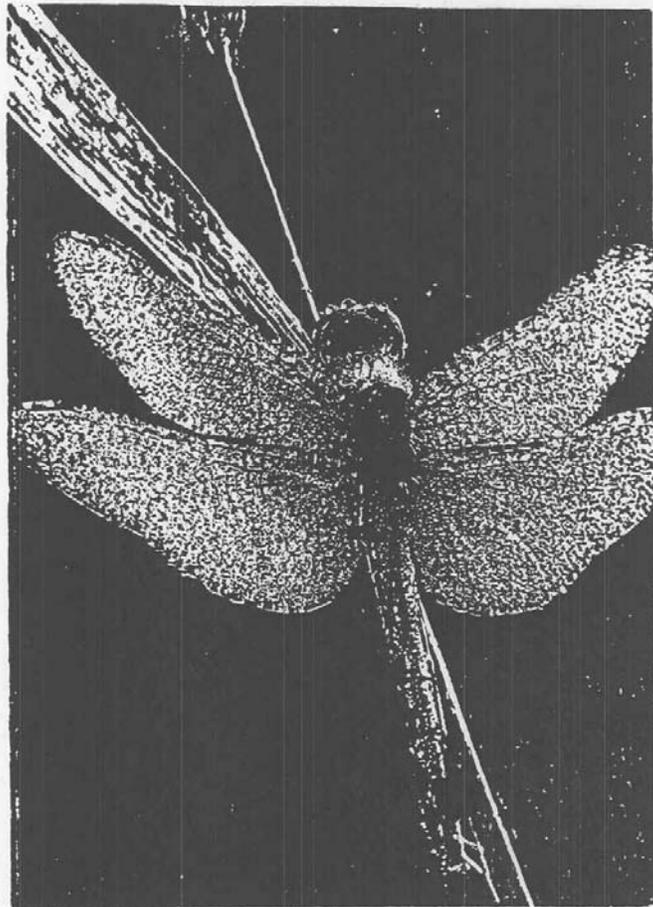


THE DRAGONFLIES OF SELECTED EASTERN MINNESOTA RIVERS



JOHN HAARSTAD
CEDAR CREEK NHA
BETHEL, MN 55005

The Dragonflies of Selected Eastern Minnesota Rivers

John Haarstad, Cedar Creek NHA, Bethel, MN 55005

During the summer of 1992 I visited 25 rivers and streams in eastern Minnesota collecting dragonfly exuviae and adults. Streams visited in the Northeast were the Gooseberry (1 site), Baptism (3 sites), Manitou (1 site), Temperance (4 sites), Cascade (2 sites), Stony (1 site), Kawishiwi (1 site), and St. Louis (3 sites). Streams visited in Eastcentral Minnesota were the St. Croix (12 sites), Kettle (5 sites), Snake (7 sites), Crooked Creek (1 site), Little Sand (1 site), Sand (2 sites), Rock Creek (1 site), Sunrise (1 site), Groundhouse (1 site), Ann (1 site), and Rum (2 sites). Streams visited in the Southeast were the Cannon (4 sites), Zumbro (5 sites), Whitewater (2 sites), Root (8 sites) and Mississippi (5 sites). A total of 33 species of riverine dragonflies were collected. Species of GOMPHIDAE included *Hagenius brevistylus*, *Dromogomphus spinosus*, *Ophiogomphus earolus*, *Ophiogomphus colubrinus*, *Ophiogomphus howei*, *Ophiogomphus rupinsulensis*, x *Ophiogomphus sabrinus*, *Hylogomphus adelphus*, *Hylogomphus viridifrons*, *Gomphurus externus*, *Gomphurus fraternus*, *Gomphurus lineatifrons*, *Gomphurus vastus*, *Gomphurus ventricosus*, *Gomphus exilis*, *Gomphus graslinellus*, *Gomphus lividus*, *Gomphus quadricolor*, *Gomphus spicatus*, *Arigomphus cornutus*, *Stylurus amnicola*, *Stylurus notatus*, and *Stylurus spiniceps*. Species of AESHNIDAE included *Anax junius*, *Aeshna umbrosa*, *Basiaeshna janata*, *Boyeria grafiana*, and *Boyeria vinosa*. Species of CORDULEGASTRIDAE included *Cordulegaster maculata* and *Cordulegaster obliqua*. Species of MACROMIIDAE included *Didymops transversa* and *Macromia illinoiensis*. Species of CORDULIIDAE included *Cordulia shurtleffi*, *Epicordulia princeps*, *Epitheca canis*, *Epitheca spinigera*, *Neurocordulia yamaskenensis*, *Somatochlora minor*, and *Somatochlora elongata*. LIBELLULIDAE (primarily *Plathemis lydia*, *Libellula pulehella*, *Libellula luctuosa*) were noted but generally not collected since most occur abundantly at ponds and marshes. Also noted was the presence of the damselflies *Calopteryx aequabilis*, *Calopteryx maculata*, and *Hetaerina americana*.

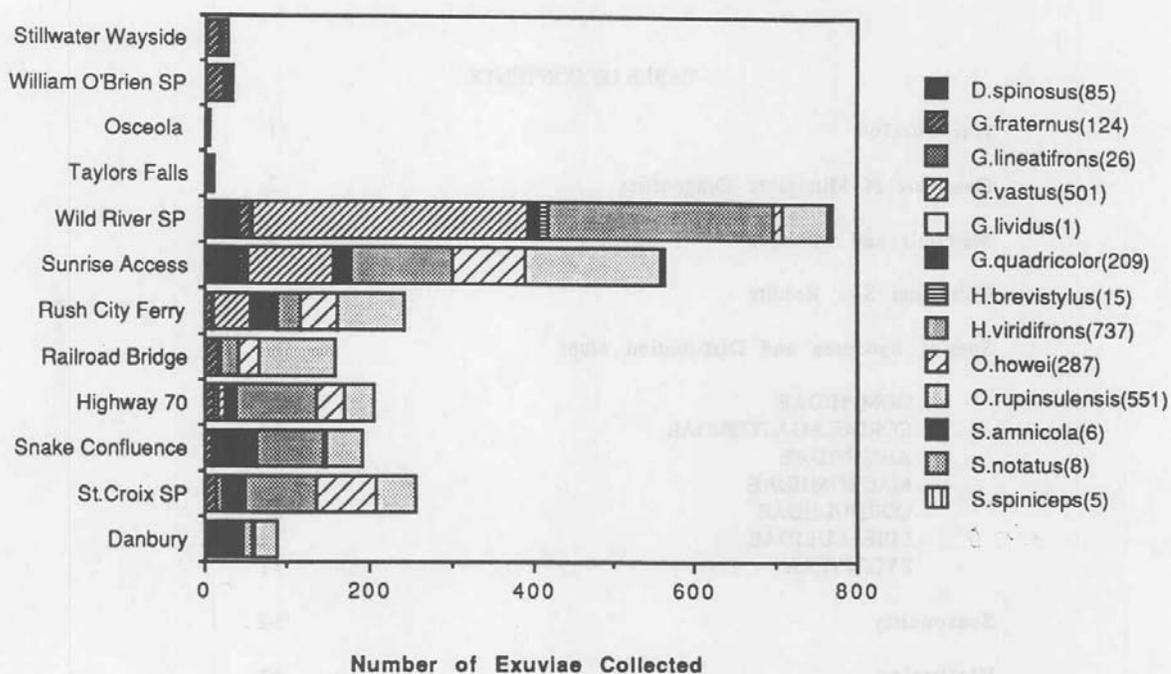
ACKNOWLEDGEMENTS

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GOMPHID EXUVIAE along the ST CROIX



INTRODUCTION

Any visitor to Minnesota's waters cannot help but notice the adult dragonflies present. Their large size and aerial agility inspire awe and in myself elicit a primitive hunter's instinct--desiring to capture and examine these 'flight-machines' close up. Less frequently observed but no less interesting are the aquatic; sometimes grotesque; larvae with their jet propulsion and protrusible labium armed with wicked teeth for capturing prey. Minnesota with its 10,000 lakes and innumerable ponds, marshes, and streams is rich in species. Wisconsin which is well collected reports 109 species and it is likely that 100 occur in Minnesota. Unfortunately, dragonflies do not have the following that birds and butterflies do. This is because they do not preserve well; adults lose their brighter colors and the life spark leaves their eyes when pinned and dried.

During the 1960's Hamrum, Anderson and colleagues from Gustavus Adolphus College, St. Peter, collected dragonflies widely across the state and produced a series of informative papers on the distribution and abundance of dragonflies in Minnesota (Hamrum, et.al. (1965, 1971); Boole, et.al. (1974); Miller, et.al. (1964)). They recorded 70 species for the state, of which five were new state records: My M.S. Thesis research was on the dragonflies of Cedar Creek Natural History Area in east-central Minnesota (Haarstad, 1980a; 1980b). I collected 45 species, more than half the state total, and presented habitat preference and life history information on the species found. The aquatic habitats of Cedar Creek NHA are primarily lentic waters--small lakes, ponds, and marshes; and most of the species collected belong to the Libellulidae. In recent years I have collected at some of the state's many rivers, and the Minnesota total now stands at 86 species. This collecting was inspired in part by the Wisconsin Natural Heritage Program (WNHP) report of the discovery of a species new to science. They found *Ophiogomphus sabrinus* along the St. Croix River opposite Pine, Chisago, and Washington counties.

Little attention has been given to the stream-dwelling dragonflies of Minnesota. This is unfortunate because many of these species are sensitive to conditions of substrate and water quality and would likely be valuable indicators of stream deterioration. In this report I present results of a survey of selected eastern Minnesota streams in the summer of 1992. I provide information on the species of dragonflies present, their distribution, abundance, and habitat preference. I also note species of uncommon occurrence that are in need of more study and possibly protection. Before proceeding I present a brief overview of the dragonflies known to occur in Minnesota.

OVERVIEW OF MINNESOTA DRAGONFLIES

GOMPHIDAE (The Clubtails--25 species)

Adults of this family are medium to large-sized, elongate, and generally patterned in green and black. They have the eyes separated atop the head, and generally they have a clubbed tail. Several genera are reported for the state and most are confined to streams and rivers. These include *Hagenius brevistylus*, *Dromogomphus spinosus*, *Ophiogomphus* (5 spp.), *Hylogomphus* (2 spp.), *Stylurus* (3 spp.), and *Gomphurus* (5 spp.). Genera with primarily lentic but some lotic representatives are *Arigomphus* (3 spp.) and *Gomphus* (5 spp.). The larvae of this family are generally dorso-ventrally flattened, wedge-shaped burrowers in soft substrates.

AESHNIDAE (The Darners--11 species)

Adults of this family are large, elongate, clear-winged species with dark abdomens spotted in blue and conspicuous thoracic stripes or spots. *Anax junius*, a common migrant dragonfly with bright green thorax, is an exception to the rule. It is common in quiet waters and stream backwaters throughout the state. The large genus *Aeshna* (7 spp.) are primarily inhabitants of lentic waters, but *Aeshna umbrosa* is commonly found along streams and rivers. *Basiaeshna janata* is a common species of streams and rivers in early summer (June). Two species of *Boyeria*, with paired spots laterally on the thorax, are common along some eastern streams in late summer (August). The larvae of this family are elongate, cylindrical clingers to submerged vegetation or debris.

CORDULEGASTRIDAE (The Biddies--2 spp.)

Adults of this family are large, elongate, clear-winged, with black bodies and bright yellow markings. Their eyes barely touch atop the head. Two species have been collected in the state. *Cordulegaster maculata* is a common inhabitant of smaller streams in northern Minnesota, and *Cordulegaster obliqua* is a rare species of seeps? in eastcentral Minnesota. The larvae are large, robust creatures with labium edged in jagged teeth. They occur in silt-bottomed pools of streams.

MACROMIIDAE (The River Cruisers--2 species)

Adults are large, elongate, clear-winged, with a single lateral thoracic stripe each side. Their eyes meet broadly across the top of the head. *Macromia illinoensis* is blackbodied with paired yellow spots along the abdomen; *Didymops transversa* is a dull redbrown with pale spots. The larvae are long-legged, oval, flattened, creatures with a horn atop the head. They clamber over bottom detritus in quiet areas of streams and rivers.

CORDULIIDAE (The Green-eyed Skimmers--17 species)

Most members of this family inhabit lentic waters. The adults are medium-sized, dark-bodied, and generally clear-winged. They have a constricted waist and are the most acrobatic of fliers. Two species of *Neurocordulia*, the Shadowflies, occur in quiet backwaters of larger streams and rivers. Several of the nine species of *Somatochlora* (brilliant green eyes) appear to inhabit slow-water boggy streams primarily in the northern half of the state. *Eplcordulia princeps* (with maroon-spotted wings) and three species of *Epithea* (abdomen black and rimmed in yellow) are generally found in lakes and ponds but occasionally occur in quiet streams. *Cordulia shurtleffi* inhabits muckbottomed river expansions in northeast Minnesota. *Dorocordulia Ilbera* is confined to marsh-margined ponds. The larvae of this family are generally oval-flattened, spinypatterned, leggy-clamberers over bottom detritus.

LIBELLULIDAE (The Pond Skimmers--29 species)

Most of the adults of this family frequent ponds and marshes. They are small to medium-sized, robust-bodied, and many have colored wings or bodies. *Plathemis lydia* visited once in mid June. Collecting was, in general, quite good, but diversity was not very high. *Ophiogomphus carolus* was by far the most abundant species encountered in mid-June.

EAST-CENTRAL REGION

The streams of the east-central region where I collected include the Kettle River (5 sites), the Snake River (7 sites) and the St. Croix River (12 sites). A number of these were visited repeatedly. Visits were also paid to smaller tributaries of these rivers. These include the Grindstone (to the Kettle), the Sand (2 sites), Little Sand, and Crooked Creek (to the St. Croix in Pine Co.), Rock Creek and Sunrise River (to the St. Croix in Chisago Co.), the Ann and Groundhouse Rivers (to the Snake in Kanabec Co.). Two sites along the Rum River in Isanti and Anoka counties were also searched for exuviae. The Mississippi River was also visited near Elk River (Sherburne Co.). The streams and rivers mentioned above vary considerably in size but they are generally lightly-stained, soft-water streams flowing over glacially-deposited ground moraine. They have moderate current, considerable fluctuations in water level and varied gravel, sand, or silt substrate. It was along the streams of this region (especially the St. Croix) where I encountered the greatest abundance and diversity of dragonfly species (especially Gomphidae).

THE SOUTHEAST

Streams and rivers visited in the southeast include the Cannon River (4 sites), the Zumbro River (5 sites), the Whitewater River (2 sites), and the Root River (8 sites). The lower Mississippi River was also searched (5 sites). Again the streams visited varied considerably in size but most are sluggish and turbid hard-water streams emanating from limestone bedrock of the Driftless Area. Many are bordered by pasture or cultivated fields along portions of their flowage, and I suspect they are quite 'eutrophic' judging by the 'flocculent-covered' substrate and the number of dead carp encountered. I had little luck finding either exuviae or adults on my two collecting trips to this region (end-May and late June). However, the first was perhaps slightly early, and my second search for exuviae may have been unsuccessful because of heavy rains that preceded this visit. Only one adult gomphid was seen and a handful of exuviae collected. This suggests that few dragonflies exist in these streams. The Lower Mississippi is probably an exception. Whedon (1914) reports of the massive emergence of *Gomphurus vastus* at Read's Landing (Wabasha Co.) early in the century. An adequate search of this area would require summer residency aboard a houseboat. Any available?

DF site chars

Code	NE Collection Sites	Width(m)	Depth	Quality	Current	Substrate
1	Gooseberry at Hwy 61	12	0.7	clear	fast	rocky/gravel
2a	Baptism at Eckbeck	18	1	stained	fast	rocky
2b	Baptism at Finland	10	0.5	stained	moderate	rocky/silt
2c	Baptism on #7	wide	deep	stained	sluggish	silt
3	Manitou on #7	8	0.5	stained	moderate	gravel/sand
4a	Temperance Pool	25	deep	turbid	sluggish	sand/silt
4a	Temperance Gorge	25	1	stained	fast	rocky
4b	Temperance by Toftø	25	1	stained	moderate	gravel
4c	Temperance NF CpGd	20	1.5	stained	moderate	gravel/sand
4d	Temperance at Baker L	10	0.5	stained	fast	rocky
7b	Cascade at Hwy 61	10	0.5	stained	fast	rocky
7a	Cascade Expansion	wide	deep	stained	sluggish	silt
8	Stony at Hwy 1	25	1.5	stained	moderate	gravel/sand
9	Kawishiwi at Hwy 1	wide	deep	turbid	moderate	sand
10a	St.Louis at Forbes	25	2?	turbid	moderate	silt/cutbank
10b	St.Louis at Toivola	35	3?	turbid	moderate	silt/cutbank
10c	St.Louis at Floodwood	50	3?	turbid	moderate	silt/cutbank
	SE Collection Sites	Width(m)	Depth	Quality	Current	Substrate
23a	Cannon at Cannon Falls	40	2?	turbid	moderate	rocky/silt
23b	Cannon at Sunset Trail	50	2?	turbid	moderate	rocky/silt
23c	Cannon above Welch	50	3?	turbid	sluggish	sandy/silt
23d	Cannon below Welch	30	2?	turbid	moderate	rocky/silt
24a	Zumbro at Mazeppa	12	0.7	clear	moderate	algal rocks
24b	Zumbro at Zumbro Fall	30	1.5	clear	slow	gravel/sand/silt
24c	Zumbro at Hammond	40	2?	turbid	slow	sand/silt
24d	Zumbro at Milville	40	3?	turbid	slow	rocky/silt
24e	Zumbro at Kellogg	30	deep	turbid	moderate	sand/silt cutbanks
25a	Whitewater at Carley SP	5	0.3	turbid	moderate	rocky/silt
25b	Whitewater at WWSP	5	0.3	turbid	moderate	rocky/silt
26a	Root at Chatfield	18	0.7	turbid	moderate	rocky/gravel
26b	Root at Parsley Bridge	30	2?	turbid	moderate	gravel/silt
26c	Root at Forestville SP	15	1.5	clear	moderate	gravel/silt
26d	Root at Preston	20	1.5	clear	moderate	rocky/silt
26e	Root at Whalen	40	deep	turbid	moderate	sand/silt cutbanks
26f	Root at Peterson	35	deep	turbid	moderate	gravel/silt
26g	Root at Rushford	30	1.5	turbid	moderate	sand/gravel
26i	Root at Hokah	30	deep	turbid	moderate	mud cutbanks
	Mississippi Collection Sites	Width(m)	Depth	Quality	Current	Substrate
27a	Mississippi at Elk River	wide	deep	clear	moderate	rocky/gravel
27b	Mississippi at Red Wing	wide	deep	turbid	sluggish	silt cutbanks
27c	Mississippi at Frontenac	wide	deep	turbid	sluggish	sand
27d	Mississippi at Wabasha	wide	deep	stained	sluggish	sand/silt
27e	Mississippi at Dresbach	wide	deep	stained	moderate	sand
27f	Mississippi at Brownsville	wide	deep	stained	moderate	sand
	St. Croix Collection Sites	Width(m)	Depth	Quality	Current	Substrate
22a	St.Croix at Danbury	wide	deep	stained	moderate	sand/boulder
22b	St.Croix in State Park	wide	deep	stained	sluggish	silt/boulder
22c	St.Croix at Snake	wide	deep	stained	moderate	silt/stone
22d	St.Croix at Hwy 70	wide	deep	stained	moderate	silt/boulder
22e	St.Croix at RR Bridge	wide	deep	stained	moderate	sand/boulder
22f	St.Croix at RC Ferry	wide	deep	stained	moderate	sand/boulder
22g	St.Croix at Sunrise	wide	deep	stained	moderate	rock/gravel
22h	St.Croix at Wild River	wide	deep	stained	moderate	sand
22i	St.Croix at Taylors Falls	wide	deep	stained	moderate	sand/silt bars
22j	St.Croix at Osceola	wide	deep	stained	moderate	sand
22k	St.Croix at Wm O'Brien	wide	deep	stained	sluggish	gravel/silt

MATERIALS AND METHODS

From mid-May to end-July 1992 I visited 85 sites along 25 streams and rivers in eastern Minnesota (see Figure 1). Sites visited were within State Parks, at public landings, and occasionally at bridge crossings. Portions of the Snake and St. Croix were also explored by canoe. The general procedure was to search for and collect exuviae along a stretch of shoreline for 30 minutes. Exuviae were bagged and later identified to species and counted. Sites along many of the rivers were visited on more than one occasion during the summer. After collecting exuviae some time was spent searching for and collecting adults, and general notes made of their behavior. Notes were also made of stream characters at each of the sites visited. These include width, depth, current, water clarity, and substrate (see Table I). Voucher specimens were deposited in the Entomology Collection, Hodson Hall, St. Paul Campus, University of Minnesota.

