation of feasible water resource development projects, it is doubtful if further physical damage could be done to the Southeastern Lowlands portion of Cape La Croix Creek. Presently, this portion of the stream has little value for fish and wildlife. Substantial habitat improvement could result from implementation of a project which included a program for removal of stumps, log jams, trash, and for grading and planting of the stream banks and adjacent areas.

Wetland Areas

Limited sampling in wetland areas was included in this study to provide general information on the aquatic communities representative of inland shallow and deep fresh marshes and wooded swamps. As expected in clear, non-flowing water, a substantial phytoplankton and zooplankton

developed (Tables 19, 20). The large number of taxa recorded attest to the diversity of microhabitats such areas provide. In the benthos, oligochaetes reached very high densities in the soft organic sediments and a large number of insect taxa were observed (Table 21).

In spite of this diversity of plankton and benthos, a surprisingly small number of fishes were characteristic of wetland habitats. Table 22 lists only 13 species as likely to occur here and results of this sampling program (Table 23) yielded but a single species, the mosquitofish.

As stated above, the extent of all wetland habitats in the watershed is probably too small to contribute substantially to the overall ecology of the project area. Their value lies principally in their role as refugia for species which were once widespread and are now restricted to relict areas which escaped drainage as the Southeastern Lowlands was cleared and drained for agriculture. Undisturbed wetland habitat typically has a relatively stable water level. The dying larger trees in the wooded swamp discussed above indicated higher water levels in the recent past. The presence of a diverse microflora and microfauna, with mosquitofish as the only fish, indicated that the wetlands periodically dry. Indirect effects such as these may already have altered these wetland areas significantly. Water resource development projects which would stabilize water levels in the wetlands would insure their continued usefulness at least in the natural area/outdoor classroom capacity. In addition, the arrow arum (*Peltandra virginica*) observed here is considered to be rare in Missouri (Holt, *et al.* 1974). Protection from drainage would preserve this population.

The wetland type open fresh marsh is represented in the project area by several lakes and numerous small ponds. Nearly one-half of this acreage is contained in Lake Hollenbeck northwest of Cape Girardeau. Most of these lakes and ponds are north and northwest of the city and are artificial farm ponds. Table 22 lists 19 species of fishes likely to occur in this habitat.

While not sampled specifically during the course of this project, experience in adjacent portions of Illinois has shown that most of these farm ponds are stocked initially with largemouth bass and either bluegills or golden shiners or both. Contamination usually occurs from nearby streams or by uninformed sportsmen. Hence, many farm ponds also contain green sunfish, carp, bullheads, and other undesirable species. Typically, carp predominate in biomass, small bluegills and green sunfish predominate in actual numbers, and largemouth bass reproduction is eliminated or seriously reduced. Such severe population imbalance is best controlled by eradication and restocking. Properly managed, farm ponds could contribute substantially to the fish and wildlife resources of the project area.

Mississippi River and Associated Backwater Areas

As stated above, Mississippi River and associated backwater and oxbow habitats are not strictly within the boundaries of the project watershed. Data presented here are meant to supplement information for the watershed and to provide perspective on the kinds of species which are available as colonizers should high water permit them to invade the lower reaches of Cape La Croix Creek. Table 22 lists 76 species for the river and 26 for

associated backwater and oxbow habitats. Predominating are the minnows (Cyprinidae) with 24 species. Other abundant groups include the suckers (Catostomidae) and darters (Percidae) with 10 species each, and the sunfishes (Centrarchidae) with 9 species. It is significant to note that 41 of the fishes listed in Table 22 are exclusive to the Mississippi River and associated backwaters and oxbows. This high number serves to underscore the uniqueness of the large-river habitat.

PESTIFEROUS PLANTS AND ANIMALS

Among the pestiferous plants and animals known or thought to occur in the Cape La Croix Creek watershed are several plants, numerous invertebrate species or groups, two mammals, and representatives of two families of snakes.

Poison ivy (*Toxicodendron radicans*) was a conspicuous plant in many areas of the watershed. It formed one of the chief understory plants in the lowlands and floodplain forest, occurred along roadside ditches, stream banks, and other waste areas. Contact with any part of this plant often produces severe allergic reactions in individuals sensitive to its sap.

Ragweeds (*Ambrosia* spp.), common in waste areas and moist lowland areas, is an annoyance because of the allergic reactions in individuals sensitive to its pollen.

Stinging nettle (*Urtica dioica*) is a common herbaceous plant of floodplain or moist lowland woods and waste land. The sting of nettles is caused by sharp hairs on the leaves and stem. Brushing against the surfaces of the leaves may break off these hairs in the skin where they liberate formic acid. This formic acid produces the irritation. If the plant is picked with the hairs pressing down against the stem, there is no sting.

Four of the invertebrate pests are common in upland forests along the bluffs of the Mississippi River. They can, however, be transported easily either because of their association with humans (as with the brown recluse spider) or movements of man or animals from upland forest areas to exurban, suburban, and urban areas.

Although the brown recluse spider (*Loxosceles reclusa* Gertsch & Muliak) favors the upland forest habitats, it may occur in populous areas of the watershed because of its association with man. Its bite results in a painful wound which is very slow to heal. The black widow spider [*Latrodectus mactans* (Fabricius)] also prefers upland forest situations, but may be a potential inhabitant of the exurban, suburban, and urban areas.

No recent cases of spider bites have been reported to the Missouri Division of Health from Cape Girardeau County. This does not rule out possible bites, however, because reporting these incidents is not mandatory. It should be further noted that most physicians are not familiar with the symptoms of spider bites and many bites may be attributed to other causes.

Two ticks [*Dermacentor variabilis* (Say), the wood tick, and *Amblyomma americanus* (Linnaeus), the lonestar tick] frequent the upland forests in the higher elevations on either side of the Mississippi River. Both species may be carriers of rocky mountain spotted fever. This disease is caused by the pathogen *Rickettsia rickettsii*. In addition, the lonestar tick is also the vector for tularemia (*Pasteurella tularensis*). Both diseases, while infrequent, can be fatal to man.

The Diptera (flies) include many pests to man and livestock, especially the biting midges (Ceratopogonidae), black flies (Simuliidae), and mosquitoes (Culicidae). Deer flies (Tabanidae) and robberflies (Asilidae) also produce painful, itching bites. Representatives of all these families were observed in the watershed. With the exception of the Asilidae, all these insects have immature stages which are aquatic. Mosquitoes are potentially harmful to man and livestock through their transmittal of encephalitis-producing ultra-microscopic viruses.

No locally transmitted cases of malaria or yellow fever have occurred in Cape Girardeau County within the past three years (the period of inquiry). The Missouri Division of Health considered the reported cases as imported since they were contracted by servicemen returning from the tropics. Two, potentially three, strains of encephalitis are known from Cape Girardeau County. These include the St. Louis, Western, and, possibly, California encephalitis. One case of St. Louis and two unspecified cases of viral encephalitis were reported from Cape Girardeau County in 1976.

The biting and stinging Hymenoptera [especially the honey bees and bumblebees (Apidae); yellow jackets, hornets, and paper wasps (Vespidae); and mud daubers (Sphecidae)] can produce painful bites and/or stings. In highly sensitive individuals the allergic response to these bites or stings can be so rapid and severe that death can result if immediate medical attention is not provided. These insects are common in urban, suburban, exurban, and agricultural habitats and are especially abundant in waste areas and dumps.

The striped skunk (*Mephitis mephitis*) and the spotted skunk (*Spilogale putorius*) are obvious pests to man and animals because of their defensive, offensive spraying. The scent of the spotted skunk is considered to be stronger and more disagreeable than that of the striped skunk.

Five species and subspecies of Crotalidae, the venomous snakes in the watershed, are summarized in Table 8. While they can inflict bites which are potentially fatal to man, these snakes are very secretive and are not often seen by casual observers. Three species are more characteristic of upland regions: the northern copperhead (*Agkistrodon contortrix mokeson*), the southern copperhead (*Agkistrodon c. contortrix*), and the timber rattlesnake (*Crotalus h. horridus*). The western cottonmouth (*Agkistrodon piscivorus leucostoma*) and the canebrake rattlesnake (*Crotalus horridus atricaudatus*) are more frequently associated with lowland areas, floodplains, swamps, marshes, and wetlands.

No recent cases of venomous snake bites have been reported to the Missouri Division of Health from Cape Girardeau County. As was the case for spider bites, reporting is not mandatory and unreported cases may exist.

THREATENED AND ENDANGERED FLORA AND FAUNA

Federal law establishes two categories of endangerment: (1) those species in danger of extinction throughout all or a significant portion of their range, *i. e., endangered* species; and (2) those species which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range, *i. e., threatened* species.

Table 25 summarizes threatened or endangered flora and fauna of the Cape La Croix Creek watershed. This list was compiled from two sources: Holt, *et al.* (1974), which summarizes the rare and endangered species of Missouri, and U. S. Department of the Interior, Fish and Wildlife Service (1974, 1976a, 1976b, 1976c, 1976d).