In the report that follows I borrow heavily from the works of Hamrum and colleagues cited earlier as well as the work of Walker (1958) and Walker and Corbet (1975) on the Odonata of Canada and Alaska. I am also extremely indebted to Tim Vogt of the Wisconsin Natural Heritage Program for supplying me with a list of Wisconsin Odonata and an annotated checklist of dragonflies this group has collected along the St. Croix River. The WNHP list records species and abundances along the Upper (Wisconsin source to Minnesota border in Pine Co.), Middle (Hwy 48 crossing to Danbury south to Taylors Falls), and Lower (Taylors Falls south to Douglas Point and its confluence with the Mississippi). I have examined the pinned material in the University of Minnesota, St. Paul Collection, but have not gone through the hundreds of specimens in paper triangles.

THE STUDY SITES

Streams in three areas of the state were searched for exuviae and adult dragonflies. See Figure 1 and Table I for location of collection sites and stream characters. Table II records the number of exuviae of each species collected at each site. The codes across the top of the Table refer to the Collection Site as identified in the Results Section. Below I present a general overview of stream character and dragonfly abundance in these three regions. Tom Water's (1977) Streams and Rivers of Minnesota, and pamphlets of Minnesota Canoe Routes produced by the Minnesota DNR are very useful references providing information on history, geology, water quality, and the logistics of visiting these streams.

THE NORTHEAST

The streams along the North Shore are small to mid-sized, shallow, cold, well-aerated, fast-water streams racing over rocky basaltic substrate as they descend to Lake Superior. They are lightly stained and 'soft-watered' reflecting their boggy headwater origins. Those near Duluth have little in the way of headwater sources and are 'consequently 'flashy' with boom and bust water levels. Those further north are more constantly supplied by headwater sources and are less seasonal in flowage. Upstream, behind the basaltic ridge along the North Shore these streams are slower with reduced gradient, and the substrate can vary from rock, to gravel, to sand and finer sediment in slow water areas. Stretches of the Baptism River (north of Finland) and the Cascade River (near Cascade Lake) are sluggish, marsh-bordered impoundments with abundant emergent vegetation and silty substrate. Streams at which I collected exuviae and/or adults include the Gooseberry (1 site), the Baptism (3 sites), the Manitou (1 site), the Temperance (4 sites), and the Cascade (2 sites). Two collecting trips were conducted--one from 9-12 June the second from 9-12 July. Two brief visits were made in late July and late August of 1991. In the interior of the Arrowhead Region I collected at the Stony River and the Kawishiwi River at the National Forest Campground off Hwy 1 in mid-June and visited them again in late August. Three sites along the muddy cut-bank St. Louis River were (the White-tail), *Libellula pulchella* (the Ten-spotter), *Libellula luctuosa* (the Widow), and *Perithemis tenera* (the Amber wing) are four of the more conspicuous libellulids seen with some regularity along sluggish streams in the southern half of the state. *Ladona julla* and two species of *Celithemis* occur in lakes. *Erythemis simplicicollis*, *Leucorrhinia* (5 spp.), *Libellula quadrimaculata*, *Pachydiplax longipennis*, *Pantala* (2 spp.), *Tramea* (2 spp.), and *Sympetrum* (9 spp.) occur in ponds and marshes. *Nannothemis bella* is the smallest dragonfly in North America and occurs in sphagnum-cranberry bogs. The larvae of this family are generally dark, hairy, bottom-sprawlers in mucky sediment, or spiny-patterned climbers in submerged vegetation.

COLLECTION SITE RESULTS

The number of exuviae of each species collected at each site are to be found in Table 11. The Headers of this Table refer to the Sites enumerated below (e.g. 2a = Baptism at Eckbeck).

THE NORTHEAST

1. **Gooseberry River**

Collecting was done above the Falls off Hwy 61. The stream was rather small (ca. 40 ft wide by 2 ft deep) with rocky rapids and slower pools; banks were of gravel and red clay. *Ophiogomphus carolus* exuviae were abundant. A few exuviae of *Hylogomphus adelphus* and *Cordulegaster maculata* were also collected. Adult *Epithea spinigera* were present.

2. **Baptism River**

a. Eckbeck National Forest Campground

The Baptism River at the Hwy 1 crossing south of Finland is ca. 60 x 2 ft with a good gradient. The fast shallow waters flow over a rocky substrate with -many' projecting rocks. Numerous *Ophiogomphus carolus* and a few *Hylogomphus adelphus*, *Ophiogomphus rupinsulensis*, and *Cordulegaster maculata* exuviae were collected. An adult *Somatochlora minor* was taken and ?*Ophiogomphus colubrinus*? and *Calopteryx maculata* adults were observed on a mid-July visit. *Epithea canis* was present at all three sites along the Baptism.

b. Finland National Forest Campground

This site is located at the #6 crossing of the Baptism just east of Finland. The stream is small (ca. 20 x 1 ft) with boulder substrate and projecting stones impounding a silt-bottomed slow-water area just upstream. *Ophiogomphus carolus* exuviae were common in the rapids area and adult males were perched atop projecting stones. They were extremely wary and challenging to collect. A few *Hylogomphus adelphus* ' exuviae were also collected here. *Cordulegaster maculata* was patrolling the rapids section, and *Calopteryx aequabilis* was present along the shoreline. In the pool area adult *Didymops transversa*, *Basiaeshna janata*, and *Cordulia shurtleffi* males were patrolling. Exuviae collected in the pool area included *Ophiogomphus carolus*, *Ophiogomphus rupinsulensis*, *Gomphus exilis*, *Hylogomphus adelphus*, and *Gomphus lividus*.

c. Baptism Expansion

This site is located ca. 6 miles north of Finland at the #7 crossing. To the west of the bridge the stream is a small rapidly descending cascade (ca. 10 x 1 ft) over boulders. No exuviae were found. To the east the river is very broad and sluggish with lily pads and equisetum patches and a silty substrate. Exuviae collected included *Ophiogomphus carolus*, *Gomphus lividus*, *Hylogomphus adelphus*, *Ophiogomphus rupinsulensis*, *Cordulegaster maculata*, and *Didymops transversa*. *Arigomphus cornutus* was observed emerging. Patrolling adults included *Didymops transversa*, *Cordulia shurtleffi*, and *Basiaeshna janata*. On a mid-July visit *Hagenius brevistylus* was present as were *Arigomphus cornutus*, *Cordulia shurtleffi*, *Libellula pulchella*, *Plathemis lydia*, *Ladona julia*, and *Calopteryx aequabilis*.

3. **Manitou River**

This site is located east of the #7 crossing ca. 10 miles north of Finland (Lake Co.). The stream is small and shallow (ca 20 x 2 ft) with gravel substrate in faster water areas and sand-silt substrate and bars in quiet water areas. *Ophiogomphus carolus* exuviae were abundant. A few *Hylogomphus adelphus*, *Cordulegaster maculata* and *Gomphus lividus* exuviae were also taken. Adults taken included *Cordulegaster maculata*, *Gomphus lividus*, and on a mid-July visit' *Boyeria grafiana*. *Calopteryx maculata* was abundant at stream edge and in the surrounding woods.

4. **Temperance River**

a. Gorge of the Temperance

Collecting was done above and below the Gorge of the Temperance west of Hwy 61 crossing. The lower area was a quiet pool with silty sediment over rocky substrate. *Ophiogomphus carolus* exuviae were numerous, and the exuviae of *Hylogomphus adelphus* were common. A few exuviae of *Gomphus lividus*, *Ophiogomphus rupinsulensis*, and *Cordulegaster maculata* were also found. Above the gorge the river is wide (ca. 70 x 2ft) fast, and rocky. Exuviae of *Ophiogomphus carolus* and *Cordulegaster maculata* were collected here. Adults of

Ophiogomphus carolus were common in a grassy powerline cut near the gorge. On a late July visit *Aeshna umbrosa* males were noted patrolling the river in some numbers.

b. Old Bridge crossing

This site is located ca. 5 miles north of Tofte off #2. The river is rather wide (ca. 80 x 2 ft), with moderate current over rocky-gravel substrate and scattered deeper quiet water silt-bottomed areas near the edge. Exuviae of *Ophiogomphus carolus* were numerous in rapids area, a few *Hylogomphus adelphus* and *Cordulegaster maculata* exuviae were found as well.

c. Temperance River National Forest Campground

This site is located ca. 11 miles north of Tofte off #2. At this point the river is considerably smaller (ca. 50 x 3 ft) with alternating riffles over rocky-gravel substrate and deeper water pools with sand-silt substrate. Exuviae collected include *Ophiogomphus carolus* and *Hylogomphus adelphus*. On a late July visit *Boyeria grafiana* was taken patrolling the riffle area and a *Somatochlora elongata* female in a quiet silt-bottomed backwater.

d. Temperance at Baker Lake

The Temperance River at a gravel Forest Service road crossing running from the Sawbill to Gunflint Trails is a small stream (ca. 10 x 1 ft), with fast water flowing over projecting rocks and having scattered quiet silt-bottomed pools. *Ophiogomphus rupinsulensis* was observed emerging. The only other exuviae was of *Hylogomphus adelphus*.

5. **Baker Lake Boat Landing**

Baker Lake is a small sand-bottomed marsh-bordered lake. Exuviae and 'tenerals of *Gomphus exilis*, *Gomphus spicatus*, *Ladona julia*, and *Epithea spinigera* were abundant. Several *Ophiogomphus rupinsulensis* exuviae were also collected. *Libellula quadrimaculata* adults were common in the fringing marsh as were *Leucorrhinia proxima* and *Leucorrhinia hudsonica*.

6. **Cascade Lake Boat Landing**

This site is located off the Sawbill-Gunflint Forest Service Road. The lake is relatively large and open with considerable wave action and a gravel-sand shoreline. *Gomphus spicatus* exuviae were common.

7. **Cascade River**

a. Cascade Expansion

The Cascade River at the crossing ca. 4 miles east of Cascade Lake is broad, sluggish, marsh-bordered, and silt-bottomed. Exuviae of *Cordulia shurtleffi* were common. Also collected were exuviae of *Gomphus lividus*, *Ladona julia*, and *Epithea spinigera*. Adults taken included *Cordulia shurtleffi*, *Epithea spinigera*, *Libellula quadrimaculata*; and in late July *Aeshna canadensis*.

b. Hwy 61 Crossing

The Cascade River at this point is a narrow (ca 20 x 2 ft) rapidly descending stream over rocky substrate. *Ophiogomphus carolus* was emerging in fair numbers.

8. **Stony River**

This collection site is located at the Hwy 1 crossing of the Stony River in Lake Co. The stream is rather wide, (ca 80 x 3 ft) with rocky-gravel riffles and sand-silt bottomed pools. Many *Ophiogomphus rupinsulensis* exuviae were collected as well as one *Hagenius brevistylus*. Adults collected include *Gomphus lividus* (ovipositing), *Gomphus spicatus*, and *Hylogomphus adelphus*.

9. **Kawishiwi River**

This site is located at the National Forest Campground off Hwy -1 ten miles southeast of Ely. At this point the Kawishiwi is very wide, sluggish, and deep with sandy shoreline. Exuviae of *Gomphus exilis* and *G. spicatus* were common. *Didymopoda transversa* was taken patrolling the shoreline. This species is rather easy to net. It courses rapidly about a meter above the water but will hover-inspect any projecting object such as a netwielding collector. A late August visit netted *Aeshna umbrosa* and *Boyeria vinosa* males patrolling the shoreline ca. 30 cm. above the surface.

10. **St. Louis River**

a. Forbes Landing

This site is located just south of Forbes at the #7 crossing: The river is rather wide and deep (ca. 80 x ?? ft) with turbid waters, muck-bottomed, and sand-silt cutbanks. The most common exuviae collected were those of *Ophiogomphus rupinsulensis*. Exuviae of *Gomphurus fraternus*, *Neurocordulla sp.*, *Hylogomphus adelphus*, *Gomphus lividus* and *Macromia illinoiensis* were also collected. Adult *Hylogomphus adelphus* and *Calopteryx aequabilis* were taken.

b. Toivola Landing

This site is located at the #52 crossing and landing just east of Toivola. The river is similar in character to Forbes Landing only wider (ca. 100 ft). The exuviae of *Ophiogomphus rupinsulensis* were most common. *Gomphurus fraternus* and *Hylogomphus adelphus* exuviae were also collected.

c. Floodwood Landing

This site is located along #29 ca. 6 miles northeast of Floodwood. The river is wide and deep (ca. 150 x ?? ft), sluggish, and turbid, with sand-silt cutbanks and mucky substrate. Exuviae of *Ophiogomphus rupinsulensis*, *Gomphurus fraternus* and *Hylogomphus adelphus* were all common. *Didymops transversa* was observed patrolling, and a large gomphid (? *Gomphurus lineatifrons* ?) was observed but not taken. The damselfly *Calopteryx aequabilis* was common at all three sites along the St. Louis River.

DF site chars

22i	St. Croix at Stillwater	wide	deep	stained	moderate	sand
	EC Collection Sites	Width(m)	Depth	Quality	Current	Substrate
11a	Kettle at Willow River	15	1.5	stained	slow	sand/silt
11b	Kettle at Hwy 23	40	deep	stained	moderate	sand/silt
11c	Kettle at Banning SP	wide	deep?	stained	sluggish	silt
11d	Kettle at Sandstone	50	deep	stained	moderate	rocky/silt
11e	Kettle at Hwy 48	40	deep	stained	sluggish	sand/silt
12a	Snake at McGrath	5	0.5	clear	moderate	rocky/silt
12b	Snake at Silver Star Rd	20	1.5	stained	sluggish	silt+rocky riffle
12c	Snake at Altin Park	20	1	stained	moderate	boulder/silt
12d	Snake at #3	25	2.5	turbid	sluggish	silt
12e	Snake at Mora	18	0.7	stained	moderate	gravel/sand
12f	Snake at Little Walleye	30	deep	turbid	sluggish	silt cutbanks
12g	Snake at Fur Post	wide	deep	stained	moderate	sand
12h	Snake at St. Croix	8	0.7	stained	moderate	rocky/silt
	EC Collection Sites	Width(m)	Depth	Quality	Current	Substrate
15	Grindstone	8	0.4	clear	moderate	rocky/gravel
16	Sand	12	1	stained	moderate	sand
17	Little Sand	3	1	turbid	sluggish	silt cutbanks
18	Crooked Creek	7	0.7	clear	moderate	gravel/sand
13	Ann River	wide	deep	turbid	sluggish	silt
14	Groundhouse River	10	1	clear	moderate	rocky/silt
19	Rock Creek	5	0.4	clear	moderate	rocky/gravel/sand
20	Sunrise River	20	1.5	turbid	moderate	rocky/sand
21a	Rum at Walbo Ferry	25	2?	turbid	sluggish	sand/silt
21b	Rum at St. Francis	30	1.5	turbid	moderate	gravel/silt

DF site exuviae

NorthEast Exuviae	1	2a	2b	2c	3	4a	4b	4c	4d	5	6	7a	7b	8	9	10a	10b	10c	24d	26e	27	
Arigomphus cornutus				1																		1
Dromogomphus spinosus																						
Gomphurus fraternus																4	12	25	4			2
Gomphurus lineatifrons																						
Gomphurus vastus																						1
Gomphus exilis			5							10						24						
Gomphus graslinellus																						
Gomphus lividus			2	4	2	1						1				2						
Gomphus quadricolor																						
Gomphus spicatus										25	5					4						
Hagenius brevistylus															1							
Hylogomphus adelphus	8	2	2	2	1	22	2	5	1								2	2	7			
Hylogomphus viridifrons																						
Ophiogomphus carolus	78	45	7	3	25	193	74	7					18									
Ophiogomphus colubinus																						
Ophiogomphus howei																						
Ophiogomphus rupinsulensis	2	3	1		2				4	9				30		15	51	15				2
Ophiogomphus sabrinus																						
Stylurus amnicola																						
Stylurus notatus																						
Stylurus spiniceps																						
Basiaesha janata																						
Cordulegaster maculat	1	1		1	1	6	1															
Didymops transversa				1																		
Macromia illinoensis																	1					
Cordulia shurtleffi												11										
Epicordulia princeps																						
Epiteca canis																						
Epiteca spinigera										6		1										
Neurocordulia sp.																	5					
Ladona julia										3		2										
Leucorrhinia proxima																						
Plathemis lydia																						
Number of Species	3	4	5	7	4	5	3	2	2	5	1	4	1	2	2	6	3	3	1	1	2	2
Total Exuviae	87	50	19	13	29	224	77	12	5	53	5	15	18	31	28	29	65	47	4	1	4	4

EAST-CENTRAL REGION

11. Kettle River

a. Willow River Crossing

The Kettle at the #41 crossing just north of Willow River is small (ca 50 x 2 ft) and rather sluggish with sand-silt cutbanks and substrate. Common exuviae were *Ophlogomphus rupinsulensis*, *Hylogomphus adelphus*, and *Gomphus lividus*. A few exuviae of *Gomphurus lineatifrons*. *Gomphus quadricolor*, *Ophiogomphus carolus*, and *Epitheca canis* were also found. *Calopteryx maculata* was present along the shoreline.

b. Hwy 23 Landing

A wide and deep (ca 140 x 6 ft) river flows through a steep sided valley just north of Banning State Park. The river is rather sluggish and turbid with sand-silt margins. *Gomphus quadricolor* and *Gomphus lividus* were the most common exuviae. *Hylogomphus adelphus?* and *Ophiogomphus rupinsulensis* exuviae were also collected. A *Hylogomphus viridifrons* adult was taken at this site.

c. Banning State Park

Collecting was done near the Boat Landing in the wide deep area just above Hell's Gate Rapids. The exuviae of *Hylogomphus adelphus* were numerous, and those of *Ophiogomphus rupinsulensis*, *Gomphus lividus* and *Gomphus quadricolor* were common. Other exuviae collected included *Hagenius brevistylus*, *Basiaeshna janata*, *Macromia illinoiensis*, *Didymops transversa*, and *Epitheca canis*. Adults noted or taken included *Hylogomphus adelphus*, *Macromia illinoiensis*, *Hagenius brevistylus*, *Libellula quadrimaculata*, *Leucorrhinfa intacta*, *Plathemis lydia*, *Ladona julia*, *Epitheca canis*, *Anax junius*, *Calopteryx maculata* and *Calopteryx aequabilis*. On a mid-September visit *Aeshna umbrosa* and *Boyeria vinosa* were observed.

d. Robinson Park

The Kettle at this point just east of Sandstone and north of the #30 crossing is wide, sluggish, deep, dark-stained and rock margined. *Hylogomphus adelphus* was the most common exuvise. Exuviae of *Ophiogomphus rupinsulensis* were also present.

e. Kettle River SNA

The Kettle Landing at the Hwy 48 crossing east of Hinckley is wide and deep (ca 140 x 10 ft), dark-stained, with moderate--current, and sand-silt margins. Exuviae collected included *Gomphus quadricolor*, *Hylogomphus sp.*, and *Basiaeshna janata*. Species taken, as adults include *Gomphurus lineatifrons*, *Dromogomphus 'spinosus*, *Didymops transversa*, and *Macromia illinolensis*. Other species noted include *Libellula pulchella*, *Plathemis lydia*, *Ladona julfa*, *Calopteryx maculata*, and *Calopteryx aequabilis*.

12. Snake River

a. McGrath Landing

The Snake at the Hwy 65 landing just north of McGrath is a small shallow stream (ca 10 x 1 ft) with gentle current and rocky riffles and silt-bottomed pools. Only stonefly exuviae were collected but *Didymops transversa* was observed patrolling.

b. Silver Star Road Landing

The Snake at this landing one mile east of Hwy 65 in southern Aitkin Co. is rather broad (ca 70 x 3 ft) sluggish, and dark-stained with marsh-margined mucky-substrate and cutbanks except for an artificial rocky riffle deposited for vehicle crossing in low water. A few exuviae of *Ophiogomphus rupinsulensis*, *Gomphus graslinellus?*, and *Epitheca canis* were collected. *Didymops transversa* was observed patrolling.

c. Aitkin Co. Park

I canoed a 19 mile stretch of the Snake River from the Park at the Aitkin-Kanabec Co. line south to the #3 crossing north of Mora on 20 June. During much of the upper course of the river the dark-stained waters are of moderate current flowing through a boulder riddled channel ca 60 ft wide with sand-silt cutbanks and pools of quiet water. At the Upper and Lower falls the river gradient increases as it flows through a granite flanked gorge. Below this point, the river widens, slows, and deepens as it approaches the Hwy 3 crossing. Exuviae collected at two points above the falls include *Hylogomphus adelphus*, *Dromogomphus spinosus*, *Ophiogomphus*

rupinsulensis, *Basiaeshna janata*, *Gomphus quadricolor*, and *Didymops transversa*. An adult *Gomphus graslinellus* male was taken perched atop a shoreline boulder.

d. Highway # 3 Landing

The Snake at this point is rather wide and deep (ca 80 x 4 ft), sluggish, somewhat turbid with sand-silt cutbanks and mucky substrate. The most common exuviae were those of *Hylogomphus viridifrons*, *Gomphus quadricolor* and *Ophiogomphus rupinsulensis*. Exuviae of *Gomphurus fraternus*, *Basiaeshna janata*, *Neurocordulia* sp., and *Didymops transversa* (noted emerging) were taken in smaller numbers. Adults taken/observed included *Hylogomphus viridifrons*, *Gomphurus ventricosus*, *Cordulia shurtleffi*, *Epitheca canis*, *Epitheca spinigera*, *Epitheca cynosura*, *Libellula quadrimaculata*, *Leucorrhinia intacta* and *Ladona julia*.

e. Mora Landing

The Snake at the Mora Landing just west of town off #6 is rather small and shallow (ca 50 x 2 ft), dark-stained, with gentle current, sand-gravel substrate, and sand-silt cutbanks. Exuviae collected in decreasing abundance were *Ophiogomphus rupinsulensis*, *Gomphus quadricolor*, *Hylogomphus adelphus*, and *Gomphurus fraternus*.

f. Little Walleye Landing

The Snake at this landing 2.5 miles east of Grasston off #7 is rather broad and sluggish (ca 100 x 6? ft) with muck bottom and flanked by marsh and floodplain forest. *Gomphurus fraternus*, and *Gomphus quadricolor* were the most common exuviae collected. Smaller numbers of exuviae of *Ophiogomphus rupinsulensis*, *Epitheca canis*, *Leucorrhinia proxima*, and a single *Ophiogomphus howei* were collected. *Plathemis lydia* and *Arigomphus cornutus* were noted emerging. Adults noted include *Basiaeshna janata*, *Anax junius*, *Ladona julia*, *Libellula pulchella*, and *Calopteryx aequabilis*.

g. Northwest Fur Post

The Snake at the site of the Fur Post ca 2 miles west of Pine City off #7 is wide and deep and sand-silt margined. *Gomphurus fraternus* were the only exuviae collected. *Anax junius* was observed patrolling. *Aeshna umbrosa* was noted patrolling on a late August visit.

h. Snake-St. Croix confluence

The Snake near its confluence with the St. Croix ca 10 miles east of Pine City off # 8 is again small and rocky (ca 15 x 1 ft) with some muck-margined quiet areas. Exuviae of *Ophiogomphus rupinsulensis* and *Hylogomphus viridifrons* were abundant; *Gomphus quadricolor* was common, and a few *Gomphurus fraternus*, *Gomphurus lineatifrons*, and *Ophiogomphus sabrinus* were also collected. Adults taken include *Gomphurus ventricosus*, *Gomphurus fraternus*, *Hylogomphus viridifrons*, and *Basiaeshna janata*. *Plathemis lydia*, *Calopteryx maculata*, *Calopteryx aequabilis*, and *Hetaerina americana* (the Ruby Spot) were also present.

13. **Ann River**

The Ann River Landing off Hwy 65 two miles south of Mora is a wide deep impoundment behind a dam near its confluence with the Snake. Emergent vegetation is sparse but water lilies and Potamogeton are abundant. Exuviae collected include *Arigomphus cornutus* and *Epitheca spinigera*.

14. **Groundhouse River**

The Groundhouse River at the Hwy 65 crossing 5 miles south of Mora is a small stream (ca 30 x 2 ft) with gentle current and a combination of rock and silt substrate. Exuviae of *Gomphus lividus* were the only ones found.

15. **Grindstone River**

The Grindstone is a small, rocky stream (ca 25 x 1 ft) with moderate current that is crossed by Hwy 48 twice before it enters the Kettle River east of Hinckley in Pine Co. Exuviae collected include *Ophiogomphus rupinsulensis*, *Hylogomphus adelphus*, *Gomphus quadricolor*, *Gomphus lividus*, *Basiaeshna Janata*, *Macromia illinoensis*, and *Cordulegaster maculata*. *Hylogomphus adelphus* and *Gomphus quadricolor* males were common perched atop projecting boulders in the stream and proved a challenge to collect. *Cordulegaster maculata* was conspicuous but impossible to capture on its patrolling flights.

16. **Sand River**

I visited the Sand River at two sites. At both the Hwy 48 crossing 12 miles east of Hinckley and a gravel road crossing within St. Croix State Park the Sand River is a small stream (ca 40 x 2 ft) with moderate current, light-stained waters and generally sandy substrate. Exuviae collected in decreasing abundance were *Hylogomphus adelphus*, *Gomphus lividus*, *Ophiogomphus rupinsulensis*, *Gomphus quadricolor*, *Basiaeshna Janata*, *Macromia illinoiensis*, and *Gomphurus lineatifrons*. *Hylogomphus adelphus*, *Gomphus lividus*, *Gomphus quadricolor*, *Basiaeshna Janata*, *Didymops transversa*, and *Epitheca canis* were taken as adults. A *Boyeria vinosa* male was captured patrolling the stream on a mid-July visit.

17. **Little Sand River**

I stopped at this small stream (ca 15 x 2 ft) at the Hwy 48 crossing ca 13 miles east of Hinckley. The stream is sluggish, somewhat turbid, and muck-bottomed. A solitary *Didymops transversa* exuvia was collected. An egg-laden *Gomphus lividus* female was also collected here, and *Plathemis lydia* noted.

18. **Crooked Creek**

This stream is another tributary to the St. Croix that crosses Hwy 48 ca 4 miles west of the Wisconsin border. It is small and shallow (ca 20 x 2 ft), with light-stained waters, gentle current and substrate varying from rocky riffles to sandy-gravel beds to silt bottom pools. Exuviae collected include *Hylogomphus adelphus*, *Ophiogomphus rupinsulensis*, *Ophiogomphus colubrinus*, and *Gomphus lividus*. Adults noted include *Dorocordulia libera*, *Libellula quadrimaculata*, and *Calopteryx aequabilis*.

19. **Rock Creek**

Rock Creek is a small, clear-water stream (ca. 15 x 1 ft) that enters the St. Croix in northern Chisago Co. At the #3 gravel crossing it has gentle current with rock, gravel, and sand substrate. *Gomphus lividus* exuviae were common and a few *Ophiogomphus rupinsulensis* exuviae were found as well. *Gomphus quadricolor* adults were present, and *Macromia illinoiensis* was seen patrolling.

20. **Sunrise River**

The North Branch of the Sunrise enters the St. Croix just northeast of the town of Sunrise off # 9. I collected exuviae at a stairway descent to the river just opposite the parking lot. At this point the river is fairly wide (ca. 60 x 3 ft) with fast-flowing turbid waters over rocky substrate. Exuviae collected include *Ophiogomphus rupinsulensis*, *Gomphus quadricolor*, *Hylogomphus viridifrons*, *Gomphurus fraternus*, *Gomphus lividus*, *?Gomphurus ventricosus?* and *?Ophiogomphus colubrinus?*

21. **Rum River**

a. Walbo Ferry Landing

The Rum at the Walbo Landing ca 4 miles west of Cambridge off Hwy 95 is a sluggish river (ca 80 x 6 ft) with turbid waters and sand-silt substrate. Several *Gomphurus fraternus* exuviae were collected, and an adult *Gomphurus fraternus* taken. Other adults observed include *Basiaeshna janata*, *Plathemis lydia*, *Gibellula quadrimaculata*, and *Leucorrhinia intacta*.

b. St. Francis Landing

The Rum at this landing just north of #24 in St. Francis is medium-sized (ca 50 x 3 ft), with turbid waters, moderate current and gravel-muck substrate. Exuviae of *Gomphurus fraternus* were most common. Also collected were *Ophiogomphus rupinsulensis*, *Hylogomphus adelphus*, and *Basiaeshna janata* exuviae. Adult *Gomphurus fraternus* were present.

22. **St. Croix River**

Twelve sites along the St. Croix from the Hwy 48 crossing to Danbury (Pine Co.) south to a Wayside Rest off Hwy 95 north of Stillwater (Washington Co.) were searched for exuviae. A number of these sites were visited on several occasions, and Sunrise Access and Wild River State Park Landing were visited weekly from mid-May to mid-July. The St. Croix at all these collecting stations is wide and deep with lightly-stained waters and moderate current. Substrate is generally of gravel or sand, but some of the sites were at slower water and were silt-muck margined. Exuviae collected are recorded in decreasing abundance. See Tables I and II for Site Characters and species numbers.

a. Hwy 48 Landing (to Danbury)

Exuviae collected were *Gomphus quadricolor*, *Ophiogomphus rupinsulensis*, *Hylogomphus viridifrons*?, *Macromia illinoensis*, *Ophiogomphus howei*, *Basiaeshna janata*, and *Gomphurus lineatifrons*. Exuviae of *Macromia illinoensis* were conspicuous on the concrete pilings under the bridge ca 10 meters from the river. The damselfly *Calopteryx aequabilis* was common along the shore.

b. St. Croix State Park

I collected exuviae at the Boat Landing behind the Lodge. At this point the river is rather slow and muck-margined. Exuviae collected were *Hylogomphus viridifrons*, *Ophiogomphus howei*, *Ophiogomphus rupinsulensis*, *Gomphus quadricolor*, *Gomphurus fraternus*, *Gomphurus lineatifrons*, *Ophiogomphus sabrinus*, and *Gomphus lividus*. The quiet water with silty-substrate proved to be the best collecting site for *Gomphurus lineatifrons*.

c. Confluence with the Snake

At this site ca 10 miles east of Pine City, the St. Croix is wide, deep, and sandmargined. Exuviae collected include *Hylogomphus viridifrons*, *Gomphus quadricolor*, *Ophiogomphus rupinsulensis*, *Gomphurus fraternus*, *Gomphurus vastus*, *Ophiogomphus howei*, *Ophiogomphus sabrinus*, and *Neurocordulia sp.* Adults taken include *Gomphurus ventricosus*, *Hylogomphus viridifrons*, *Hagenius brevistylus*, *Dromogomphus spinosus*, *Stylurus amnicola*, *Ophiogomphus sabrinus*, *Ophiogomphus howei*, *Ophiogomphus rupinsulensis*, *Gomphurus lineatifrons*, and *Macromia illinoensis*. *Plathemis lydia*, *Libellula pulchella*, *Libellula luctuosa*, *Calopteryx aequabilis*, *Calopteryx maculata*, and *Hetaerina americana* were observed here.

d. Hwy 70 Crossing

I collected exuviae along the shoreline bordering the Visitor Center. Exuviae collected include *Hylogomphus viridifrons*?, *Ophiogomphus rupinsulensis*, *Ophiogomphus howei*, *Ophiogomphus sabrinus*, *Gomphus quadricolor*, *Gomphurus fraternus*, *Gomphurus vastus*, *Gomphurus lineatifrons*, and *Basiaeshna janata*.

e. Old Railroad Crossing

This site is off gravel road #3 in northern Chisago Co. The river is wide and deep with sand and boulder margin. Exuviae collected include *Ophiogomphus rupinsulensis*, *Hylogomphus viridifrons*, *Ophiogomphus howei*, *Gomphurus fraternus*, *Ophiogomphus sabrinus*, and *Gomphus quadricolor*. Adults taken include *Hagenius brevistylus*, *Gomphurus lineatifrons*, *Gomphurus ventricosus*, and *Hylogomphus viridifrons*. Adults of *Ladona julia*, *Libellula pulchella*, *Libellula quadrimaculata*, and *Epicordulia princeps* were present at this site.

f. Rush City Ferry

Located 5 miles east of Rush City off #5 this site is similar to the preceding. Exuviae collected include *Ophiogomphus rupinsulensis*, *Gomphurus vastus*, *Ophiogomphus howei*, *Gomphus quadricolor*, *Hylogomphus viridifrons*, *Ophiogomphus sabrinus*, *Gomphurus fraternus*, and *Gomphurus lineatifrons*.

g. Sunrise Access

The St. Croix at the State Park Landing off #9 just north of Sunrise is wide and deep with moderate current and sand-gravel substrate. The Sunrise River enters the St. Croix at this point. The Landing is only 30 miles from my home and is the site visited with the greatest frequency. Consequently, the list of encountered species may appear inflated, but in reality suggests that other sites along the St. Croix should yield more species. Exuviae collected in decreasing abundance include *Ophiogomphus rupinsulensis*, *Ophiogomphus sabrinus*, *Hylogomphus viridifrons*, *Gomphurus vastus*, *Ophiogomphus howei*, *Dromogomphus spinosus*, *Gomphus quadricolor*, *Gomphurus lineatifrons*, *Gomphurus fraternus*, *Stylurus spiniceps*, *Hagenius brevistylus*, *Stylurus amnicola*, *Basiaeshna janata*, and *Epicordulia princeps*. Nearly all of the above were taken as adults and in addition, *Gomphurus ventricosus*, *Gomphus lividus*, *Macromia illinoensis*, and *Cordulia shurtleffi* were collected at this site. Other species noted include *Libellula pulchella*, *Plathemis lydia*, *Libellula quadrimaculata*, *Epithea spinigera*, *Epithea canis*, *Calopteryx maculata*, *Calopteryx aequabilis*, and *Hetaerina americana* were noted here.

DF site exuviae

0	St. Croix Exuviae	22a	22b	22c	22d	22e	22f	22g	22h	22i	22j	22k	22l
1	Arigomphus cornutus												
1	Dromogomphus spinosus							43	42				
1	Gomphurus fraternus		13	9	12	18	9	3	14	4	2	23	17
1	Gomphurus lineatifrons	1	10		5		1	6	3				
1	Gomphurus vastus			3	7		47	105	335	1		3	
1	Gomphus exilis												
1	Gomphus graslinellus												
1	Gomphus lividus		1										
1	Gomphus quadricolor	45	25	53	15	2	31	18	14	2			4
1	Gomphus spicatus												
1	Hagenius brevistylus							3	10		1	1	
1	Hylogomphus adelphus												
1	Hylogomphus viridifrons	12	88	81	98	22	30	123	278				5
1	Ophiogomphus carolus												
1	Ophiogomphus colubinus												
1	Ophiogomphus howei	4	71	1	34	25	45	90	13	4			
1	Ophiogomphus rupinsulensis	28	48	46	35	92	80	166	56				
1	Ophiogomphus sabrinus		3	1	25	7	26	114	23				3
1	Stylurus amnicola							2	2		2		
1	Stylurus notatus											2	6
1	Stylurus spiniceps							4	1				
2	Basiaesha janata	2			1			1	2				
3	Cordulegaster maculata												
4	Didymops transversa												
4	Macromia illinoensis	5							3	1			
5	Cordulia shurtleffi												
5	Epicordulia princeps							1	2				
5	Epiteca canis												
5	Epiteca spinigera			1									
5	Neurocordulia sp.			1					5		25	15	
6	Ladona julia												
6	Leucorrhinia proxima												
6	Plathemis lydia												
	Number of Species	7	8	9	9	6	8	14	16	5	4	7	3
	Total Exuviae	97	259	196	232	166	269	679	803	12	30	52	27

h. Wild River State Park Landing

At the Landing the river is wide and deep and sand-margined. Exuviae collected include *Gomphurus vastus*, *Hylogomphus viridifrons*, *Ophlogomphus rupinsulensis*, *Ophiogomphus sabrinus*, *Ophiogomphus howei*, *Gomphus quadricolor*, *Dromogomphus spinosus*, *Hagenius brevistylus*, *Gomphurus fraternus*, *Gomphurus lineatifrons*, *Basiaeshna janata*, *Macromia illinoensis*, *Neurocordulia sp.*, *Epicordulia princeps*, *Stylurus spiniceps*, and *Stylurus amnicola*. Most of these species were taken as adults. This was the site where *Gomphurus vastus* emerged in greatest numbers. Other species noted were the same as those observed at Sunrise Access.

i. Taylors Falls Campground

I collected exuvise near the Boat Landing at Interstate State Park. The river is very wide and deep and somewhat sluggish below the Dells of the St. Croix. River banks are sand with fine sand-silt bars during periods of low water. Exuviae collected were not numerous and include *Ophiogomphus howei*, *Gomphurus fraternus*, *Gomphurus vastus*, *Gomphus quadricolor*, and *Macromia illinoensis*. *Gomphurus fraternus* was the most common adult encountered.

j. Osceola, Crossing

The river at this wayside park and boat landing is sand and sand-silt cutbank margined. Exuviae again were not numerous. *Neurocordulia sp.* was the most common species collected. Several *Neurocordulia* exuviae were also found at a stagnant pool isolated from the river just north of the bridge. Other exuviae include *Gomphurus .- fraternus* and *Stylurus amnicola*. *Gomphurus fraternus* was the most common adult seen, but I did collect a *Gomphurus externus* male at a backwater slough area ca. 1/2 mile south of the landing on 4 July 1991.

k. William O'Brien State Park

Exuviae were collected along the main channel near the embayment containing the boat launch. The bulk of the river flows around an offshore island, and consequently the near-shore collection area was of quieter water with rock and fine sediment substrate. Exuviae were not numerous. *Neurocordulia sp.* was most common. Also collected were exuviae of *Hylogomphus viridifrons*, *Gomphurus fraternus*, *Gomphurus vastus*, *Ophiogomphus sabrinus*, *Hagenius brevistylus*, and *Stylurus notatus*. Adults taken include *Hylgomphus viridifrons*, *Hagenius brevistylus*, *Gomphus quadricolor*, *Gomphurus fraternus*, *Stylurus notatus*, *Macromia illinoensis*, and *Basiaeshna janata*. Several pond loving libellulids were abundant, opecially *Libellula luctuosa*, *Plathemis= lydia*, and *Ladona julia*. South of the Park at a stagnant backwater of the St. Croix north of the Science Museum Station I took an adult *Neurocordulia yamaskenensis*.

l. Stillwater Wayside

This collection site is a sand-beached sandstone cliff margined portion of the river north of Stillwater and the public boat landing off Hwy 95. A few *Gomphus quadricolor* exuviae were collected, and *Stylurus notatus* was observed to be emerging in some numbers on 6 June. The latter is a federally listed species and would appear to be 'threatened' by the trash and heavy motorboat traffic in this area.