Holt, *et al.* (1974) list two plant species and one genus as being threatened or endangered in Cape Girardeau county: arrow arum (*Peltandra virginica*), the elms in general (*Ulmus* spp.), and the cucumber tree (*Magnolia acuminata* var. *acuminata*).

While arrow arum was abundant in the wetlands sampled south of Cape Girardeau (transects E-E' and F-F'), its occurrence was limited to that one area. Should that wetland be drained, the arrow arum would likely disappear.

Although many species of elms were commonly observed in the project area both in floodplain and upland forest areas, they were generally young specimens, especially those of the American elm (*Ulmus americana*). Their inclusion in the list of threatened and endangered species results from the ravaging effects of Dutch elm disease.

While the cucumber tree was not observed in the project area, it has been reported as occurring infrequently in the low woods in stream valleys at the bases of limestone and gravel bluffs. Its endangered status results most likely from reductions in acreages of woods and quite possibly, harvesting by man.

The U. S. Fish and Wildlife Service (1976d) proposed two plants as endangered which occur in Missouri and are not specifically excluded from this inventory (Table 4) due to generic-level identification. They are *Asclepias meadii* Torr., a milkweed, and *Plantago cordata* Lam., heartleaf plantain. Mead's milkweed is rarely found in mesic, virgin prairies and heartleaf plantain occurs rarely in woods along streams (Mohlenbrock 1975). Holt, *et al.* (1974), however, do not include these species in their Missouri list of rare and endangered species.

The pallid sturgeon (*Scaphirhynchus albus*) is essentially restricted to the mainstream of the Missouri River and the Mississippi River downstream from the mouth of the Missouri. Its endangered status probably results from overexploitation by man and habitat destruction through the creation of dams.

The alligator gar (*Lepisosteus spatula*) and possibly the Alabama shad (*Alosa alabamae*) were never common in the Mississippi River in the vicinity of the project area; this region would represent the northern extension of their respective ranges.

Table 25. Rare and endangered plants and animals known or likely to occur in the Cape La Croix Creek watershed.

SPECIES	MO DEPT. CONS.	U. S. DEPT. INTERIOR
PLANT KINGDOM		
ARACEAE		
Peltandra virginica (L.) Kunth.		
Arrow arum	R	
ULMACEAE		
Ulmus spp. L.		
Elms	E	
MAGNOLIACEAE		
Magnolia acuminata L. var. *acuminata*		
Cucumber tree	E	
ANIMAL KINGDOM		
FISHES		
Alosa alabamae Jordan & Evermann		
Alabama shad	R	
Cycleptus elongatus (Lesueur)		
Blue sucker	R	
Hybopsis gelida (Girard)		
Sturgeon chub	E	
Hybopsis meeki Jordan & Evermann		
Sicklefin chub	E	
Lepisosteus spatula Lecépède		
Alligator gar	R	
Scaphirhynchus albus (Forbes & Richardson)		
Pallid Sturgeon	E	
AMPHIBIANS		
Rana s. sylvatica LeConte		
Wood frog	E	
REPTILES		
Crotalus horridus atricaudatus Latreille		
Canebrake rattlesnake	R	
Macroclemys temminckii (Troost)		
Alligator snapping turtle	R	
Natrix e. cyclopion (Duméril, Bibron, & Duméril)		
Green water snake	R	

Table 25. (continued).

ANIMAL KINGDOM		
SPECIES	MO DEPT. CONS.	U. S. DEPT. INTERIOR
BIRDS		
Accipiter cooperii (Bonaparte) Cooper's Hawk	E	
Accipiter striatus Vieillot Sharp-shinned Hawk	E	
Bartramia longicauda (Bechstein) Upland Sandpiper	E	
Buteo lineatus (Gmelin) Red-shouldered Hawk	R	
Coragyps atratus (Bechstein) Black Vulture	R	
Corvus ossifragus Wilson Fish Crow	R	
Falco peregrinus Tunstall Peregrine Falcon	E	E
Haliaeetus leucocephalus alascanus Townsend Bald Eagle (Northern)	R	
Haliaeetus l. leucocephalus (Linnaeus) Bald Eagle (Southern)	X	E
Ictinia misisippiensis (Wilson) Mississippi Kite	R	
Limnothlypis swainsonii (Audubon) Swainson's Warbler	R	
Pandion haliaetus (Linnaeus) Osprey	E	
Phalacrocorax auritus (Lesson) Double-crested Cormorant	E	
Rallus elegans Audubon King Rail	R	
Sterna albifrons Pallas Least Tern	R	
Tyrannus verticalis Say Western Kingbird	R	
Tyto alba (Scopoli) Barn Owl	R	

Table 25. (concluded).

ANIMAL KINGDOM		
SPECIES	MO DEPT. CONS.	U. S. DEPT. INTERIOR
MAMMALS		
Lutra canadensis (Schreber) River otter	E	
Mustela frenata Lichtenstein Long-tailed weasel	R	
Myotis grisescens Howell Gray bat	E	E
Myotis keenii (Merriam) Keen's bat	R	
Myotis sodalis Miller & Allen Indiana bat	E	E
Sylvilagus aquaticus (Bachman) Swamp rabbit	R	

E = Endangered
R = Rare
X = Extirpated

The occurrence of the sturgeon chub (*Hybopsis gelida*), the sicklefin chub (*Hybopsis meeki*), and the blue sucker (*Cycleptus elongatus*) has been affected most by habitat destruction, principally through the construction of dams and reservoirs. These species inhabit swift channels and chutes in large rivers.

The wood frog (*Rana sylvatica*) exists in Missouri only as relict populations. Both the alligator snapping turtle (*Macroclemys temminckii*) and the canebrake rattlesnake (*Crotalus horridus atricaudatus*) are threatened in Missouri because of habitat destruction as wetlands in the Southeastern Lowlands are drained. Southeastern Missouri is the extreme northern extension of the range of the green water snake (*Natrix e. cyclopion*).

Many species of birds occur in Missouri and the project area only as the northern or eastern extensions of their ranges or as transients. These include the black vulture, sharp-shinned hawk, Cooper's hawk, western kingbird, fish crow, and least tern. Others which were formerly widely distributed, some even nesting in Missouri, have declined in general or have become restricted to the southern portions of the state because of habitat destruction and overexploitation by man. These include the upland sandpiper, red-shouldered hawk, osprey, peregrine falcon, double-crested cormorant, and the king rail. The barn owl, while a widely distributed permanent resident in Missouri, is uncommon throughout its range. Swainson's warbler is known in Missouri only in the canebrake understory of mature bottomland hardwoods in the Southeastern Lowlands. The Mississippi kite nests in the Southeastern Lowlands, straying north along the Mississippi River to St. Louis. It is uncommon.

During waterfowl census flights conducted by the Illinois Natural History Survey from 1972 through 1975, an effort was made to census the population of bald eagles occurring from St. Louis, Missouri, to Cairo, Illinois, along the Mississippi River. Their data are summarized for seven sections of the river, two of which are pertinent to the study area: Grand Tower to Cape Girardeau and Cape Girardeau to Cairo.

Data are available for 30 census flights from 15 November 1972 through 17 December 1975. Bald eagles were observed on 17 of these flights. Mean number of bald eagles observed on flights with sightings was 8.9 + 6.2 eagles. Mean number of bald eagles observed on all flights was 5.0 + 6.4 eagles. On 10 February 1975, 23 bald eagles were sighted. This is the maximum number recorded in the census. These individuals are assumed to be the northern subspecies which winters in Missouri in reasonable numbers (Holt, *et al.* 1974). No evidence of nesting of the southern subspecies has been observed since 1966.

The Indiana bat (*Myotis sodalis*) is recognized nationally as an endangered species, principally because it is extremely colonial and overwinters in only a few caves in the United States. The gray bat (*Myotis grisescens*), also recognized nationally as endangered, is associated closely with the central and southern limestone cave region in Missouri. Keen's bat (*Myotis keenii*) is considered to have always occurred in limited numbers in Missouri.

Populations of long-tailed weasels (*Mustela frenata*) have undergone an obvious decrease in abundance throughout Missouri during the past 20 to

25 years. No explanation has been proposed although overexploitation through trapping might be a contributing factor.

The river otter (*Lutra canadensis*) and swamp rabbit (*Sylvilagus aquaticus*) are confined primarily to southeastern Missouri possibly as the result of both intensive land development and wetland drainage.

PROBLEMS AND OPPORTUNITIES

During the course of field portions of this inventory, several problems and opportunities, or potential problems, were identified. Later study of several planning documents for the area served to clarify a number of these cases. The following statements, often seemingly unrelated, are presented as they may prove useful in making long-term plans for the watershed. Order of listing is not used to prioritize these items.