THE SOUTHEAST

23. Cannon River

a. Riverside Park in Cannon Falls

The Cannon River in Cannon Falls is wide and fairly deep (ca 120 x 6 ft) with good current (waters being released from the dam at Byllesby Reservoir). The water is rather turbid and the substrate is silt-enshrouted rocks. The much smaller Little Cannon (ca 15 x 1 ft) with clear waters, gentle current, and sand substrate enters the Cannon at Riverside Park. No exuviae or adults were noted.

b. Sunset Trail Access

Seven river miles east -of Cannon Falls off the Sunset Trail lies a road accessible portion of the Cannon River Trail. One gomphid (?*Gomphurus fraternus*?) was seen flying near, the river, but no exuviae were found. The Rubyspot Damselfly, *Hetaerina americana* was common.

c. Hidden Valley Campground

The Cannon above the dam at Welch is broad and deep (ca 120 x 8 ft) with gentle current and rock-silt substrate. No exuviae or adults were found.

d. Welch

I searched an area along the south bank of the Cannon below the dam at Welch and found only dead carp along the muddy trashed banks.

24. **Zumbro River**

a. Mazeppa Park

The North Fork of the Zumbro River below the dam in Mazeppa Park is small and shallow (ca 30 x 2 ft) with algal-covered limestone rock substrate and dead suckers. Some stonefly exuviae were collected but no dragonfly exuviae or adults were noted. However, the damselfly *Calopteryx maculata* was present.

b. Zumbro Falls

The Main Stem of the Zumbro River at a roadside pullover off #68 2 miles east of Zumbro Falls is wide and shallow (ca 80 x 3 ft) with gentle current, clear waters, and flocculated gravel substrate and extensive sandbars. No dragonfly exuviae or adults were noted, but tiger beetles (*Cidindela repanda*) were common on the sandbars.

c. Hammond Boat Landing

At this site the river is turbid and deeper with silt-enshrouded rocky shoreline. No dragonfly exuviae were found.

d. Read's Park

It was at this Landing near , Milville that I collected several exuviae °of *Gomphurus fraternus*. *Plathemis lydia* adults were patrolling along the shoreline as was *Hetaerina americana*.

e. Kellogg Landing

The Zumbro River just north of Kellogg off Hwy 61 is wide and deep (ca 80 x ?? ft) with turbid waters and .sand-clay cutbanks. *Plathemis lydia* and *Hetaerina americana* were common, but no river gomphids were encountered.

25. **Whitewater River**

a. Carley State Park

The North Branch of the Whitewater flows through Carley State Park 4 miles south of Plainsview. The stream is small (ca 15 x 1 ft) and 'flashy' with a rocky limestone bed. The only river species encountered was *Calopteryx maculata*.

b. Whitewater State Park

The South Branch of the Whitewater flowing through 'user-friendly' (cold pop, hot showers) Whitewater State Park is small (ca 15 x 2 ft) and 'flashy' with a rocky limestone bed and trout. Only *Calopteryx maculata* was observed. *Lbellula pulchella* and *Plathemis lydia* were noted near the imported sand swimming beach diversion. I liked the park (especially the bluff overviews) anyway.

26. **Root River**

a. Chatfield Landing

The North Branch of the Root River at the #5 Landing west of Chatfield is small (ca 40 x 2 ft) with moderate current over rocky-silt substrate. No exuviae or dragonflies were noted.

b. Parsley Bridge Landing

The North and Middle Branches of the Root have joined above Parsley Bridge roughly 3 miles southeast of Chatfield on Hwy 52. The river is somewhat larger (ca 60 x 4 ft) with moderate current and rock-silt substrate.

A few exuviae of *ophiogomphus rupinsulensis* and *Gomphurus fraternus* were collected here. *Calopteryx maculata* and *Hetaerina americana* were present.

c. Forestville State Park

The South Branch of the Root River (ca 50 x 3 ft) is crossed by a pedestrian footbridge within the park. The waters are crystal clear and gentle flowing with rock-silt substrate and 'lunker' brown trout. No dragonfly exuviae were found.

d. Preston

Two sites were explored along the South Branch of the Root at Preston--the Landing on the west side of town and the tiny park on the east. The stream is small ca (40 x 4 ft) with clear waters and rock-silt substrate. No dragonfly exuviae or adults were found.

e. Whalen Access

Two miles east of Lanesboro the North+Middle Branches have joined the South Branch of the Root River, and at the Whalen Access the river is large and deep (ca 120 x ?? ft) with sand-clay cutbanks. One *Gomphus vastus* exuvia was found. *Plathemis lydia* adults were abundant.

f. Peterson Access

The Root River at this Landing is wide and deep (ca 90 x 6 ft?) with mud cutbanks. No adults or exuviae were found. '' .

g. Rushford Access

The Root River at the Rushford Landing is wide and deep (ca 100 x 4 ft?) but With some shallow areas of rocky riffles. *Calopteryx maculata* was present, but no dragonfly adults or exuviae were found.

h. Houston Access

The Houston Access is a .site of Army Corps dredge spoils. No dragonfly adults or exuviae were found.

i. Hokah Pullover

This site is just before the bridge north of town. The Root River is wide and deep with black mud cutbanks. No exuviae or adult dragonflies were found at this site.

27. **Mississippi River**

a. Elk River Park

The Mississippi at this park just west of the Hwy 169 crossing off Hwy 10 (Sherburne Co.) is wide and deep (ca 500 x 10 ft?) with trash and dead carp covering a gravel-boulder shoreline. Among fishermen line the shoreline. A few stonefly exuviae were found but no sign of dragonfly life.

b. Mouth of the Cannon

A long drive east on a deteriorating gravel road (#4) just north of the Hwy 61 crossing of the Cannon River in Goodhue Co. brings one to a trashy, mosquito-infested, hardwood swamp edging a backwater of the Mississippi. The only signs of life were burbling carp and buzzing mosquitoes.

c. Sand Point--Frontenac State Park

A long walk in from a~Historic Marker on Hwy 61 south of Frontenac (Goodhue Co.) through a wood nettle Floodplain Forest and an attractive impounded pond alive with pond dragonflies brings one to Sand Point on Lake Pepin. Reputedly good birding, I found only *Calopteryx maculata* along the river but did encounter a good Orthoptera--*Orchelimum nigripes*--in shoreline willow scrub.

d. Indian Slough Landing

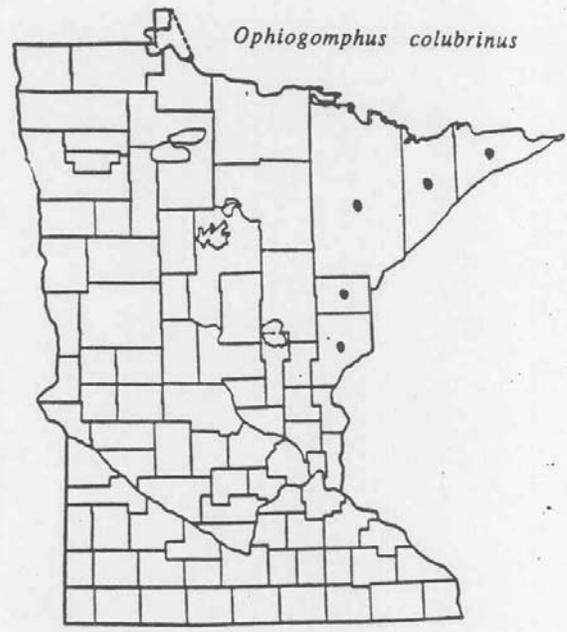
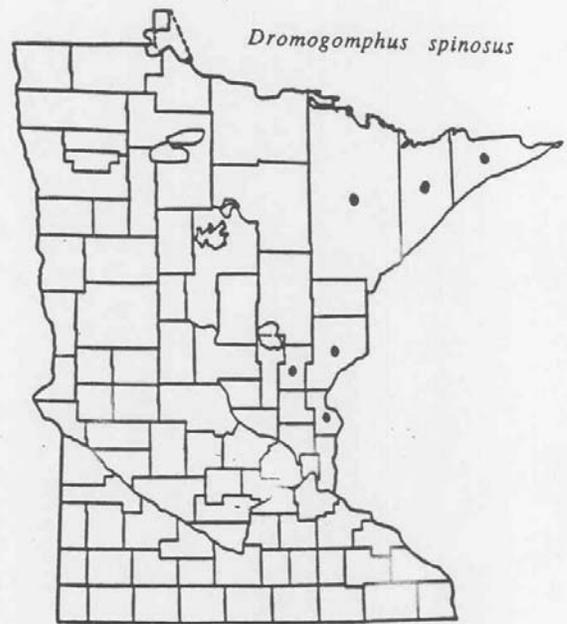
Along the causeway from Wabasha to Wisconsin on Hwy 60 are several Federal Boat Landings. Indian Slough is the first encountered in this island-strewn bayou-appearing area of the Mississippi. I saw only *Anax junius* but a boat is necessary to thoroughly search this area.

e. Dresbach Tourist Center

Just north of Interstate 90 (Winona Co.) crossing to Wisconsin is an attractive Visitor Center overlooking the Mississippi. The River at a boat landing just to the south is wide, with scattered dredge-pile islands and wide sandy beaches. It looked like a good place to find gomphids, but I didn't find any.

f. Brownsville Marina

The Mississippi at Brownsville (Houston Co.) is wide, deep, lightly stained and slow flowing with a lovely sand beach soon to be occupied by Townhouses. It appeared to be a good place to find gomphids, but again I found none. One needs a boat to explore this stretch of the river.



GOMPHIDAE

Hagenius brevistylus (Selys)

According to Walker (1958) the Dragon Hunter frequents forest streams with perceptible current and rocky channels between Precambrian Lakes. Hamrum, et.al. (1971) collected *Hagenius brevistylus* in Cook, Lake, St. Louis, Koochiching, and Cass Co. The WNHP lists *Hagenius* as common along the upper (in Wisconsin) and middle (south to Taylors Falls) St. Croix. It is the largest Gomphid in the state and frequently takes other dragonflies as prey. I have seen it capture *Plathemis lydia* on the wing and then fly to a perch to consume it. The larvae are distinctive flattened creatures the size of a quarter. I found them emerging in small numbers in mid-June from scattered locales along the St. Croix (Sunrise Access, Wild River SP. Osceola crossing--Chisago Co.; William O'Brien SP-Washington Co.), the Kettle (Banning SP--Pine Co.), and the Stony River (Lake Co.). In addition, adults were collected on an expansion of the Baptism north of Finland (Lake Co.), at St. Croix SP (Pine Co.), at the confluence of the Snake and St. Croix (Pine Co.) and at an old Railroad Crossing on the St. Croix in northern Chisago Co.. I believe the Dragon Hunter is a common inhabitant of streams and Precambrian lake channels in the Arrowhead Region, and that it becomes increasingly rare west and south of there.

Dromogomphus spinosus (Selys)

According to Walker (1958) the Jade-Fronted Spinyleg frequents rivers with rapids as well as smaller streams and lakes. Hamrum, et.al. (1971) took this species in Cook, Lake, and St. Louis Co. and report it as a new state record. The WNHP lists this species as abundant along the upper, middle, and lower (Taylors Falls to Douglas Point) St. Croix. Like *Hagenius*, the Spinyleg emerges in mid-June. Exuviae are dorso-ventrally flattened wedge-shaped burrowers with conspicuous mid-dorsal hooks. Exuviae were common along the St. Croix at Sunrise Access and Wild River SP (Chisago Co.). Subsequent rains and rising river water eliminated the possibility of searching, for exuviae of this species along the St. Croix in Pine Co. However, I did collect adults at the confluence of the Snake and St. Croix and along the Kettle River at the Hwy 48 crossing (Pine Co.). I also collected several exuviae from the Snake River just above the lower falls (Kanabec Co.) During July adults were common cruising along the St. Croix at Sunrise Access. They proved to be easy to net even from a canoe as they have a tendency to inspect-hover boaters and even land on the canoe. Although I did not encounter this species in the Northeast I suspect it is relatively common there.

Ophiogomphus carolus (Needham)

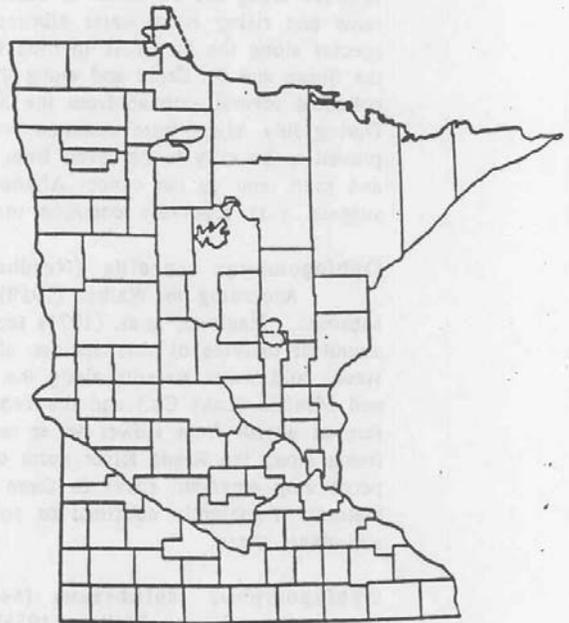
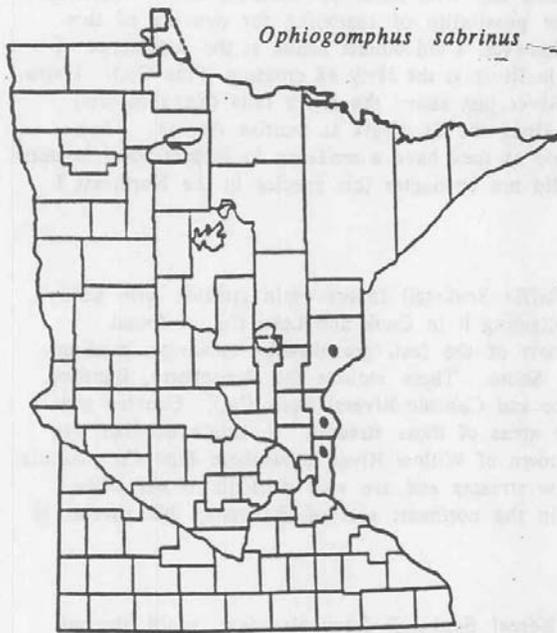
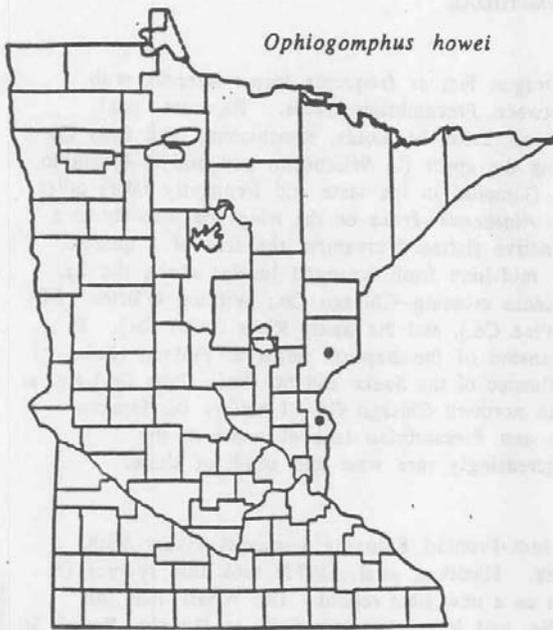
According to Walker (1958) the Riffle Snaketail favors rapid streams with sandy substrate. Hamrum, et.al. (1971) report collecting it in Cook and Lake Co. I found abundant exuviae of this species along most of the fast, gravel-Cocky substrate, medium-sized, cold water streams along the North Shore. These include the Gooseberry, Baptism, and Manitou (Lake Co.) and the Temperance and Cascade Rivers (Cook Co.). Exuviae were rare or absent from slower water sediment areas of these streams. A single exuviae was found along the Kettle River north of the town of Willow River in northern Pine Co. Adults perch atop emergent rocks in these shallow streams and are very difficult to net when mature. Apparently confined to streams in the northeast part of the state; this species is abundant there.

Ophiogomphus colubrinus (Selys)

According to Walker (1958) the Boreal Snaketail frequents clear, rapid streams with gravel or sandy beds. Hamrum, et.al. (1971) collected this species in Cook, Lake, and St. Louis Co. The WNHP reports this species as rare along the St. Croix in Pine Co. I found no exuviae of this species along the St. Croix but did collect a few from Crooked Creek (St. Croix SP--Pine Co.). Crooked Creek is a small stream with gravel-sandy substrate and moderate current. I suspect this species emerges slightly later than *Ophiogomphus carolus* but rains and high waters eliminated finding any exuviae on a mid-July visit to the North Shore streams. A few *Ophiogomphus ?colubrinus?* adults were seen along the Baptism River (Eckbeck Cpgd--Lake Co.), but I failed to net any. I suspect this species is common in northeast Minnesota and occurs in many of the same streams as *Ophiogomphus carolus*.

Ophiogomphus howei

This is a new state record for Minnesota. It was not collected by Hamrum, et.al. (1971), but the WNHP list it as common along the middle St. Croix. I collected numerous exuviae of Howe's Snaketail along the St. Croix from the Mina-Wisconsin border at the Danbury Crossing on Hwy 48 (Pine Co.) south to Taylors Falls (Chisago Co.). Exuviae were most abundant in southern Pine (St. Croix SP and the crossing at Hwy 70) and in northern.