Problems. 1. Bratton (1974) states that the land west and northwest is most suitable for expansion of urban development from Cape Girardeau. He further states that Cape La Croix Creek is a losing stream in that it gives up water to the groundwater. It was noted by us that urban development is, in fact, spreading west and northwest from Cape Girardeau. As stated above, the succession appears to be agricultural to exurban to suburban. The unorganized beginning of such developments leads us to conclude that wastewater treatment is by septic tanks. Since these developments are in the Cape La Croix Creek watershed and since these upland areas lose water to the groundwater, contamination of this water resource by septic tank leachate is a distinct possibility. A discussion of groundwater hydrology is beyond the scope of this report, but it is appropriate to suggest that the matter be considered.

2. Much of the development of city habitat is occurring along U. S. highway 61 west and southwest of Cape Girardeau, in a large part along the banks of Cape La Croix Creek and Walker Creek. The large paved parking lots of these areas present two potential problems to the receiving stream: a) a degraded water quality of the surface runoff due to road chemicals and oils from automobiles, and b) a rapid and uncontrolled runoff from parking areas. The quality and quantity of this runoff should be evaluated to determine if retention and/or treatment is necessary to prevent degradation of water quality in the receiving stream.

3. Proposed development of a park at the South Park site would include portions of Cape La Croix Creek downstream from aquatic sampling station 3. Water resources frequently provide the focal point for such park areas. Stream banks in this area are steep and eroding. The stream bed is littered with trash (refrigerators and other large appliances) and undercut and toppled tree stumps. A clean-up program and extensive contouring and landscaping of the stream banks must be included in any park development plan if the stream is to be considered an aesthetic attribute.

Opportunities. 1. A single wooded swamp was noted in the southwestern portion of the study area (Fig. 3). It is felt that this swamp represents a relict habitat from a more extensive swamp which existed in the Southeastern Lowlands prior to drainage. Urban development from Cape Girardeau does not yet threaten this wetland, and it is felt that early recognition and protection as a natural area is desirable. Maintenance of a natural water regime should be incorporated into any protection and management plan. It is felt that present water levels are either higher or persist longer that the past history of the swamp. Many of the larger trees

presently show stress, presumably related to excess flooding.

2. Two sites for potential park development exist, both contiguous with urban areas of Cape Girardeau: North Park and South Park, as designated by the Southeast Missouri Regional Planning Commission. The North Park site is upland and mostly unforested. Creation of a park would result in the creation of old field habitat, land management permitting. The South Park site is partly forested and includes both upland and bottomland plus the dividing bluffline. Given the relief of the land, the potential for development of Cape La Croix Creek (see problem #3 above), the vegetation differences between the North Park and South Park sites, and the proposed expansion of urban areas west and northwest from the city, it would appear prudent to develop the North Park site as an activity-oriented park with baseball, tennis, and other designated areas provided. The South Park site would be suitable for development as a nature park.

3. Potential exists for the creation of a corridor park along Cape La Croix Creek, especially north of Cape Girardeau well into the Ozark Uplands. In this region the stream's aesthetic value is near-maximum and urban development has not yet encroached along most of the watercourse. Access is maximal due to the proximity of the Perryville Road. Day-user facilities, perhaps as a series of access points, might be appropriate resource utilization.

4. The water quality investigation of Cape La Croix Creek by Southeast Missouri State University found acceptable water quality throughout the watershed. Although they considered their study as preliminary and recommended additional study, their results indicate that Cape La Croix Creek represents a valuable water resource.

A report by the Office of Planning, Missouri Department of Community Affairs (1972) identifies a number of other potential developments of outdoor recreation and open space areas in the Cape Girardeau area.

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APPENDIX 1

PHYTOPLANKTON COLLECTED IN STREAM AND WETLAND HABITATS IN THE CAPE LA CROIX CREEK WATERSHED 13 AND 14 MAY 1976

PHYTOPLANKTON COLLECTED AT STATION 1
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	MEAN
CYANOPHYTA			
Schizothrix calcicola	1	3	2
CHLOROPHYTA			
Cladophora sp.	+	+	+
Keratococcus bicaudatus	44	-	22
Monoraphidium minutum	319	-	159.5
PYRROPHYTA			
Cryptomonas erosa	44	-	22
CHRYSOPHYTA			
Centrales			
Melosira varians	920	-	460
Pennales			
Achnanthes sp.	207	321	264
A. hungarica	12	15	13.5
A. lanceolata var. *dubia*	12	70	40
A. linearis f. curta	219	306	262.5
A. minutissima	56	139	97.5
Cocconeis placentula var. *euglypta*	12	-	6
Cymbella tumida	219	-	109.5
Fragilaria sp.	56	27	41.5
F. pinnata	56	-	28
Gomphonema sp.	-	15	7.5
G. angustatum	1403	1075	1239
Meridion circulare	-	42	21
Navicula sp.	41	27	34
N. accomoda	12	-	6
Navicula cf. *gracioides*	-	15	7.5
N. minima	-	27	13.5
N. pelliculosa	-	54	27
N. salinarum var. *intermedia*	56	15	35.5
Nitzschia sp.	139	85	112
N. dissipata	28	42	35
N. frustulum var. *perpusilla*	68	182	125
Nitzschia cf. *invisitata*	96	139	117.5
N. kuetzingiana	28	42	35
Rhoicosphenia curvata	111	54	82.5
Surirella ovata	193	166	179.5
S. ovata var. *pinnata*	-	15	7.5
Unidentified Pennates	55	154	104.5
TOTAL NUMBER OF SPECIES	26	25	32

PHYTOPLANKTON COLLECTED AT STATION 1
CAPE LA CROIX CREEK[1]
(concluded)

TAXA	REPLICATES 1	REPLICATES 2	MEAN
TOTAL NUMBER OF INDIVIDUALS	4407	3030	3717.5

[1]Entries represent number of phytoplankters per liter; "+" = present in insufficient densities to establish accurate count.

PHYTOPLANKTON COLLECTED AT STATION 2
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	MEAN
CHLOROPHYTA			
Chlamydomonas sp.	-	73	36.5
Monoraphidium dybowskii	-	73	36.5
M. minutum	1330	338	834
Scenedesmus dimorphus	132	73	102.5
EUGLENOPHYTA			
Euglena sp.	191	-	95.5
PYRROPHYTA			
Chroomonas sp.	73	73	73
CHRYSOPHYTA			
Mallomonas sp.	-	73	36.5
Centrales			
Cyclotella sp.	28	-	14
Melosira granulata var. *angustissima*	-	+	+
Stephanodiscus sp.	141	-	70.5
S. astraea var. *minutula*	84	-	42
Unidentified Centrics	703	-	351.5
Pennales			
Achnanthes minutissima	13	12	12.5
Cymbella turgida	27	-	13.5
Fragilaria vaucheriae	-	254	127
Gomphonema olivaceum	13	49	31
G. sphaerophorum	27	-	13.5
Navicula spp.	-	12	6
Navicula cryptocephala	13	60	36.5
N. rhyncocephala var. *germanii*	-	12	6
Nitzschia spp.	53	49	51
N. acicularis	27	-	13.5
Surirella ovata	106	109	107.5
Unidentified Pennates	119	36	77.5
TOTAL NUMBER OF SPECIES	15	16	22
TOTAL NUMBER OF INDIVIDUALS	3080	1296	2188

[1]Entries represent number of phytoplankters per liter; "+" = present in insufficient densities to establish accurate count.

PHYTOPLANKTON COLLECTED AT STATION 3
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	MEAN
CYANOPHYTA			
Unidentified Filamentous	39	-	19.5
CHLOROPHYTA			
Monoraphidium contortum	39	-	19.5
M. minutum	718	330	524
Scenedesmus dimorphus	232	78	155
EUGLENOPHYTA			
Euglena sp.	273	117	195
PYRROPHYTA			
Cryptomonas erosa	468	195	331.5
CHRYSOPHYTA			
Centrales			
Cyclotella sp.	-	3	1.5
C. meneghiniana	-	5	2.5
Melosira distans	-	78	39
Stephanodiscus sp.	-	51	25.5
S. astraea var. *minutula*	-	11	5.5
Unidentified Centrics	-	8	4
Pennales			
Achnanthes lanceolata var. *dubia*	-	12	6
Cymatopleura solea	22	-	11
Gyrosigma scalproides	22	-	11
Navicula spp.	22	-	11
N. minima	22	-	11
Navicula cf. *placentula*	11	12	11.5
Navicula cf. *rhynchocephala*	22	-	11
N. rhynchocephala var. *germainii*	44	-	22
Nitzschia spp.	55	25	40
N. acicularis	-	12	6
N. amphibia	-	12	6
N. dissipata	-	12	6
N. filiformis	22	-	11
N. frustulum var. *perpusilla*	22	-	11
N. kuetzingiana	89	163	126
N. microcephala	-	25	12.5
N. palea	55	138	96.5
N. sigma	-	12	6
N. sublinearis	67	50	58.5
Pinnularia spp.	-	25	12.5
Rhoicosphenia curvata	44	-	22
Surirella ovata	55	75	65
S. ovata var. *pinnata*	44	-	22

PHYTOPLANKTON COLLECTED AT STATION 3
CAPE LA CROIX CREEK[1]
(concluded)

TAXA	REPLICATES 1	REPLICATES 2	MEAN
Pennales (concluded)			
Synedra rumpens var. *meneghiniana*	-	25	12.5
Synedra tenera	-	175	87.5
Unidentified Pennates	-	38	19
TOTAL NUMBER OF SPECIES	21	24	35
TOTAL NUMBER OF INDIVIDUALS	2387	1687	2037

[1]Entries represent number of phytoplankters per liter.

PHYTOPLANKTON COLLECTED AT STATION 4
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	MEAN
CYANOPHYTA			
Schizothrix calcicola	1191	1068	1129.5
Unidentified Filamentous	159	-	79.5
CHLOROPHYTA			
Chlamydomonas sp.	-	73	36.5
Monoraphidium minutum	1604	638	1121
Scenedesmus dimorphus	319	146	232.5
EUGLENOPHYTA			
Euglena sp.	-	73	36.5
CHRYSOPHYTA			
Centrales			
Cyclotella meneghiniana	+	-	+
Melosira italica	+	-	+
M. varians	+	-	+
Stephanodiscus astraea var. *minutula*	+	-	+
Pennales			
Achnanthes lanceolata var. *dubia*	21	62	41.5
Cocconeis placentula var. *euglypta*	-	20	10
Gomphonema angustatum	64	20	42
G. olivaceum	21	-	10.5
Navicula spp.	107	41	74
N. cryptocephala var. *veneta*	-	41	20.5
N. heufleri var. *leptocephala*	-	41	20.5
N. pelliculosa	21	83	52
N. pupula	-	41	20.5
N. rhynchocephala var. *germainii*	43	41	42
Nitzschia spp.	86	103	94.5
N. acicularis	107	41	74
N. clausii	-	41	20.5
N. dissipata	-	41	20.5
N. frustulum var. *perpusilla*	-	41	20.5
N. kuetzingiana	129	145	137
N. palea	64	41	52.5
Surirella angusta	-	20	10
S. minuta	-	41	20.5
S. ovata	215	166	190.5
TOTAL NUMBER OF SPECIES	18	24	29
TOTAL NUMBER OF INDIVIDUALS	4151	3068	3609.5

[1]Entries represent number of [illegible] organisms per liter; "+" = present in insufficient densities to [illegible] accurate count.

PHYTOPLANKTON COLLECTED AT STATION 5
WALKER CREEK[1]

TAXA	REPLICATES 1	2	MEAN
CYANOPHYTA			
Schizothrix calcicola	119	-	59.5
CHLOROPHYTA			
Pandorina morum	-	232	116
Spirogyra sp.	319	-	159.5
CHRYSOPHYTA			
Mallomonas sp.	-	73	36.5
Centrales			
Melosira varians	2266	+	1133
Pennales			
Achnanthes sp.	20	-	10
A. lanceolata var. *dubia*	-	170	85
A. linearis f. curta	10	237	123.5
A. minutissima	10	-	5
Amphora ovalis	20	-	10
Gomphonema angustatum	20	-	10
Navicula spp.	20	102	61
N. cryptocephala	-	67	33.5
N. cryptocephala var. *veneta*	20	170	95
Navicula cf. *placentula*	10	-	5
N. pelliculosa	10	-	5
N. secreta var. *apiculata*	30	67	48.5
Nitzschia spp.	20	405	212.5
N. acicularis	20	-	10
N. dissipata	-	67	33.5
Nitzschia cf. *invisitata*	-	67	33.5
N. kuetzingiana	70	642	356
Nitzschia cf. *linearis*	-	135	67.5
N. palea	40	67	53.5
Surirella ovata	-	202	101
S. ovata var. *pinnata*	-	35	17.5
Synedra rumpens	-	67	33.5
TOTAL NUMBER OF SPECIES	17	18	27
TOTAL NUMBER OF INDIVIDUALS	3024	2805	2914.5

[1]Entries represent number of phytoplankters per liter; "+" = present in insufficient densities to establish accurate count.

PHYTOPLANKTON COLLECTED AT STATION 6
UNNAMED WETLAND[1]

TAXA	REPLICATES 1	REPLICATES 2	MEAN
CYANOPHYTA			
Agmenellum quadruplicatum	1530	-	765
Anacystis marina	10773	807	5790
Schizothrix calcicola	82	788	435
CHLOROPHYTA			
Chlamydomonas spp.	528	-	264
Chlorella spp.	1530	456	993
Chlorogonium euchlorum	-	4591	2295.5
Keratococcus bisetus	1659	911	1285
Monoraphidium contortum	-	765	382.5
M. minutum	4354	4411	4382.5
M. tortile	6143	2554	4348.5
Schroederia setigera	1023	-	511.5
Spirogyra spp.	2049	16092	9070.5
EUGLENOPHYTA			
Lepocinclis spp.	-	439	219.5
Phacus curvicauda	-	146	73
P. pleuronectes	-	146	73
Trachelomonas volvocina	292	-	146
PYRROPHYTA			
Chroomonas nordstedtii	2124	2188	2506
Cryptomonas erosa	-	292	146
C. ovata	146	-	73
CHRYSOPHYTA			
Ophiocytium capitatum var. [illegible]	-	1530	765
Pennales			
Achnanthes sp.	22	1158	590
A. hungarica	43	191	117
A. lanceolata var. *dubia*	11	-	5.5
Achnanthes linearis f.	11	-	5.5
Fragilaria spp.	86	-	43
Gomphonema parvulum	-	191	95.5
Navicula spp.	-	382	191
N. cuspidata var. *hungarica*	-	191	95.5
N. pastrea	-	191	95.5
N. radiosa var. *tenella*	-	191	95.5
Nitzschia spp.	43	382	212.5
N. amphibia	-	382	191
N. dissipata	-	382	191
N. palea	-	191	95.5
Stauroneis spp.	-	579	289.5
S. anceps f. gracilis	22	-	11

PHYTOPLANKTON COLLECTED AT STATION 6
UNNAMED WETLAND[1]
(concluded)

TAXA	REPLICATES 1	REPLICATES 2	MEAN
Pennales (concluded)			
Synedra ulna	43	-	21.5
Unidentified Pennates	11	1731	871
TOTAL NUMBER OF SPECIES	21	27	37
TOTAL NUMBER OF INDIVIDUALS	32825	42258	37541.5

[1]Entries represent number of phytoplankters per liter.

ANNEX 2

RESULTS OF ZOOPLANKTON COLLECTIONS IN STREAM AND WETLAND HABITATS
IN THE CAPE FEAR-BUCKHORN CREEK WATERSHED
15 AUG - 1 SEP 1976

ZOOPLANKTON COLLECTED AT STATION 1
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	REPLICATES 2	MEAN
COPEPODA			
Nauplii	+	+	+
Cyclopoid Copepodids	+	+	+
ROTIFERA			
Bdelloid Rotifers	-	+	+
TOTAL NUMBER OF TAXA	-	1	1
TOTAL NUMBER OF INDIVIDUALS	-	-	-

[1]Entries represent number of zooplankters per liter; "+" = present in insufficient densities to establish accurate count.

ZOOPLANKTON COLLECTED AT STATION 2
CAPE FEAR-BOYA CREEK[1]

TAXA	REPLICATES 1	2	MEAN
COPEPODA			
Nauplii	+	+	+
Eucyclops Copepodids	+	+	+
ROTIFERA			
Cephalodella spp.	+	+	+
Lecane spp.	+	-	+
Monostyla spp.	+	-	+
Bdelloid Rotifers	+	+	+
TOTAL NUMBER OF TAXA	5	3	5
TOTAL NUMBER OF INDIVIDUALS	-	-	-

[1]Entries represent number of zooplankters per liter; "+" = present in insufficient densities to establish accurate count.

ZOOPLANKTON COLLECTED AT STATION 3
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	MEAN
COPEPODA			
Eucyclops agilis	-	+	+
Nauplii	+	+	+
ROTIFERA			
Cephalodella spp.	-	+	+
Euchlanis spp.	+	+	+
Notommata spp.	+	-	+
Bdelloid Rotifers	-	+	+
TOTAL NUMBER OF TAXA	2	4	5
TOTAL NUMBER OF INDIVIDUALS	-	-	-

[1]Entries represent number of zooplankters per liter; "+" = present in insufficient densities to establish accurate count.

ZOOPLANKTON COLLECTED AT STATION 4
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	MEAN
CLADOCERA			
Alona circumfimbriata	+	-	+
Bosmina spp. (immature)	-	+	+
Chydorus sphaericus	+	+	+
COPEPODA			
Diaptomus spp.	-	+	+
Nauplii	3	3	3
Cyclopoid Copepodids	1	+	0.5
Harpacticoida	-	+	+
ROTIFERA			
Cephalodella spp.	4	6	5
Euchlanis spp.	+	+	+
Testudinella spp.	-	1	0.5
Trichocerca spp.	+	1	0.5
Trichotria spp.	-	+	+
Bdelloid Rotifers	1	1	1
TOTAL NUMBER OF TAXA	6	10	11
TOTAL NUMBER OF INDIVIDUALS	9	12	10.5

[1]Entries represent number of [illegible] liters per liter; "+" = present in insufficient densities to est[illegible] accurate count.