Chisago Co. (old RR crossing, Rush City Ferry, and Sunrise Access--Wild River SP). A solitary exuvia was collected along the Snake River at Little Walleye Landing (Kanabec Co.). This small *Ophiogomphus* emerges very early in the summer (late May) and is infrequently encountered as an adult. Indeed, this species is considered rare everywhere and was only recently (1975?) discovered to spend most of its adult life perching high in the canopy of trees. Exuviae are clean suggesting they inhabit streams having moderate current and sandy substrate

Ophiogomphus rupinsulensis (Walsh)

The Rusty Snaketail is the most commonly encountered member of the genus in Minnesota and appears to have the greatest range of habitat tolerance. Hamrum, et.al. (1971) report it for Lake, St. Louis, Pine and Pennington Co. The WNHP list it as common along the entire length of the St. Croix. Barbara Delaney gave me a specimen collected along the Mississippi River in Morrison Co. I have collected exuviae from Baker Lake and the headwaters of the Temperance River (Cook Co.) at all three sites along the Baptism River, and numerous exuviae were taken from the Hwy 1 crossing of the Stony River (Lake Co.). This species was common at three sites along the silty cut-bank St. Louis River (St. Louis Co). Numerous exuviae were collected along the St. Croix from the Hwy 48 crossing to Danbury (Pine Co.) south to Wild River SP (Chisago Co.). Exuviae were also common along the Grindstone, Sand, and Crooked Creek as well as several sites along the Kettle (Pine Co.) and Snake River (Kanabec Co.). In addition a few exuviae were taken from the Rum River (St. Francis--Anoka Co.) and in southeastern Minnesota along the Root River (Parsley Bridge--Fillmore Co.).

****Ophiogomphus sabrinus**

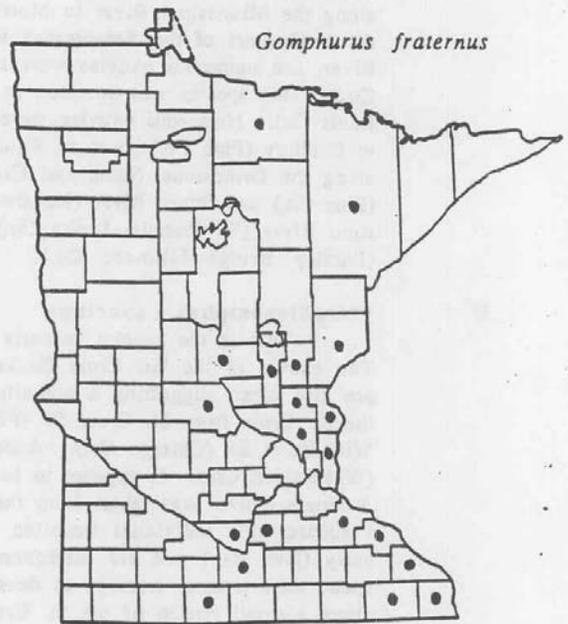
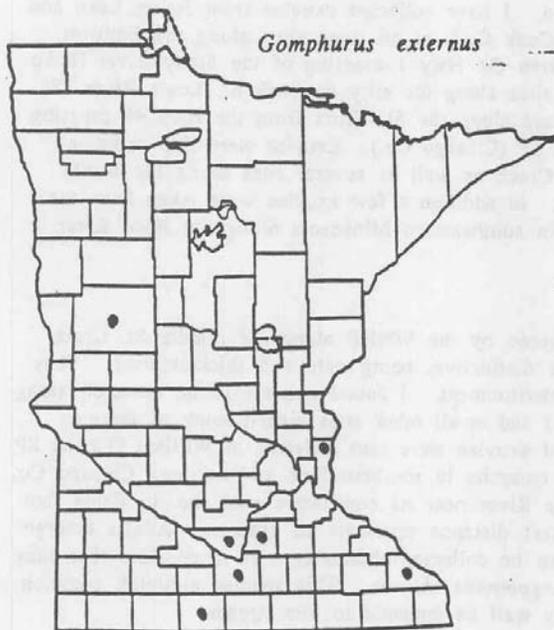
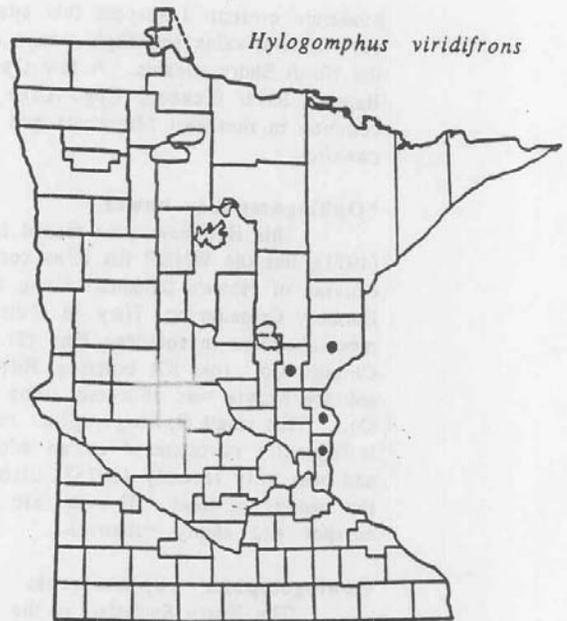
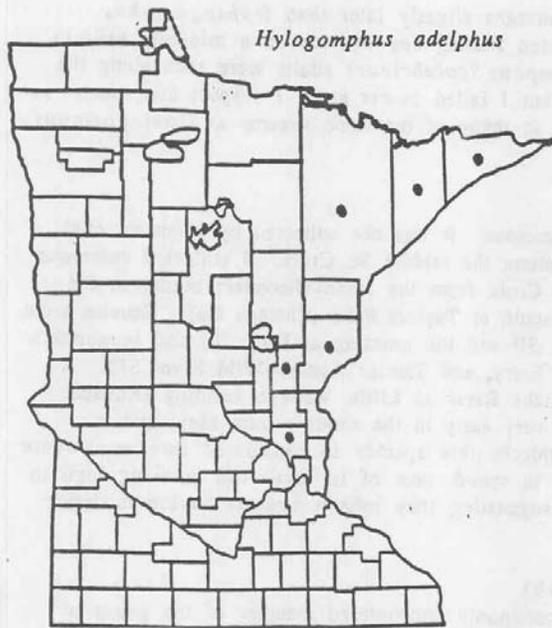
This is the species recently discovered by the WNHP along the middle St. Croix. The exuvia of the 'St. Croix Snaketail' is distinctive, being pale and thick-skinned. They are also clean suggesting a non-siltation environment. I found exuviae to be common along the St. Croix from St. Croix SP (Pine Co.) and at all other sites visited south of there to Wild River SP (Chisago Co.). A couple of exuviae were also collected at William O'Brien SP (Washington Co.). It appears to be most common in southern Pine and northern Chisago Co. A single exuvia was taken from the Snake River near its confluence with the St. Croix, but I suspect this individual travelled the short distance upstream to emerge. Adults emerge early (late May) and are infrequently seen or collected thereafter. It is possible that they spend their lives in treetops as does *Ophiogomphus howei*. This species although common along a small stretch of the St. Croix may well be endemic to this stream.

Hylogomphus adelphus (Selys)

Walker (1958) says that the Riffle Clubtail frequents rapid streams and exposed lake shores. Hamrum, et.al. (1971) report this species as *Hylogomphus brevis* and collected it in Cook and Lake Co. The WNHP lists this species as common along the upper and middle St. Croix. Two species of *Hylogomphus* occur in the state, the second being *Hylogomphus viridifrons*, and although they are easily differentiated as adults I was unable to differentiate their exuviae. I collected numerous exuviae of *Hylogomphus* from a wide variety of rivers and smaller streams from Cascade River (Cook Co.) south to the Rum River (St. Francis--Anoka Co.) and the lower St. Croix (William O'Brien SP--Washington Co.). All exuviae were clean suggesting the larvae do not occur in slow-water, silt-laden areas and probably inhabit areas of coarser sand-sediment and moderate current. At several of the sites I did manage to collect adult *Hylogomphus*, and on the basis of these, collections make the following suggestions. *Hylogomphus adelphus* is found in medium to small sized streams of varied character throughout much of eastern and northern Minnesota. Adults were collected at the small, fast, rocky headwaters of the Temperance River (Cook Co.) along the wider rocky-gravelly Stony river at the Hwy 1 crossing in Lake Co., along the silty cut-bank St. Louis River (Forbes Landing--St. Louis Co.), at an expansion of the Kettle just above Hell's Gate Rapids in Banning SP and along the Sand River in St. Croix SP (Pine Co.). Many *Hylogomphus* exuviae were taken at several sites along the Snake and Kettle Rivers in Kanabec and Pine Co. and I suspect that most were those of *Hylogomphus adelphus*. A single exuvia was taken from the somewhat silty Rum River at St. Francis (Anoka Co.) and I suspect this was *Hylogomphus adelphus* as well.

***Hylogomphus viridifrons** (Hine)

Walker (1958) states that the Green-faced Clubtail is everywhere rare. Hamrum, et.al. (1971) do not report it for Minnesota, and the WNHP does not list it as occurring along the St. Croix. However, apart from one *viridifrons* taken along the Kettle at tire Hwy 23 landing north of Banning SP (Pine Co.) and four *viridifrons* taken along the Snake at the Hwy 3 crossing (Kanabec Co.), all adult *Hylogomphus viridifrons* I have collected were taken in the vicinity of the St. Croix ranging from the confluence of the Snake and St. Croix (Pine Co.) to Sunrise Access--Wild River SP (Chisago Co.) to William O'Brien SP (Washington Co.). *Hylogomphus* exuviae were



abundant from the Hwy 48 crossing to Danbury (Pine Co.) south to Wild River SP (Chisago Co.), and I suspect that most of these were *Hylogomphus viridifrons*. I suspect that *H. viridifrons* is confined to larger rivers with moderate current and sandy substrate and is more southern in distribution than *H. adelphus*.

Gomphurus externus (Hagen)

According to Walker (1958) the Plains Clubtail frequents more or less rapid rivers with muddy bottoms. Hamrum, et.al. (1971) report this species for several counties in south-central Minnesota as well as Ottertail (WC) and Winona (SE). The WNHP did not find this species along the St. Croix. I did not find any exuviae, although I collected a patrolling male along the St. Croix south of the Osceola crossing in a quiet mud-margined backwater of the river. I hoped to collect this species along muddier slower stretches of the Cannon, Zumbro, and Root Rivers in southeast Minnesota but had no luck. I suspect this species is most at home in the Blue Earth watershed of southcentral Minnesota.

Gomphurus fraternus (Say)

According to Walker (1958) the Midland Clubtail occurs in rapid streams and also in the shallows of larger lakes. Hamrum, et.al. (1971) report this species for several counties in eastern and southern Minnesota as well as Koochiching Co. in the north. The WNHP list it as common along the middle and lower St. Croix. *Gomphurus fraternus* is probably the most abundant member of the genus in the state. I collected exuviae of this species in moderate numbers at all sites visited along the St. Croix from St. Croix SP (Pine Co.) south to a wayside north of Stillwater (Washington Co.). I also collected *fraternus* exuviae at three sites along the silt-bottomed cut-bank St. Louis River (St. Louis Co.) at several sites along the Snake River (Kanabec and Pine Co.), along the Rum River at Walbo Ferry (Isanti Co.) and St. Francis (Anoka Co.), and in the southeast along the Zumbro River at Milville (Wabasha Co.) and the Root River at Parsley Bridge (Fillmore Co.). It was absent from streams in the northeast and strangely? from the Kettle River. Exuviae are generally silt-laden and it appears to be a burrower in finer sediment of slow-flowing, medium-sized rivers.

***Gomphurus lineatifrons** (Calvert)

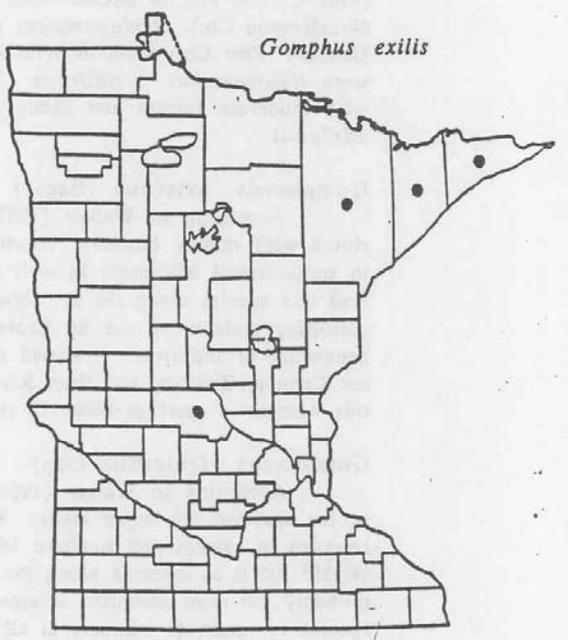
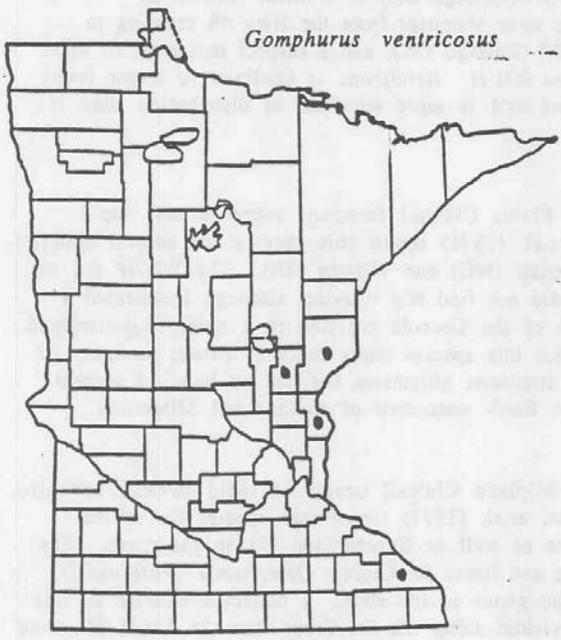
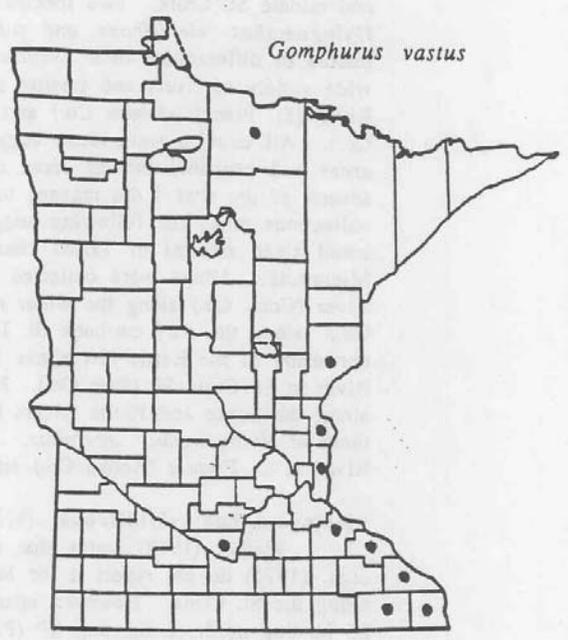
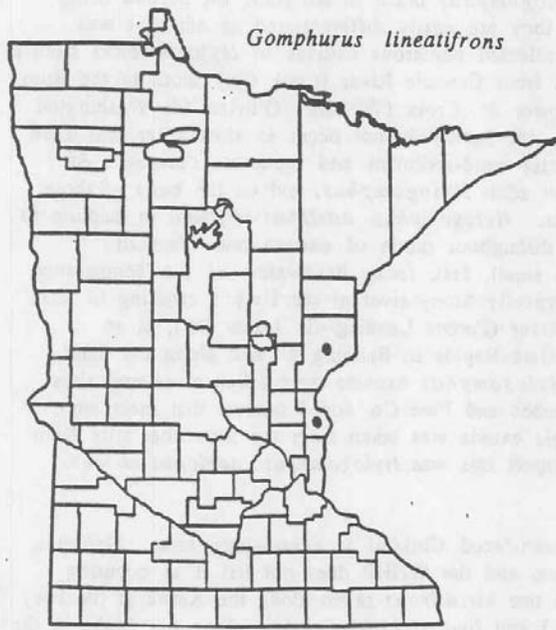
According to the WNHP the Splendid Clubtail is an uncommon inhabitant of the upper and middle St. Croix in Wisconsin. The adult of this species is large, rivalling *Hagenius brevistylus*, and has a fine black line across the face. Exuviae are correspondingly large, somewhat flattened and wedge-shaped and generally covered with fine sediment. I collected small numbers of exuviae of this species at several points along the St. Croix (Danbury crossing, St. Croix SP, Snake-St. Croix confluence, Hwy 70 crossing--Pine Co.; Rush City Ferry, Sunrise Access and Wild River SP--Chisago Co.). Solitary exuviae were found along the Kettle River (Willow River--northern Pine Co.) and Sand Creek (Hwy 48 crossing--Pine Co.). Adults were taken at the Kettle River SNA (Hwy 48 crossing) and the old RR Crossing in northern Chisago Co. as well as some of the sites where exuviae were found. These constitute new state records. Its distribution is presently confined to slow-water, silt-bottomed areas of medium (Sand, Kettle) and large rivers (St. Croix).

Gomphurus vastus (Walsh)

According to Walker (1958) the Cobra Clubtail is an inhabitant of large rivers. As the common name suggests the Cobra Clubtail has a broadly expanded abdominal club. It also has a heavy black line across the face. Hamrum; et.al. (1971) report this species for Nicollet Co. (Minnesota River?), Winona and Houston Co. (lower Mississippi) and Koochiching Co. (Big Fork ?). The WNHP lists this species as common along the middle and lower St. Croix. Historically this species was abundant along the lower Mississippi River (Reads Landing--Wabasha Co.; Whedon, 1914). I collected numerous exuviae along a stretch of the St. Croix from the Snake-St. Croix confluence (Pine Co.) south to William O'Brien SP (Washington Co.). Exuviae were most abundant at the Wild River SP landing (Chisago Co.). The exuviae of this species are clean and cylindrically tapered. Emergence is quite synchronous and occurs in early June. I suspect the larvae inhabit sandy substrate in large clean rivers with moderate current.

Gomphurus ventricosus (Walsh)

According to Walker (1958) the Skillet Clubtail is a rarer inhabitant of larger rivers. Hamrum, et.al. (1971) record it as a new state record--one specimen collected in Winona Co. The WNHP list it as uncommon along the middle St. Croix (above Taylors Falls). I am unable to distinguish the exuviae of this species but have collected a few adults along the St. Croix from the Snake-St. Croix confluence (Pine Co.) and the Old RR Bridge.



and Sunrise Access (Chisago Co.). The only specimen found away from the St. Croix was one adult taken at the Hwy 3 crossing of the Snake River in Kanabec Co. It appears to be quite rare and more effort should be expended searching for it.

Gomphus exilis (Selys)

According to Walker (1958) the Lancelet Clubtail is found near quiet streams with a soft bottom and shallow marsh-bordered bays of lakes. Hamrum, et.al. (1971) report it for Cook, Lake, and St. Louis Co. as well as Stearns. I suspect this small Gomphus is common in small, quiet, soft-bottomed lakes of the Arrowhead region. Emergence was noted and several exuviae collected from marsh-bordered Baker Lake (Cook Co.). Exuviae were also found at the edge of quiet water above rocky rapids along the Baptism River at the Finland Cpgd as well as along the broad sand-margined shores of the Kawishiwi River at the National Forest Cpgd off Hwy 1 (Lake Co.). I suspect this species is a common inhabitant of small, quiet, soft-bottomed lakes in the Arrowhead Region

Gomphus graslinellus (Walsh)

According to Walker (1958) the Pronghorned Clubtail occurs in ponds, lakes, and slow streams. Hamrum, et.al. (1971) report it for Cook?, Koochiching, and Ottertail Co. Other specimens in the Univ. of Minnesota collection are from Cass, Becker, Clay, Douglas, Olmsted and xxx Co. I collected one adult and possibly one exuvia along the Snake River in northern Kanabec Co. However, I suspect this species is most at home in the small quiet moraine lakes of westcentral Minnesota.