ZOOPLANKTON COLLECTED AT STATION 5
WALKER CREEK[1]

TAXA	REPLICATES 1	2	MEAN
CLADOCERA			
Bosmina longirostris	+	-	+
COPEPODA			
Diaptomus pallidus	+	+	+
Tropocyclops prasinus	+	+	+
Nauplii	+	+	+
Cyclopoid Copepodids	+	1	0.5
ROTIFERA			
Cephalodella spp.	1	1	1
Euchlanis spp.	+	-	+
Gastropus spp.	+	-	+
Lepadella spp.	-	+	+
Monostyla spp.	+	-	+
Trichocerca spp.	3	1	2
Bdelloid Rotifers	2	2	2
TOTAL NUMBER OF TAXA	9	6	10
TOTAL NUMBER OF INDIVIDUALS	6	5	5.5

[1]Entries represent number of zooplankters per liter; "+" = present in insufficient densities to establish accurate count.

ZOOPLANKTON COLLECTED AT STATION 6
UNNAMED WETLAND[1]

TAXA	REPLICATES 1	2	MEAN
CLADOCERA			
Alona guttata	-	+	+
Bosmina longirostris	12	7	9.5
Ceriodaphnia spp. (immature)	3	+	1.5
Chydorus sphaericus	+	2	1
Daphnia ambigua	10	4	7
D. parvula	2	2	2
Daphnia spp. (immature)	3	-	1.5
Kurzia latissima	2	2	2
Pleuroxus denticulatus	-	+	+
Simocephalus vetulus	-	+	+
COPEPODA			
Diaptomus pallidus	3	9	6
Nauplii	124	160	142
Calanoid Copepodids	3	+	1.5
Cyclopoid Copepodids	3	2	2.5
ROTIFERA			
Brachionus patulus	5	7	6
Keratella spp.	18	2	10
Lecane spp.	+	+	+
Monostyla spp.	-	+	+
Testudinella spp.	5	2	3.5
Trichocerca spp.	+	-	+
TOTAL NUMBER OF TAXA	13	15	17
TOTAL NUMBER OF INDIVIDUALS	193	199	196

[1]Entries represent number of zooplankters per liter; "+" = present in insufficient densities to establish accurate count.

APPENDIX 3

RESULTS OF BENTHIC COLLECTIONS IN STREAM AND WETLAND HABITATS IN THE CAPE LA CROIX CREEK WATERSHED 13 AND 14 MAY 1976

BENTHOS COLLECTED AT STATION 1
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	3	4	5	MEAN
INSECTA						
Ephemeroptera						
Baetidae						
Centroptilum sp.	-	-	-	-	-	+
Caenidae						
Caenis sp.	22	33	77	110	99	68.2
Ephemerellidae						
Ephemerella frisoni	-	-	-	-	-	+
Heptageniidae						
Stenacron interpunctatum	-	-	22	-	11	6.6
Stenonema femoratum	-	-	-	-	11	2.2
S. tripunctatum	44	77	55	-	-	35.2
Leptophlebiidae						
Paraleptophlebia mollis	-	11	44	-	-	11
Plecoptera						
Perlidae						
Neoperla clymene	-	-	33	-	-	6.6
Coleoptera						
Dytiscidae						
Copelatus chevrolati	-	-	-	-	-	+
Coptotomus interrogatus	-	-	-	-	-	+
Elmidae						
Dubiraphia sp. 1	-	-	-	-	-	+
Dubiraphia sp. 2	-	-	-	-	-	+
Macronychus glabratus	-	-	-	-	-	+
Stenelmis crenata	-	-	11	-	11	4.4
Hydrophilidae						
Berosus fraternus	-	-	-	-	-	+
B. infuscatus	-	-	-	-	-	+
Chaetarthria atra	-	-	-	-	-	+
Cymbiodyta cf. *blanchardi*	-	-	-	-	-	+
Enochrus ochraceus	-	-	-	-	-	+
E. pygmaeus nebulosus	-	-	-	-	-	+
Hydrochara obtusata	-	-	-	-	-	+
Paracymus subcupreus	-	-	-	-	-	+
Tropisternus spp. (immature)	-	-	-	-	-	+
Noteridae						
Suphisellus bicolor	-	-	-	-	-	+
Psephenidae						
Psephenus herricki	11	11	-	-	-	4.4
Trichoptera						
Hydropsychidae						
Chewnatopsyche sp.	-	-	-	-	-	+
C. pettiti	-	-	-	-	-	+

BENTHOS COLLECTED AT STATION 1
CAPE LA CROIX CREEK[1]
(concluded)

TAXA	REPLICATES 1	2	3	4	5	MEAN
Trichoptera (concluded)						
Philopotamidae						
Chimarra aterrima	-	-	-	-	-	+
C. feria	-	-	-	-	-	+
Diptera						
Chironomidae						
Cricotopus sp.	11	-	11	22	-	8.8
C. bicinctus	-	66	-	198	33	59.4
Corynoneura scutellata	-	11	-	-	-	2.2
Tanytarsus sp.	-	-	-	11	-	2.2
MALACOSTRACA						
Amphipoda						
Gammaridae						
Gammarus pseudolimnaeus	242	308	418	275	154	279.4
Isopoda						
Asellidae						
Asellus b. brevicauda	22	88	11	55	275	90.2
TOTAL NUMBER OF SPECIES[2]	6	8	9	6	7	14
TOTAL NUMBER OF INDIVIDUALS	352	605	682	671	594	580.8

[1]Entries represent numbers of benthic macroinvertebrates per m^2; "+" = collected during non-quantitative sampling.
[2]Quantitative only.

BENTHOS COLLECTED AT STATION 2
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	3	4	5	MEAN
ANNELIDA						
Oligochaeta						
Limnodrilus hoffmeisteri	-	-	-	22	-	4.4
L. udekemianus	-	-	11	-	11	4.4
Pristina breviseta	11	-	-	11	-	4.4
P. plumaseta	-	-	-	11	-	2.2
INSECTA						
Ephemeroptera						
Baetidae						
Centroptilum sp.	165	264	33	-	198	132
Caenidae						
Caenis sp.	-	-	11	11	-	4.4
Heptageniidae						
Stenonema tripunctatum	-	11	44	11	-	13.2
Leptophlebiidae						
Paraleptophlebia mollis	-	-	11	-	-	2.2
Plecoptera						
Perlidae						
Neoperla clymene	11	-	-	-	11	4.4
Perlesta placida	-	-	-	-	11	2.2
Coleoptera						
Elmidae						
Stenelmis crenata	11	44	-	-	11	13.2
Psephenidae						
Psephenus herricki	-	-	-	-	11	2.2
Trichoptera						
Hydropsychidae						
Cheumatopsyche spp.	616	-	-	-	594	242
Philopotamidae						
Chimarra sp.	11	-	-	-	-	2.2
C. obscura	11	-	-	-	22	6.6
Diptera						
Chironomidae						
Chironomus riparius	11	231	22	-	121	77
Cryptochironomus fulvus	-	121	11	22	-	30.8
Glyptotendipes lobiferus		-	-	-	44	8.8
Microtendipes pedellus	-	22	-	-	-	4.4
Polypedilum scalaenum	-	77	-	-	-	15.4
Procladius sp.	-	-	22	-	11	6.6
P. bellus	11	88	33	66	33	46.2
Stenochironomus sp.		11	-	-	-	2.2
Tanypus stellatus	-	33	-	-	-	6.6
Tanytarsus sp.		-	22	11	-	6.6

BENTHOS COLLECTED AT STATION 2
CAPE LA CROIX CREEK[1]
(concluded)

TAXA	REPLICATES 1	2	3	4	5	MEAN
Chironomidae (concluded)						
Thienemanniimyia complex	-	22	-	-	44	13.2
Simuliidae						
Simulium sp.	-	121	154	22	22	63.8
MALACOSTRACA						
Amphipoda						
Gammaridae						
Gammarus pseudolimnaeus	132	33	110	33	132	88
Isopoda						
Asellidae						
Asellus b. brevicauda	33	11	-	11	11	13.2
TOTAL NUMBER OF SPECIES	11	14	12	11	16	29
TOTAL NUMBER OF INDIVIDUALS	1023	1089	484	231	1287	822.8

[1]Entries represent number of benthic macroinvertebrates per m^2

BENTHOS COLLECTED AT STATION 3
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	3	4	5	MEAN
ANNELIDA						
Hirudinea						
Erpobdellidae						
Erpobdella punctata	-	-	43	-	-	8.6
Oligochaeta						
Branchiura sowerbyi	-	-	43	-	43	17.2
Limnodrilus spp. (immature)	-	1161	387	-	645	438.6
L. cervix	-	387	-	-	-	77.4
L. hoffmeisteri	129	1505	172	-	903	541.8
L. udekemianus	129	215	129	-	-	94.6
Tubifex tubifex		258	86	-	215	111.8
T. variabilis	-	43	86	-	-	25.8
Lumbriculus variegatus	-	-	-	-	86	17.2
Nais communis	-	129	-	-	86	51.6
Dero digitata	-	-	-	-	86	17.2
Tubifex tubifex	-	43	-	-	-	8.6
INSECTA						
Ephemeroptera						
Caenidae						
Caenis sp.		43	-	43	-	17.2
Heptageniidae						
Stenonema femoratum	-	-	-	-	-	+
S. tripunctatum	-	-	-	-	-	+
Coleoptera						
Dytiscidae						
Coptotomus interrogatus	-	-	-	-	-	+
Hydroporus cf. *carinthiacus*	-	-	-	-	-	+
Hydroporus sp.	-	-	-	-	-	+
Laccophilus sp. (immature)	-	-	-	-	-	+
Neoporus lacustris	-	-	-	-	-	+
Elmidae						
Stenelmis cf. *crenata*		86	43	-	-	25.8
Hydrophilidae						
Berosus sp.	-	-	-	-	-	+
Hydrophilidae						
Enochrus hamiltoni	-	-	-	-	-	+
Laccobius cf. *maculosus*	-	-	-	-	-	+
Paracymus cf. *subrotundus*	-	-	-	-	-	+
Tropisternus collaris	-	-	-	-	-	+
Tropisternus lateralis						
nimbatus	-	-	-	-	-	+
Odonata						
Gomphidae						
Gomphus vastus	-	-	-	-	-	+

BENTHOS COLLECTED AT STATION 3
CAPE LA CROIX CREEK[1]
(concluded)

TAXA	REPLICATES 1	2	3	4	5	MEAN
Trichoptera						
Hydropsychidae						
Cheumatopsyche petitii	-	-	-	-	-	+
Hydropsyche orris	-	-	-	-	-	+
Potamyia flava	-	-	-	-	-	+
Leptoceridae						
Oecetis inconspicua	-	-	-	-	-	+
Philopotamidae						
Chimarra obscura	-	-	-	-	-	+
Psychomyiidae						
Cernotina celsa	-	-	-	-	-	+
Neureclipsis crepuscularis	-	-	-	-	-	+
Diptera						
Chironomidae						
Chironomus attenuatus	172	-	-	-	-	34.4
C. riparius	-	-	43	-	172	43
Cryptochironomus fulvus	43	-	172	-	-	43
Polypedilum scalaenum	172	301	129	-	66	133.6
Procladius sp.	-	43	-	-	-	8.6
P. bellus	172	86	172	43	121	118.8
Tanypus neopunctipennis	-	-	43	-	-	8.6
Tanytarsus sp.	43	-	-	-	86	25.8
MALACOSTRACA						
Isopoda						
Asellidae						
Asellus b. brevicauda	-	-	43	-	-	8.6
TOTAL NUMBER OF SPECIES[2]	8	13	14	2	11	23
TOTAL NUMBER OF INDIVIDUALS	903	4300	1591	86	2509	1877.8

[1]Entries represent number of benthic macroinvertebrates per m^2; "+" = collected during non-quantitative sampling.
[2]Quantitative only.

AD-A130 639 BIOLOGICAL INVENTORY CAPE LA CROIX CREEK WATERSHED CAPE GIRARDEAU COUNTY MISSOURI(U) MIDWEST AQUATIC ENTERPRISES MAHOMET IL JAN 77 LMSSD-76-25-26 3/3

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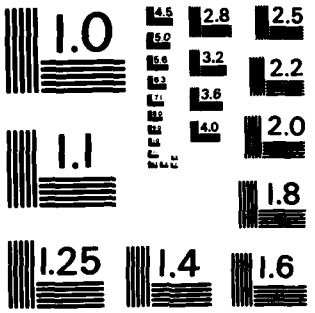


BENTHOS COLLECTED AT STATION 4
CAPE LA CROIX CREEK[1]

TAXA	REPLICATES 1	2	3	4	5	MEAN
ANNELIDA						
Oligochaeta						
Limnodrilus spp. (immature)	1075	1032	946	731	688	894.4
L. cervix	-	-	43	-	-	8.6
L. claparedeianus	387	1032	43	43	301	361.2
L. hoffmeisteri	1247	3698	2107	344	1419	1763
L. maumeensis	-	-	215	-	-	43
L. udekemianus	86	344	559	172	129	258
Peloscolex sp.	344	-	-	-	-	68.8
P. freyi	129	-	-	-	-	25.8
P. variegatus	172	258	129	-	-	111.8
Potamothrix sp.	86	-	-	-	86	34.4
P. vejdovskyi	430	-	-	-	-	86
Pristina breviseta	-	-	-	43	-	8.6
Psammoryctides curvisetosus	-	-	516	-	-	103.2
Tubifex tubifex	-	-	-	-	43	8.6
INSECTA						
Coleoptera						
Elmidae						
Stenelmis cf. *crenata*	-	-	-	43	-	8.6
Diptera						
Chironomidae						
Procladius bellus	-	43	-	-	-	8.6
Thienemannimyia complex	43	-	-	86	-	25.8
TOTAL NUMBER OF SPECIES	10	6	8	7	6	17
TOTAL NUMBER OF INDIVIDUALS	3999	6407	4558	1462	2666	3818.4

[1]Entries represent number of benthic macroinvertebrates per m^2.

BENTHOS COLLECTED AT STATION 5
WALKER CREEK[1]

TAXA	REPLICATES 1	2	3	4	5	MEAN
INSECTA						
Ephemeroptera						
Bactidae						
Centroptilum sp.	55	-	-	-	-	11
Coleoptera						
Elmidae						
Stenelmis cf. *crenata*	-	11	-	22	-	6.6
Trichoptera						
Hydropsychidae						
Cheumatopsyche sp.	33	-	-	11	-	8.8
Diptera						
Chironomidae						
Ablabesmyia sp.	11	-	-	77	11	19.8
A. mallochi	44	-	-	-	-	8.8
Chironomus attenuatus	231	77	-	253	121	136.4
C. riparius	-	11	-	22	-	6.6
Cricotopus bicinctus	44	-	-	44	-	17.6
Cryptochironomus fulvus	66	22	-	121	44	50.6
Glyptotendipes lobiferus	121	-	-	44	-	33
Harnischia sp.	55	-	-	-	-	11
Larsia sp.	22	-	-	-	-	4.4
Microtendipes pedellus	44	-	-	-	-	8.8
Paratendipes albimanus	11	33	-	-	-	8.8
Polypedilum illinoense	-	-	-	22	-	4.4
P. scalaenum	-	-	-	33	33	13.2
Procladius sp.	-	-	-	11	-	2.2
P. bellus	-	22	-	121	11	30.8
Psectrotanypus dyari	44	-	-	-	-	8.8
Stenochironomus sp.	11	-	-	-	-	2.2
Tanytarsus sp.	44	44	-	11	-	19.8
Thienemannimyia complex	-	-	-	44	-	8.8
MALACOSTRACA						
Amphipoda						
Gammaridae						
Gammarus minus	-	33	66	44	-	28.6
G. pseudolimnaeus	11	11	22	66	11	24.2
Isopoda						
Asellidae						
Asellus b. brevicauda	-	44	-	132	-	35.2
TOTAL NUMBER OF SPECIES	16	10	2	17	6	25
TOTAL NUMBER OF INDIVIDUALS	847	308	88	1078	231	510.4

[1]Entries represent number of benthic macroinvertebrates per m^2.

BENTHOS COLLECTED AT STATION 6
UNNAMED WETLAND[1]

TAXA	REPLICATES 1	2	3	4	5	MEAN
ANNELIDA						
Hirudinea						
Glossiphoniidae						
Helobdella punctatolineata	-	-	-	-	-	+
Placobdella multilineata	-	-	-	-	-	+
Oligochaeta						
Aulophorus furcatus	172	-	-	172	-	68.8
Branchiura sowerbyi	-	172	172	172	-	103.2
Dero digitata	-	-	-	-	387	77.4
D. nivea	516	602	-	-	-	223.6
D. obtusa	-	344	86	516	301	249.4
Limnodrilus spp. (immature)	-	688	43	688	-	283.8
L. claparedeianus	-	430	-	-	-	86
L. hoffmeisteri	344	688	215	602	129	395.6
L. maumeensis	-	86	258	-	215	111.8
L. udekemianus	344	-	-	172	-	103.2
Lumbriculus variegatus	-	-	-	-	43	8.6
Nais communis	1892	344	129	688	559	722.4
N. simplex	516	-	-	602	129	249.4
N. variabilis	-	-	-	172	258	86
Peloscolex ferox	-	1032	-	-	-	206.4
P. multisetosus	688	-	43	-	-	146.2
P. variegatus	2580	-	301	-	-	576.2
Potamothrix vejdovskyi	1548	602	172	516	387	645
Pristina aequiseta	-	86	-	-	-	17.2
P. breviseta	172	-	43	516	43	154.8
P. longiseta leidyi	-	-	-	172	-	34.4
P. plumaseta	172	-	-	-	-	34.4
Psammoryctides curvisetosus	-	172	-	-	-	34.4
Slavina appendiculata	516	-	43	-	-	111.8
Stylaria lacustris	688	-	-	-	-	137.6
INSECTA						
Ephemeroptera						
Caenidae						
Caenis sp.	-	43	43	-	-	17.2
Heptageniidae						
Stenonema tripunctatum	-	-	-	-	-	+
Coleoptera						
Dytiscidae						
Celina angustata	-	-	-	-	-	+
Copelatus glyphicus	-	-	-	-	-	+
Hydroporus vittatipennis	-	-	-	-	-	+
Laccophilus proximus	-	-	-	-	-	+