Gomphus lividus (Selys)

According to Walker (1958) the Ashy Clubtail occurs near gently flowing streams and sheltered inlets on wave-beaten lake shores. Hamrum, et.al. (1971) report it for Lake, St. Louis, and Pine Co. The WNHP list this species as common along the upper and middle St. Croix. Adults of this clubtail have a peculiar up-down wave action sort of flight. I found their silt-encrusted exuviae to be common on several of the small to medium-sized rivers visited in both northeast and east-central Minnesota. These include a baylike expansion of the Cascade River near Cascade Lake and a quiet pool below the gorge of the Temperance River (Cook Co.); a quiet water area of the Manitou River off #7, a baylike expansion of the Baptism River, and quiet water above the rapids at Finland Cpgd (Lake Co.); along a quiet silt-bottomed stretch of the St. Louis River (Forbes Landing--St. Louis Co.). Exuviae were also common along the middle stretches of the Kettle River (Willow River, Hwy 23, Banning SP), as well as on the smaller streams (Grindstone, Sand, Crooked Creek) draining into the Kettle and St. Croix near St. Croix SP (Pine Co.). *Gomphus lividus* was the most common gomphid found in the Groundhouse River (a small tributary to the Snake in Kanabec Co.) and in Rock Creek (a small tributary to the St. Croix in northern Chisago Co.). Two exuviae were collected from the Sunrise River near its juncture with the St. Croix at Sunrise Access (Chisago Co.). ...Only one exuvia was found in the St. Croix proper, and this at St. Croix SP (Pine Co.). Adults were taken at several of these sites as well as Caribou Creek (Cook Co.), Stony River (Lake Co.), and Little Sand River (Pine Co.). The Ashy Clubtail appears to be a common inhabitant of slow-water, silt-bottomed areas of smaller rivers and streams.

Gomphus quadricolor (Walsh)

According to Walker (1958) the Rapids Clubtail is a rare inhabitant of rapid streams with projecting rocks. Hamrum, et.al. (1971) report this species as a new state record from Lake Co. The WNHP lists it as common along the upper, middle, and lower St. Croix. This species is the first to emerge (mid-late May) from streams in east-central Minnesota where it is quite common. I have collected exuviae from nearly every site visited along the St. Croix from the Danbury crossing on Hwy 48 (Pine Co.) south to a wayside rest area north of Stillwater (Washington Co). However, it appears to be relatively uncommon below Taylors Falls. *Gomphus quadricolor* exuviae were also collected from most sites along the Snake and Kettle Rivers, and in addition, exuviae were not uncommon on such smaller streams as the Grindstone and Sand (Pine Co.) and the Sunrise at Sunrise Access (Chisago Co.). Adults were taken at a number of these sites. I did not find *Gomphus quadricolor* in the northeast, but it apparently does occur there.

Gomphus spicatus (Hagen)

According to Walker (1958) the Dusky Clubtail is a common inhabitant of shallow sand-bottomed lakes. This agrees well with my findings. It is apparently the most commonly collected gomphid being widely distributed in the northern two-thirds of the state (Hamrum, et.al., 1971). It emerges abundantly from shallow, sand-bottomed portions of Fish Lake (Cedar Creek NHA--Anoka Co.) at the end of May. I also found it to be

common in sand-bottomed lakes of the Arrowhead Region (eg. Baker Lake and Cascade Lake--Cook Co.). It occasionally occurs in sandy stretches of wide slow rivers, for I have collected both exuviae and adults from the broad Kawishiwi off Hwy 1 (Lake Co.). In the north, exuviae and adults are conspicuously larger than individuals collected in eastcentral Minnesota, and this suggests that they perhaps pass another year in the larval stage before emerging. Three winters are normally spent as larvae in east-central Minnesota (Haarstad, 1980).

Arigomphus cornutus (Tough)

According to Walker (1956) the Horned Clubtail inhabits kettle ponds, small marshy lakes and very sluggish streams. It is the most common member of the genus in the state and is widely distributed (Hamrum, et.al., 1971). It emerges in fair numbers from Cedar Bog Lake, a small muck-bottomed lake in east-central Minnesota (Cedar Creek NHA--Anoka Co.). I have also collected exuviae and/or adults from a few soft-bottomed river expansions. These include the Ann River Landing off Hwy 23 (Kanabec Co.), the Snake River at Little Walleye Landing (Pine Co.) and in the northeast at an expansion of the Baptism River north of Finland (Lake Co.).

*** Arigomphus furcifer (Hagen),**

According to Walker (1958) the Lilypad Clubtail is found on marshy lakes and ponds and sluggish streams with an abundance of floating and submerged vegetation. Hamrum, et.al. (1971) do not report this species for the state. I recently collected adults from Terrapin Lake, a shallow lilypad choked lake in Warner Nature Center (Washington Co.).

***Stylurus amnicola (Walsh)**

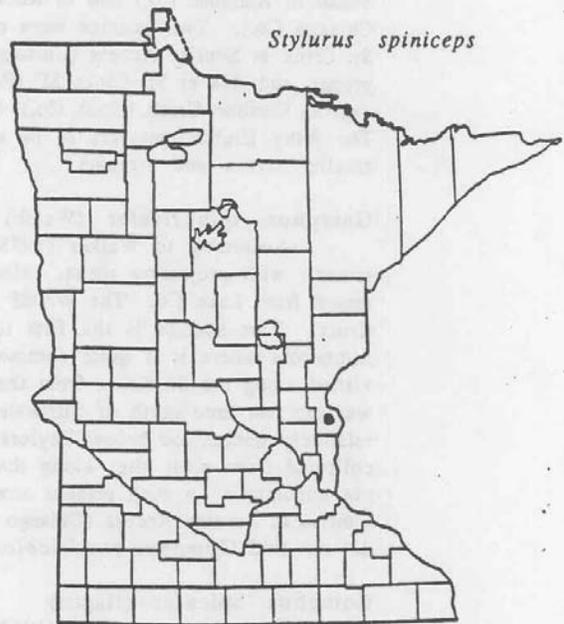
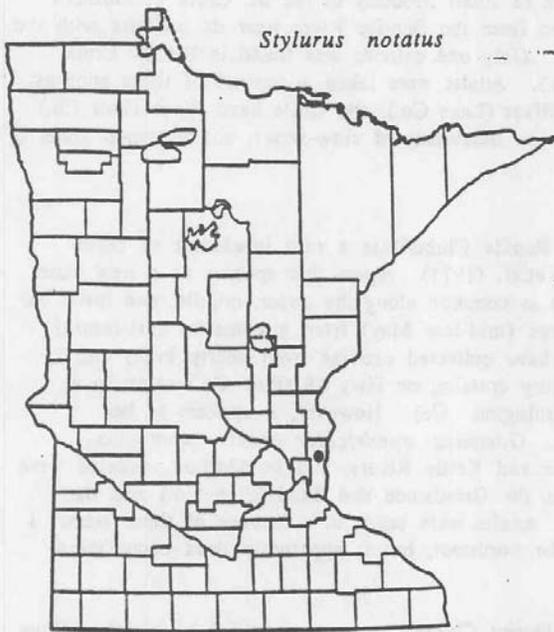
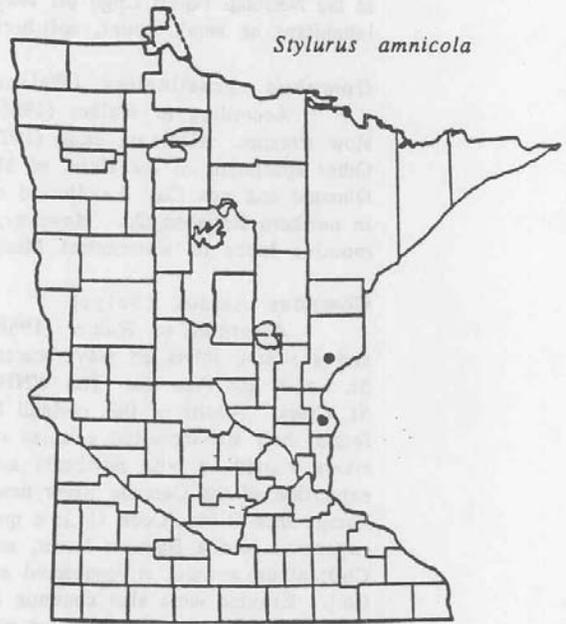
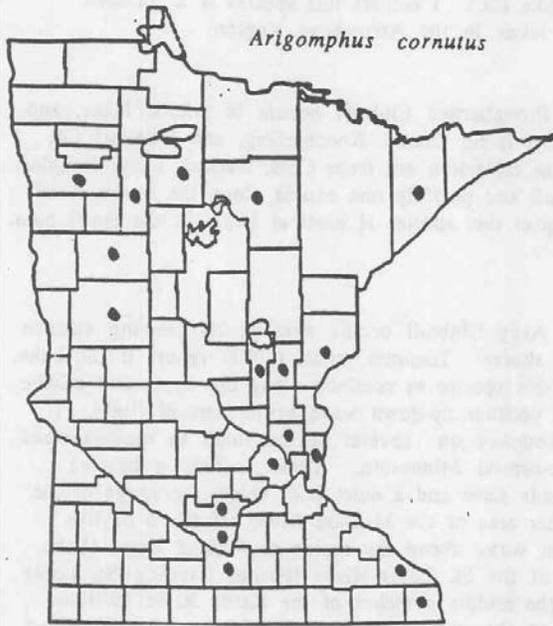
Hamrum, et.al. (1971) do not report this species for the state. However, the WNHP list the Riverine Clubtail as uncommon to rare along the middle and lower St. Croix. I have collected a handful of adults and exuviae..from scattered sites along the St. Croix including the Snake-St. Croix confluence (Pine Co.), Sunrise Access and Wild River SP and the Osceola crossing (Chisago Co.). Most collections were in mid to late June.

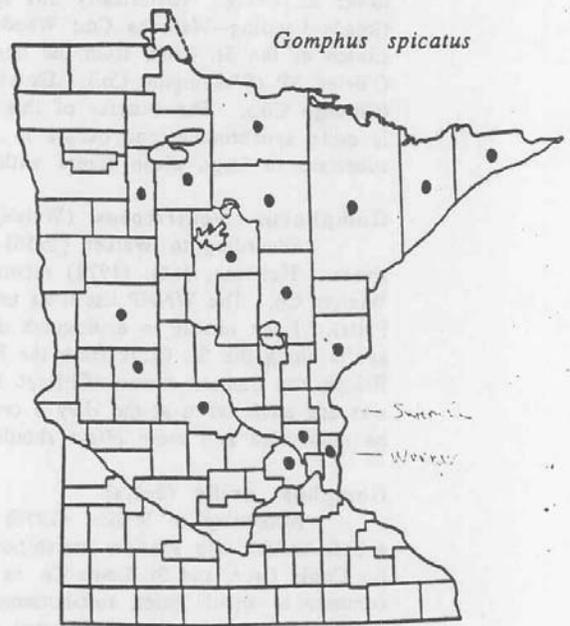
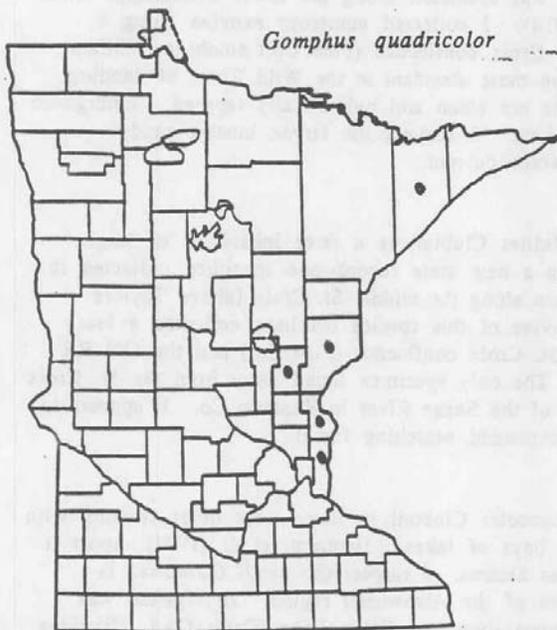
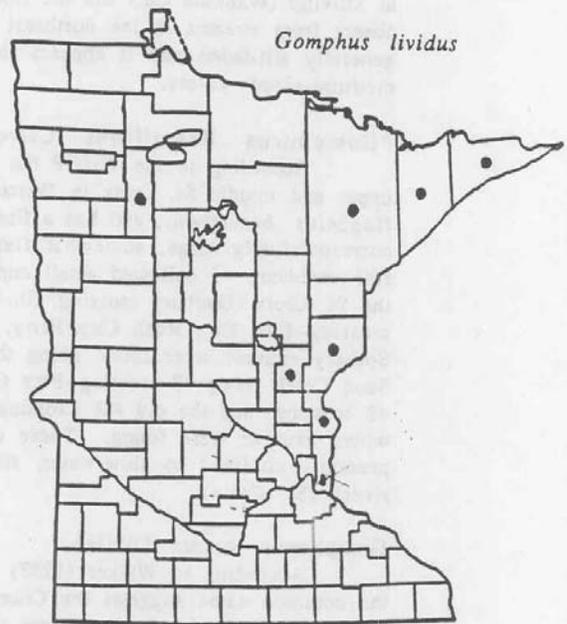
***Stylurus notatus (Rambur)**

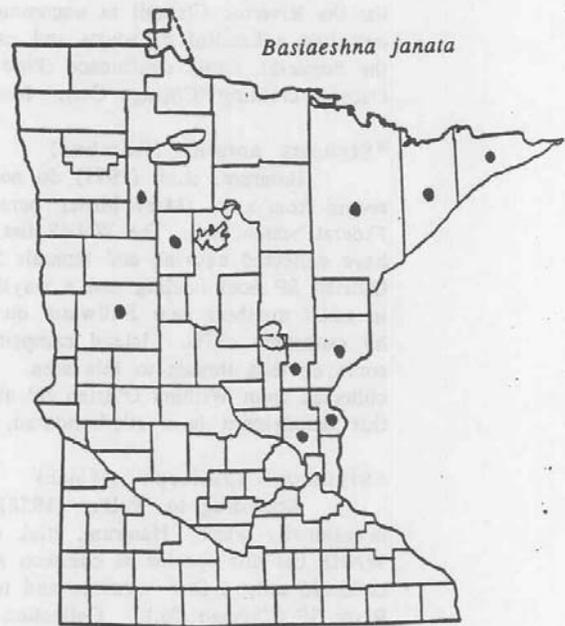
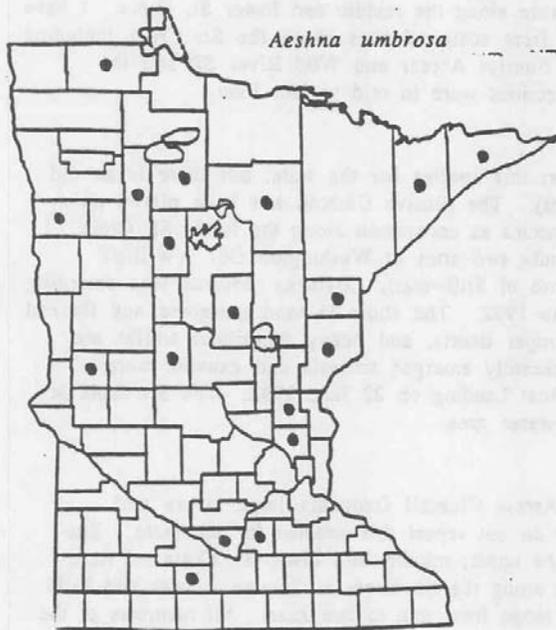
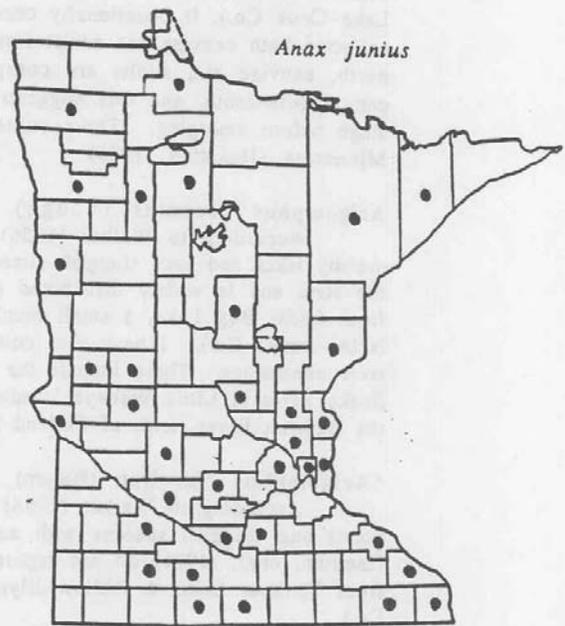
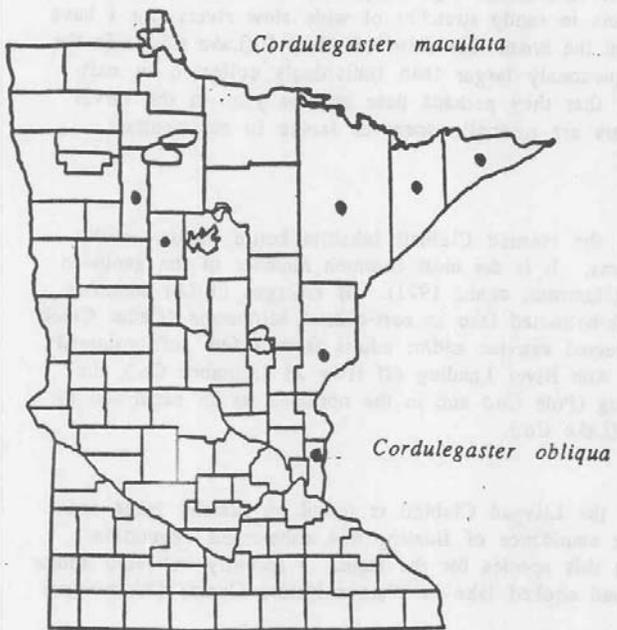
Hamrum, et.al. (1971) do not report this species for the state, but there is an old record from xxxx (Mary Miller, pers. comm). The Elusive Clubtail has been placed on a Federal 'watch' list. The WNHP list the species as uncommon along the lower St. Croix. I have collected exuviae and teneral from only two sites in Washington Co. (William O'Brien SP boat landing and a wayside north of Stillwater). Stylurus notatus was emerging in small numbers near Stillwater on 5 June 1992. The shore is sand margined and flanked by sandstone cliffs. Island campsites, camper debris, and heavy motorboat traffic are some obvious threats to this area. Two recently emerged teneral and exuviae were collected from William O'Brien SP at the Boat Landing on 22 June 1992. The St. Croix at this embayment is a silt-bottomed, slow-water area.

*** Stylurus spiniceps (Walsh)**

According to Walker (1958) the Arrow Clubtail frequents large rivers and occasionally lakes. Hamrum, et.al. (1971) do not report this species for the state. The WNHP list this species as common along the upper, middle, and lower St. Croix. I have collected only a few exuviae and teneral along the St. Croix at Sunrise Access and Wild River SP (Chisago Co.). Collection dates range from mid to late June. All members of the genus Stylurus deserve additional study.







CORDULEGASTERIDAE

Cordulegaster maculate (Selys)

According to Walker (1958) the Twin-spotted Spiketail occurs along rapid streams with intermittent pool in forested regions.

Hamrum, et.al. (1971) report this species for Lake and St. Louis Co. Additional specimens in the University of Minnesota collection are for Itasca SP (Clearwater Co.) and a historical? record for Scott Co. The WNHP list it as rare along the upper and middle St. Croix. I found the large grotesque silt-encrusted exuviae to be fairly common in quiet areas of the small rapid streams of the Arrowhead Region. Exuviae and a few adults were taken from quiet areas above and below the gorge of the Temperance River as well as an old bridge crossing of the Temperance north of Tofte (Cook Co.). A single exuvia and two adults were taken along the Manitou river 7 miles north of Finland (Lake Co.). Single exuviae were taken from the Gooseberry River and at two sites along the Baptism, one at Eckbeck Cpgd and a second at an expansion in the Baptism north of Finland (also in Lake Co.). Two exuviae were taken from the Grindstone River off Hwy 48 -and patrolling males were noted on the Grindstone and Sand Rivers (Pine Co.). Adults course rapidly ca. 30 cm above the water and although rather regular in their beat, they are extremely wary and very difficult to net. I think this species is quite common in the north but now extremely rare in the south.

****Cordulegaster obliqua*** (Say)

According to Walker (1958) the Delta-spotted Spiketail frequents spring runs and brooks with rapids and pools in open terrain. Hamrum, et.al. (1971) do not report this species for Minnesota. I collected two adult males in a weedy seep area off the railroad tracks between Copas and William O'Brien SP (Washington Co.). I suspect the species may breed in these seep pools. More effort should be expended searching for this species.

AESHNIDAE

Anax junius (Drury)

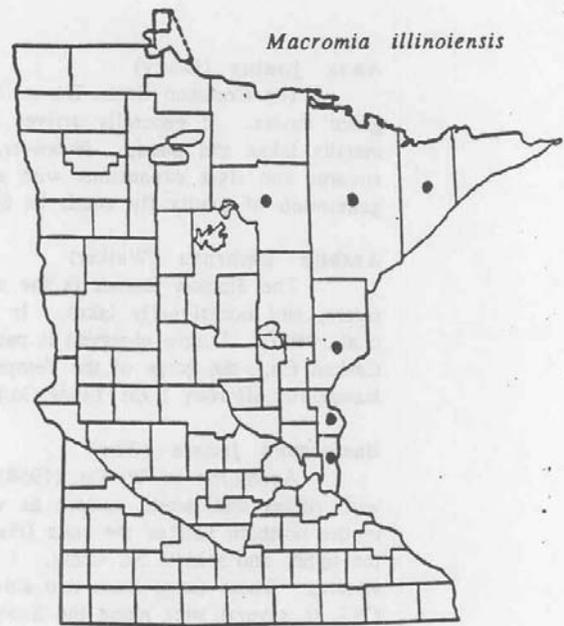
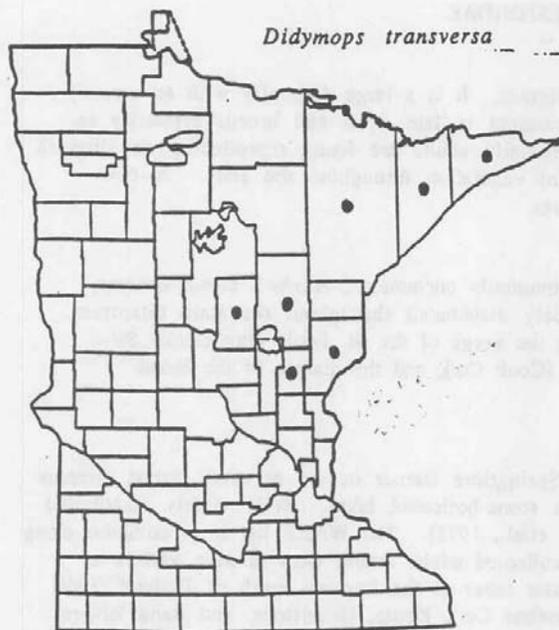
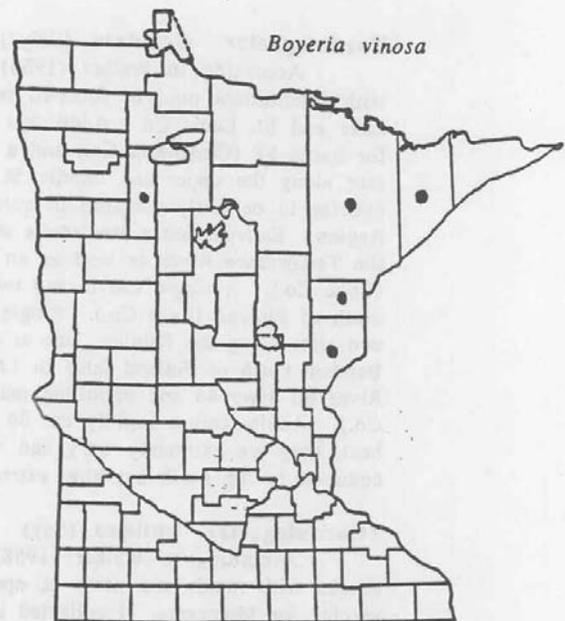
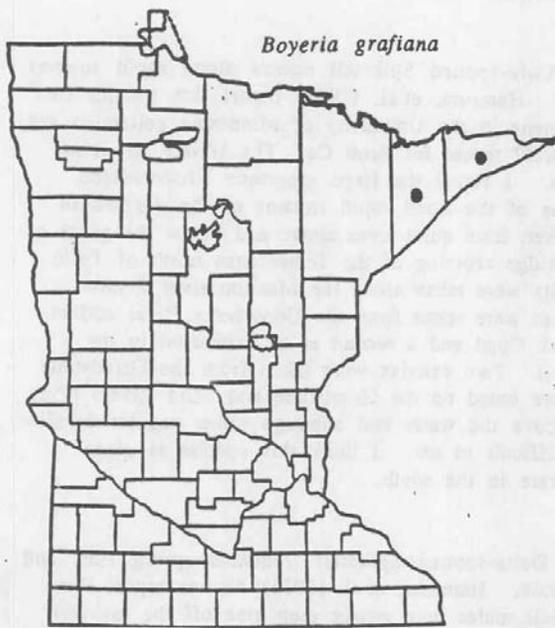
The Common Green Darner is a migrant. It is a large dragonfly with an entirely green thorax. It generally arrives in Minnesota in late April and breeds primarily in marshy lakes and ponds. However, occasionally adults are found reproducing, on sluggish streams and river expansions with emergent vegetation throughout the state. A new generation of adults fly south in September.

Aeshna umbrosa (Walker)

The Shadow Darner is the most commonly encountered *Aeshna* along streams; rivers, and occasionally lakes. It is widely distributed throughout the state (Hamrum, et.al., 1971). I have observed it patrolling the gorge of the St. Louis (Jay Cooke S.P-Carlton Co.), the gorge of the Temperance (Cook Co.), and the margin of the broad Kawashiwi off Hwy 1 (St. Louis Co.).

Basiaeshna janata (Say)

According to Walker (1958) the Springtime Darner occurs at small forest streams with riffles and gentle current as well as stone-bottomed lakes. It is widely distributed in the northern half of the state (Hamrum, et.al., 1971). The WNHP list it as common along the upper and middle St. Croix. I have collected adults and/or exuviae at a variety of streams. These range from two slower water areas of the Baptism north of Finland (Lake Co.), to several sites along the Snake (Kanabec Co.), Kettle, Grindstone, and Sand Rivers (Pine Co.), to the Rum River at St. Francis (Anoka Co.). Sites along the St. Croix where this species was encountered include the Danbury crossing on Hwy 48, the Snake-St. Croix confluence, and Wild River SP (Pine and Chisago Co.).



Boyeria grafiana (Williamson)

According to Walker (1958) the 'Slate' Darner most frequently occurs along rocky lake shores. Hamrum, et.al. (1971) report it as a new state record for Cook and Lake Co. I have collected a couple adults along the Manitou River north of Finland (Lake Co.), and along the Temperance River NF Cpgd (Cook Co.). Adult males patrol these moderately fast gravel streams in July and August.

Boyeria vinosa (Say)

According to Walker (1958) the Fawn Darner prefers shady streams with gentle rapids. Hamrum, et.al. (1971) report this species for Lake and St. Louis Co. The WNHP list it as common along the upper, middle, and lower St. Croix? I have collected no exuviae of this species but have encountered late summer patrolling males (from mid-July to mid-September) along the wide sand-margined Kawishiwi River off Hwy 1 (Lake Co.), on the Kettle River just above Hell's Gate Rapids in Banning SP (Pine Co.) and along the Sand River in St. Croix SP (Pine Co.).

MACROMIIDAE

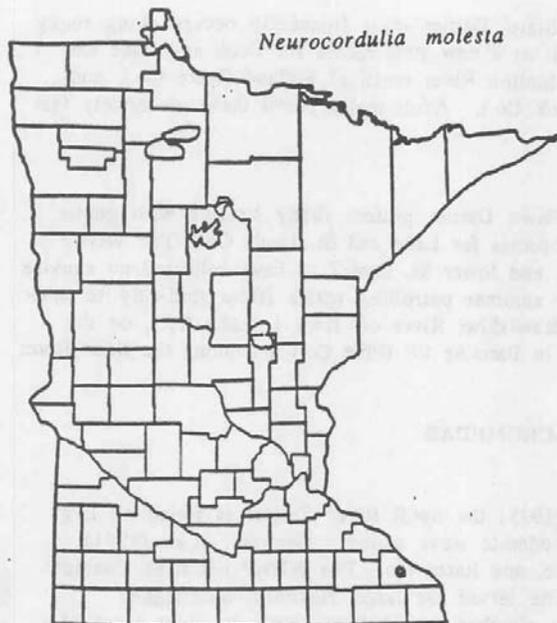
Macromia illinoiensis (Walsh)

According to Walker and Corbet (1975) the Swift River Cruiser is found on large somewhat rapid streams and lakes with moderate wave action. Hamrum, et.al. (1971) record this species for Lake, St. Louis, Pine, and Itasca Co. The WNHP list it as common along the upper and middle St. Croix. The larvae are large, flattened, long-legged creatures (with a horn atop the head) that clamber over bottom debris in quiet areas of larger streams. They are frequently silt-encrusted and often travel a considerable distance from shore before selecting an emergence support. The large yellow-spotted patrolling adults are conspicuous along the St. Croix in June and July. Exuviae were common on the cement pilings of the Hwy 48 bridge to Danbury (Pine Co.). Additional exuviae were collected at Wild River SP and Taylors Falls (Chisago Co.). Patrolling adults were noted along the St. Croix from Danbury (Pine Co.) south to William O'Brien SP (Washington Co.). Additional adults and/or exuviae were collected on the St. Louis River (Forbes Landing--St. Louis Co.), the Kettle River at Banning SP and the SNA crossing on Hwy 48 (Pine Co.), and on the smaller Grindstone and Sand Rivers (Pine Co.).

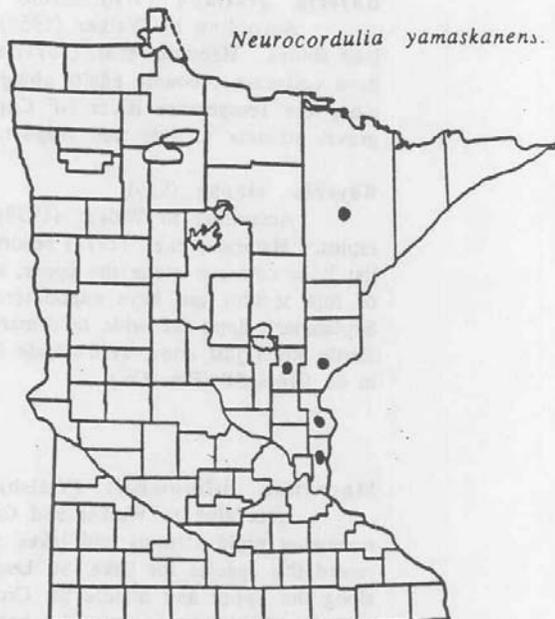
Didymops transversa (Say)

According to Walker and Corbet (1975) the Stream Cruiser frequents forest streams with gentle current and lakes with moderate wave action. Hamrum, et.al. (1971) report it for several counties in the northeast, as well as Pine, Crow Wing, and Ramsey Co. Like *Macromia illinoiensis*, *Didymops* is a long-legged clamberer over bottom debris in sluggish areas of streams. However, its eyes rest atop the head and do not project as they do in *Macromia illinoiensis*. I have collected exuviae and/or patrolling adults along slow water areas of the Baptism River north of Finland and at the broad expansion of the Kawishiwi off Hwy 1 (Lake Co.), along the St. Louis River near Floodwood (St. Louis Co.), along the Kettle at the Hwy 23 and 48 crossings as well as Banning SP, and along the Sand and Little Sand Rivers (Pine Co.), and finally along the Snake River near McGrath (Aitkin Co.) and at the Hwy 3 crossing (Kanabec Co.). My impression is that *Didymops* is more northern than *Macromia* and tends to frequent smaller streams and rivers than the latter. Both species appear to be common.

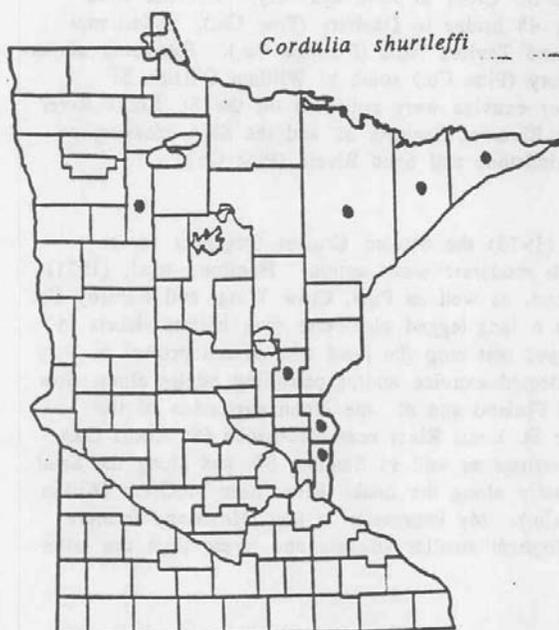
Neurocordulia molesta



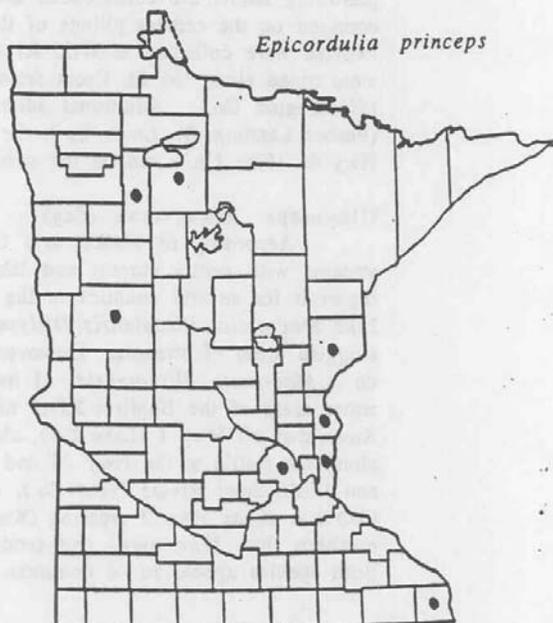
Neurocordulia yamaskanens.



Cordulia shurtleffi



Epicordulia princeps



CORDULIIDAE

Neurocordulia molesta (Walsh)

Hamrum et.al. (1971) report the Smoky Shadowfly as a new state record for Winona Co. The WNHP list this species as uncommon to rare along the middle and lower St. Croix.

***Neurocordulia yamaskanensis** (Provancher)

Walker and Corbet (1975) state that the Stygian Shadowfly inhabits the rocky shore of lakes and streams somewhat exposed to current or wave action. The WNHP list this species as uncommon to rare along the middle and lower St. Croix. I have collected one adult of this crepuscular-flying species at a backwater of the St. Croix south of Marine on the St. Croix (Washington Co.). I am unable to differentiate the exuviae of the species in this genus but have collected many specimens along the St. Croix from the Snake-St. Croix confluence (Pine Co.), Wild River SP and Osceola crossing (Chisago Co.) and William O'Brien SP (Washington Co.). At the Osceola crossing several exuviae were found at the edge of a stagnant pond removed from the St. Croix and possibly only connected during spring floods. Other exuviae of this genus were collected on the St. Louis River (Forbes Landing--St. Louis Co.) and along the Snake River at the Hwy 3 crossing (Kanabec Co.). All areas were of sluggish current and silty bottoms.

Epicordulia princeps (Hagen)

The Prince Baskettail is rather large, dark-bodied species with maroon spots on the wings. It most commonly occurs over lakes and is widely distributed in the state (Hamrum, et.al., 1971). I have seen occasional adults patrolling the St. Croix (Snake-St. Croix confluence to Wild River SP) and have collected a few exuviae from the St. Croix at Sunrise Access and Wild River SP (Chisago Co.).

Epitheca canis (MacLachlan)

The Beaver Pond Baskettail is a common pond species of northern Minnesota, but occasionally occurs at sluggish streams. I have collected exuviae from Cedar Creek (Anoka Co.), slow water areas of the Snake River (Silver Star Road Access--Aitkin Co. and Little Walleye Landing--Kanabec Co.), the Kettle River north of Willow River and above Hell's Gate in Banning SP (Pine Co.). Adults were taken at most of the streams visited in the northeast (Cook and Lake Co.) as well as those in the east-central region south to Sunrise Access (Chisago Co.).

Epitheca spinigera (Selys)

The Spiny Baskettail is widely distributed throughout much of Minnesota (Hamrum, et.al., 1971). It is most common in small, shallow, vegetation choked lakes; but occasionally occurs in river expansions. I collected a few exuviae from a lake-like expansion of the Ann River off Hwy 23 in Kanabec Co. as well as an expansion of the Cascade River in Cook Co. Adults are everywhere.

Cordulia shurtleffi (Scudder)

The American Emerald is most common in quiet, boggy ponds of NE Minnesota. I found this species emerging abundantly from an expansion of the Cascade River near Cascade Lake (Cook Co.) and also at quiet water areas of the Baptism River north of Finland (Lake Co.). Southern records of note are adults collected along the sluggish turbid Snake River at the # 3 Landing in Kanabec Co., at Sunrise Access (Chisago Co.) and at Big Marine Bog (Washington Co.).

Somatochlora spp.

While most species in this large genus are associated with northern cold boggy waters, I have taken several species at streams. These include *Somatochlora minor* (Baptism River), *Somatochlora elongata* (Temperance River), and *Somatochlora ensigera* (Cedar Creek NHA--Anoka Co.). Other species of *Somatochlora* taken at Cedar CNHA but with unknown larval habitat are *Somatochlora kennedyi*, *Somatochlora walshii*, and *Somatochlora williamsoni*.