BENTHOS COLLECTED AT STATION 6
UNNAMED WETLAND[1]
(continued)

TAXA	REPLICATES 1	2	3	4	5	MEAN
Dytiscidae (concluded)						
Thermonectes o. ornaticollis	-	-	-	-	-	+
Uvarus lacustris	-	-	-	-	-	+
Haliplidae						
Peltodytes dunavani	-	-	-	-	-	+
P. muticus	-	-	-	-	-	+
P. sexmaculatus	-	-	-	-	-	+
Helodidae						
Prionocyphon sp.	-	-	-	-	-	+
Hydrophilidae						
Berosus fraternus	-	-	-	-	-	+
B. pantherinus	-	-	-	-	-	+
B. peregrinus	-	-	-	-	-	+
Enochrus consortus	-	-	-	-	-	+
E. ochraceus	-	-	-	-	-	+
E. pygmaeus nebulosus	-	-	-	-	-	+
Helophorus sp.	-	-	-	-	-	+
Paracymus subcupreus	-	-	-	-	-	+
Tropisternus lateralis nimbatus	-	-	-	-	-	+
Noteridae						
Hydrocanthus iricolor	-	-	-	-	-	+
Trichoptera						
Hydropsychidae						
Cheumatopsyche pettiti	-	-	-	-	-	+
Hydropsyche orris	-	-	-	-	-	+
Potamyia flava	-	-	-	-	-	+
Leptoceridae						
Ceraclea transversus	-	-	-	-	-	+
Nectopsyche albida	-	-	-	-	-	+
Diptera						
Ceratopogonidae						
Palpomyia complex	-	-	43	-	-	8.6
Chaoboridae						
Chaoborus punctipennis	-	172	-	-	-	34.4
Chironomidae						
Procladius bellus	-	172	-	-	43	43
Thienemannimyia complex	-	-	-	-	43	8.6
MALACOSTRACA						
Amphipoda						
Talitridae						
Hyalella azteca	-	-	-	-	-	+

BENTHOS COLLECTED AT STATION 6
UNNAMED WETLAND[1]
(Included)

TAXA	REPLICATES 1	2	3	4	5	MEAN
TOTAL NUMBER OF SPECIES[2]	15	15	13	12	12	30
TOTAL NUMBER OF INDIVIDUALS	10148	5633	1591	4988	2537	4979.4

[1]Entries represent number of benthic macroinvertebrates per m^2; "+" = collected during non-quantitative sampling.
[2]Quantitative only.

APPENDIX 4

RESULTS OF FISH COLLECTIONS IN STREAM AND WETLAND HABITATS IN THE CAPE LA CROIX CREEK WATERSHED 11 JUNE 1976

FISH COLLECTED AT STATION 1
CAPE LA CROIX CREEK[1]

TAXA	NUMBER OF SPECIMENS	RANGE (T.L.,mm)	WEIGHT (g)
CYPRINIFORMES			
Cyprinidae			
Campostoma anomalum			
Stoneroller	198	46 to 82	414.2
Notropis lutrensis			
Red shiner	9	48 to 64	19.4
Pimephales notatus			
Bluntnose minnow	1	62	2.6
Semotilus atromaculatus			
Creek chub	6	17 to 32	0.9
Catostomidae			
Erimyzon oblongus			
Creek chubsucker	2	63, 83	10.5
ATHERINIFORMES			
Cyprinodontidae			
Fundulus olivaceus			
Blackspotted topminnow	15	47 to 72	37.8
PERCIFORMES			
Centrarchidae			
Lepomis cyanellus			
Green sunfish	2	158, 167	198.0
Lepomis megalotis			
Longear sunfish	2	52, 58	6.1
Percidae			
Etheostoma spectabile			
Orangethroat darter	12	47 to 57	15.3

[1]Specimens collected while seining 125 m length of stream, mean width 2.6 m; area sampled approximately 315 m^2.

FISH COLLECTED AT STATION 2
CAPE LA CROIX CREEK[1]

TAXA	NUMBER OF SPECIMENS	RANGE (T.L.,mm)	WEIGHT (g)
CYPRINIFORMES			
Cyprinidae			
Campostoma anomalum			
Stoneroller	1	69	3.1
Notropis lutrensis			
Red shiner	33	31 to 55	29.6
Notropis stramineus			
Sand shiner	4	44 to 54	4.3
Notropis umbratilis			
Redfin shiner	226	43 to 71	260.3
Pimephales notatus			
Bluntnose minnow	1	59	2.2
Semotilus atromaculatus			
Creek chub	40	14 to 31	10.0
ATHERINIFORMES			
Cyprinodontidae			
Fundulus olivaceus			
Blackspotted topminnow	4	52 to 62	6.8
PERCIFORMES			
Centrarchidae			
Lepomis megalotis			
Longear sunfish	9	36 to 89	23.9
Percidae			
Etheostoma nigrum			
Johnny darter	1	32	0.3
Etheostoma spectabile			
Orangethroat darter	1	25	0.2

[1]Specimens collected while seining 45 m length of stream, mean width 9 m; area sampled approximately 405 m^2.

FISH COLLECTED AT STATION 3
CAPE LA CROIX CREEK[1]

TAXA	NUMBER OF SPECIMENS	RANGE (T.L.,mm)	WEIGHT (g)
CYPRINIFORMES			
Cyprinidae			
Dionda nubila			
Ozark minnow	1	40	0.8
Nocomis biguttatus			
Hornyhead chub	1	27	0.2
Notropis lutrensis			
Red shiner	32	39 to 59	37.5
Notropis umbratilis			
Redfin shiner	36	44 to 65	42.3
Catostomidae			
Catostomus commersoni			
White sucker	2	34, 46	1.5
ATHERINIFORMES			
Cyprinodontidae			
Fundulus olivaceus			
Blackspotted topminnow	1	60	2.0

[1]Specimens collected while seining 55 m length of stream, mean width 3.5 m; area sampled approximately 193 m^2.

FISH COLLECTED AT STATION 4
CAPE LA CROIX CREEK[1]

TAXA	NUMBER OF SPECIMENS	RANGE (T.L.,mm)	WEIGHT (g)
CYPRINIFORMES			
Cyprinidae			
Notropis lutrensis			
Red shiner	7	40 to 58	10.1
Notropis umbratilis			
Redfin shiner	159	39 to 68	209.1
Pimephales notatus			
Bluntnose minnow	3	47 to 71	6.8
Catostomidae			
Minytrema melanops			
Spotted sucker	1	311	272.0
SILURIFORMES			
Ictaluridae			
Ictalurus melas			
Black bullhead	1	262	233.0
ATHERINIFORMES			
Cyprinodontidae			
Fundulus olivaceus			
Blackspotted topminnow	3	42 to 66	5.2
PERCIFORMES			
Centrarchidae			
Lepomis cyanellus			
Green sunfish	1	147	59.5
Lepomis macrochirus			
Bluegill	1	109	24.8

[1]Specimens collected while seining 77 m length of stream, mean width 6.5 m; area sampled approximately 500 m^2.

FISH COLLECTED AT STATION 5
WALKER CREEK[1]

TAXA	NUMBER OF SPECIMENS	RANGE (T.L., mm)	WEIGHT (g)
CYPRINIFORMES			
Cyprinidae			
Campostoma anomalum			
Stoneroller	20	25 to 62	15.2
Semotilus atromaculatus			
Creek chub	189	12 to 132	67.0
ATHERINIFORMES			
Cyprinodontidae			
Fundulus olivaceus			
Blackspotted topminnow	25	50 to 78	55.3
PERCIFORMES			
Centrarchidae			
Lepomis cyanellus			
Green sunfish	1	119	45.9

[1]Specimens collected while seining 25 m length of stream, mean width 4 m; area sampled approximately 100 m^2.

FISH COLLECTED AT STATION 6'
UNNAMED WETLAND[1]

TAXA	NUMBER OF SPECIMENS	RANGE (T.L.,mm)	WEIGHT (g)
ATHERINIFORMES			
Poeciliidae			
Gambusia affinis			
Mosquitofish	29	10 to 53	25.7

[1]Specimens collected while seining an approximate area of 15 m^2.

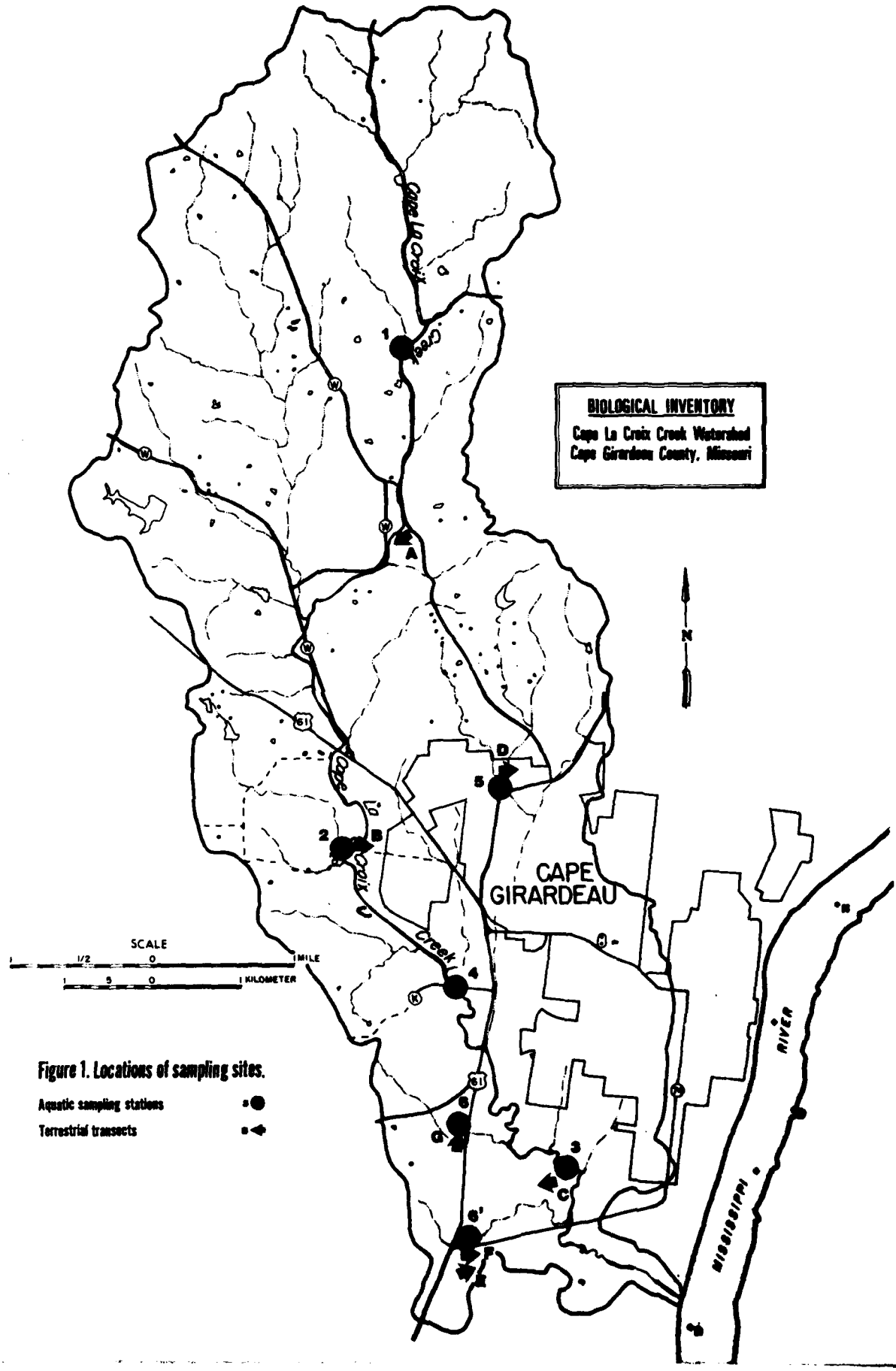


Figure 1. Locations of sampling sites.

Aquatic sampling stations ●

Terrestrial transects ◄

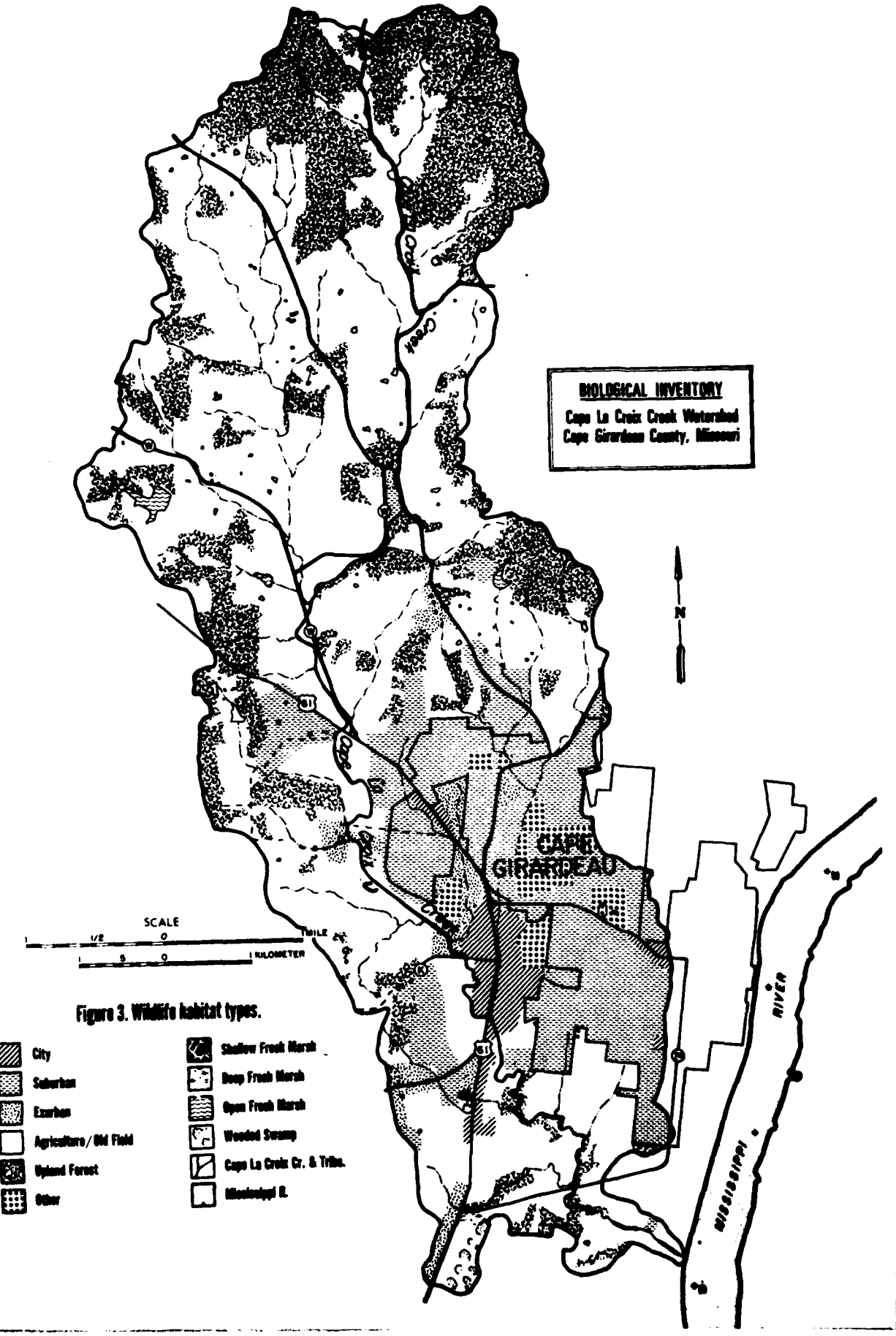
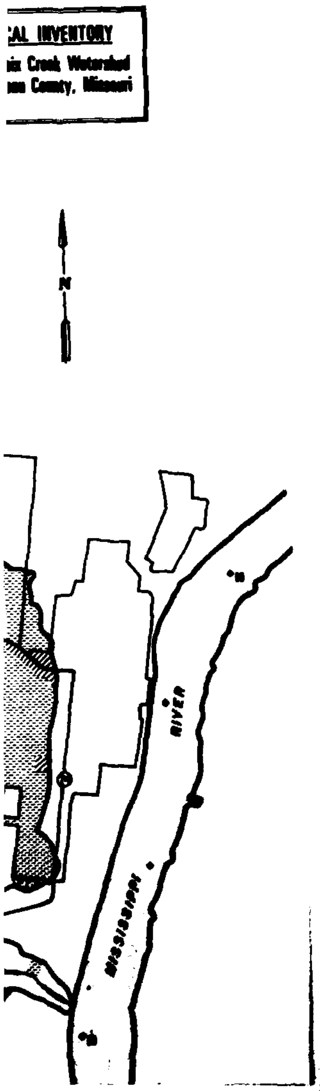


Figure 3. Wildlife habitat types.



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