LIBELLULIDAE

Most Libellulids are associated with quiet waters of marshes, ponds, and lakes. However, several are regularly found at sluggish streams and backwaters of larger rivers. I mention only four of the larger more conspicuous ones here.

Plathemis lydia (Drury)

The White-tail is widely distributed across most of the state (Hamrum, et.al., 1971), and I have routinely found it at quiet areas of streams from an expansion of the Baptism north of Finland (Lake Co.) south to the Root River at Whalen (Fillmore Co.). However, it is relatively uncommon at northern streams.

Libellula pulchella (Drury)

The Twelve-spotter most commonly occurs at ponds and lake shores but is occasionally seen at quiet streams across much of the state: It is uncommon in the north.

Libellula luctuosa (Burmeister)

The Widow is another pond and shallow soft-bottomed lake species that was abundant at the William O'Brien SP Boat Landing and occasionally seen at other sites along the St. Croix. It is absent from the northern half of the state.

Perithemis tenera (Say)

The Amberwing occurs commonly along the backwaters' of the Mississippi River in southeast Minnesota.

ZYGOPTERA

Several families of damselflies have stream representatives, but little attention was given to them on my collecting trips. Here I give but brief mention to a few.

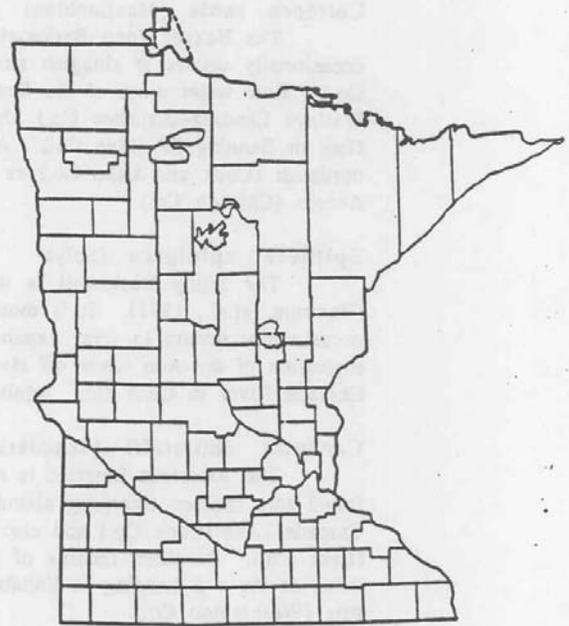
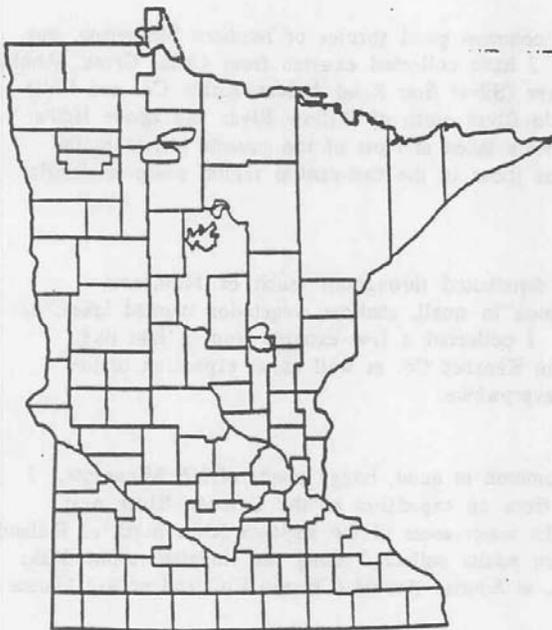
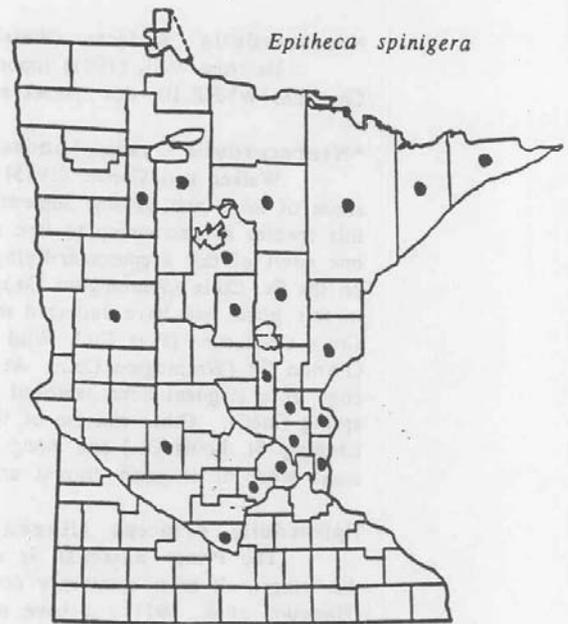
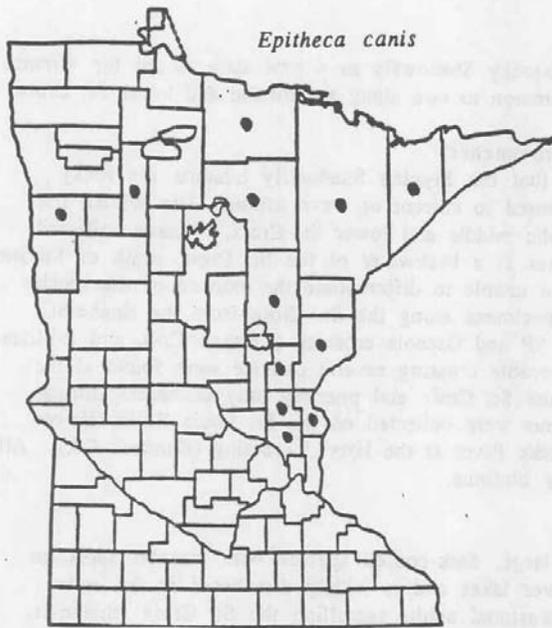
COENAGRIONIDAE

Argia species.

The genus *Argia* (? S spp) is confined to rivers, but I am not very familiar with them. At least two species were common along the St. Croix--*Argia moesta* (frosted appearance) and *Argia ?tibialis* (blue abdomen). Adults are of moderate size with, clear, wings, and spiny legs.

Enallagma species

The 'Bluets' are small damselfies with blue and black banded abdomens. Two river species appear to be *Enallagma carunculatum* and *Enallagma exulans*.



CALOYTERYGIDAE

Members of this family are large damselflies with colored wings. .

Calopteryx aequabilis (Say)

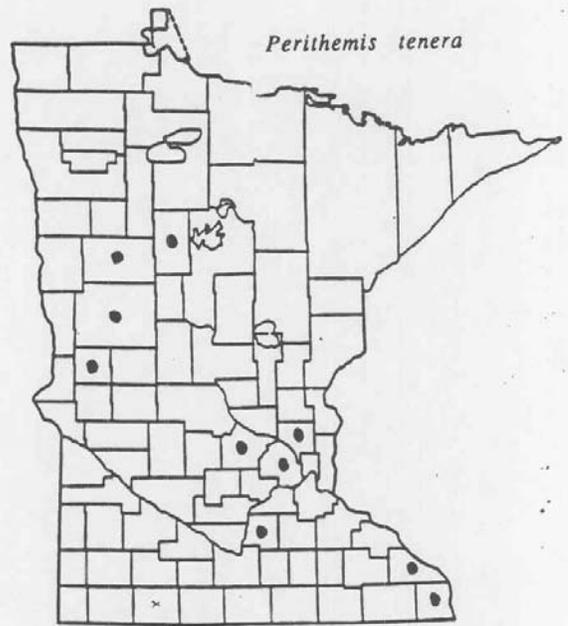
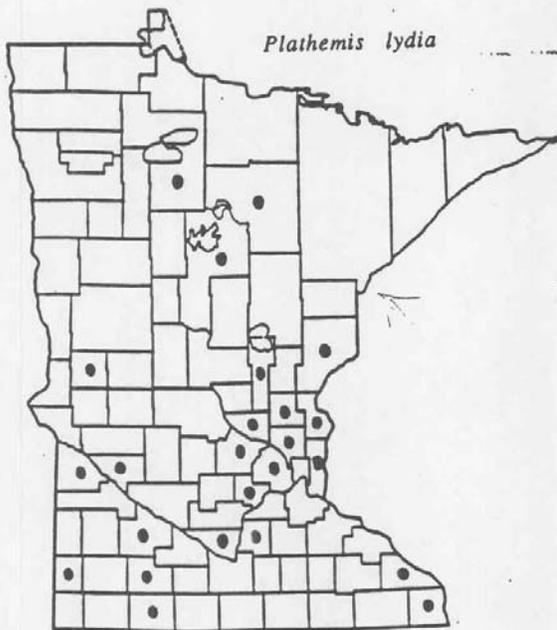
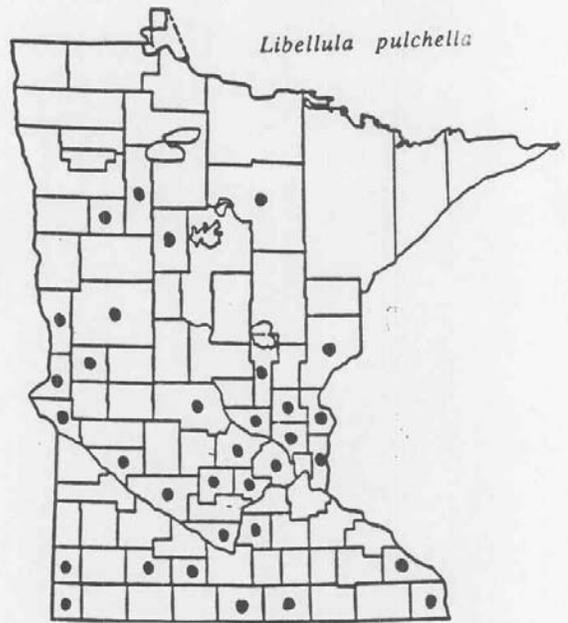
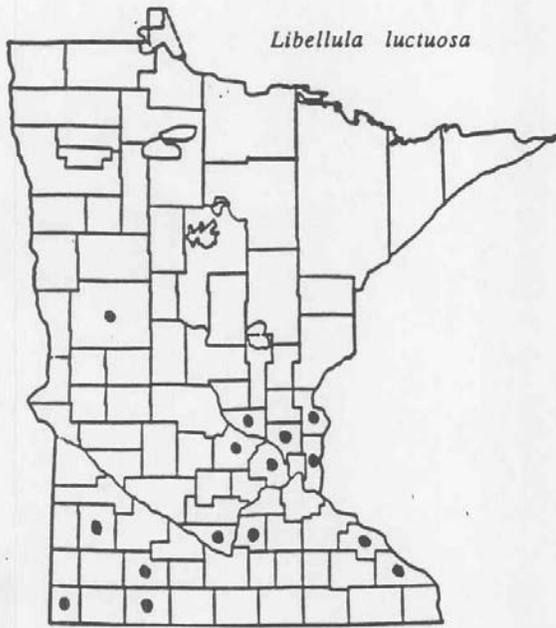
The River Jewelwing has a metallic green abdomen and the males have black-tipped wings. This species was common at most of the streams visited in the east-central region (Rum, Snake, Kettle, Rock, Sunrise, Crooked, St. Croix). It was rarer in the northeast (St. Louis, Stony, Baptism) and was absent from the southeast.

Calopteryx maculata (Beauvois)

The Ebony Jewelwing has a metallic green abdomen and the males have completely black wings. This species was found at streams throughout the state. It occurred at the Manitou in the northeast; the Kettle, St. Croix; Crooked, Rock, Sunrise, and Rum in the east-central; and the Zumbro, Whitewater, and Root in the southeast.

Hetaerina americana (Fabricius)

The American Rubyspot has a bronzed abdomen and the males have a brilliant red spot at the base of their wings. This species was common at many of the larger rivers visited in the southeast (Cannon, Zumbro, Root) but occurred as far north as the confluence of the Snake and St. Croix in southern Pine Co.



SEASONALITY

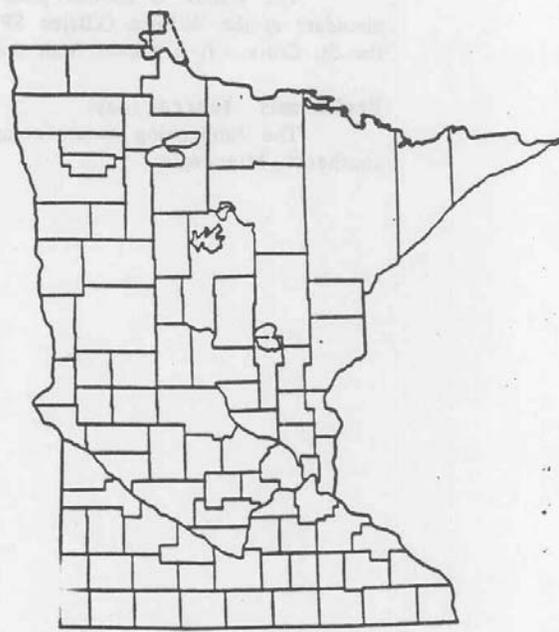
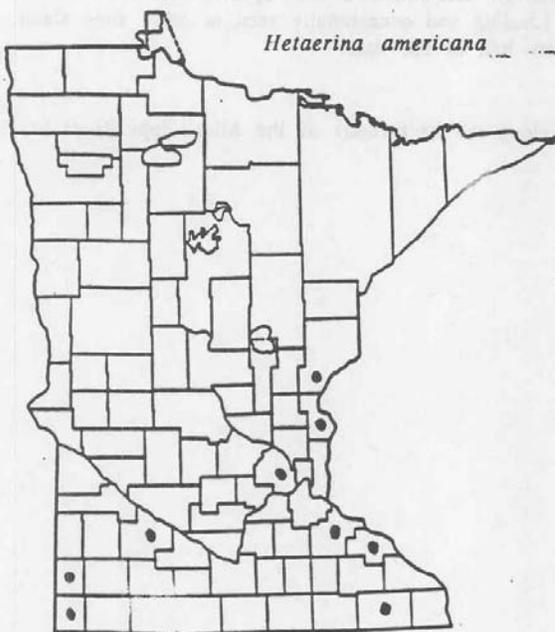
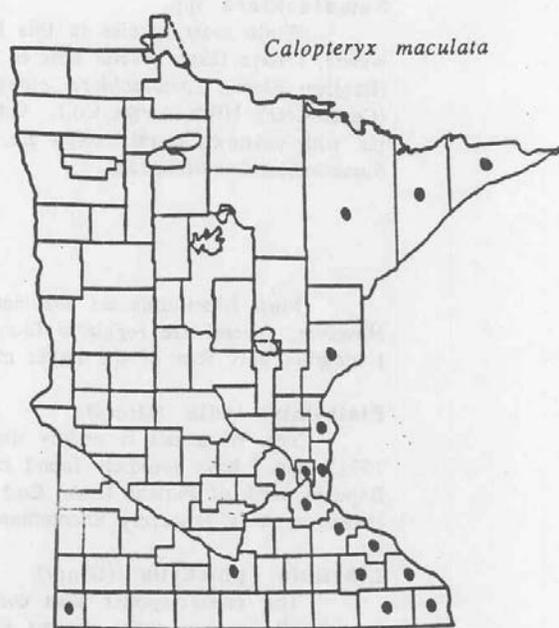
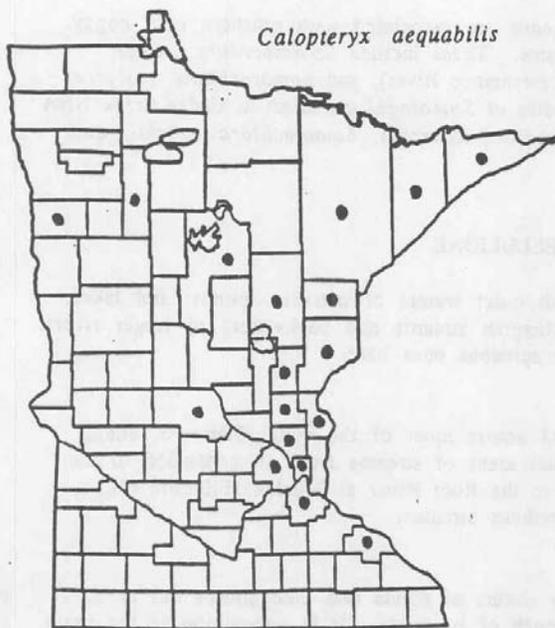
Although the timing of dragonfly emergence varies from year to year and locality to locality a generalized picture can be constructed. The following depiction is based primarily on my weekly visits to the St. Croix River at Sunrise Access with supplementary information provided from other sites. In most species emergence is quite synchronous-the bulk of the population emerging in less than one week.

The first species to emerge is *Gomphus quadricolor*. A few teneral were noted on 18 May. When I returned on 26 May, the emergence of *G. quadricolor* was basically completed. Exuviae of *Gomphurus lineatifrons*, *Gomphurus fraternus*, and *Ophiogomphus sabrinus* were now present. I believe that in the case of *O. sabrinus* emergence was basically completed. Species noted emerging in abundance on this date were *Ophiogomphus rupinsulensis*, *Ophiogomphus howei*, and *Hylogomphus viridifrons*. *Gomphurus vastus* had just begun to emerge.

No teneral were noted on 1 June, but large numbers of *Gomphurus vastus* exuviae were present and smaller numbers of *Hylogomphus viridifrons*, *Gomphurus lineatifrons*, *Gomphurus fraternus*, *Ophiogomphus rupinsulensis*, *O. howei*, and *O. sabrinus*' (some of these were probably old and missed the preceding week). Exuviae of *Basiaeshna janata* were also present.

On 8 June *Dromogomphus spinosus* and *Hagenius brevistylus* were noted emerging. Exuviae of *Macromia illinoensis*, *Basiaeshna janata*, and *Neurocordia sp.* were present. *Stylurus notatus* was noted emerging north of Stillwater at this time.

On 15 June, additional exuviae of *Dromogomphus spinosus*, *Hagenius brevistylus*, *Macromia illinoensis*, and *Neurocordulia sp.* were found as well as a few of *Epicordulia princeps*, *Stylurus spiniceps*, and *Stylurus-annicola*. *Stylurus spiniceps* and *Stylurus notatus*, were noted still emerging on 22 June and 29 June respectively. After this time my visits became more erratic, but the few exuviae encountered subsequently indicated that emergence of these species was basically complete.



DISCUSSION

In the discussion that follows I make brief mention of rivers in need of attention and uncommon or local species requiring additional work.

RIVERS

My survey work was most satisfactory along the St. Croix and its major tributaries, the Snake and the Kettle. Although I visited several smaller streams in east-central Minnesota (e.g. Grindstone, Sand, Little Sand, Rock, Sunrise) others could be sought out and surveyed to increase our understanding of species distribution and habitat preference in this region.

Only a smattering of streams were visited in the northeast (e.g. Gooseberry, Baptism, Temperance, Cascade); and the only satisfactory visit was done in mid-June. My mid-July visit followed heavy rains and exuviae were impossible to find. It would prove informative to visit more streams as well as some of the numerous lakes, ponds, and bogs of this region. Several new state records are sure to be lurking there (e.g. *Williamsonia fletcheri*, several species of *Somatochlora*, and a few species of *Aeshna*).

My three visits to the southeast were not very successful. The first two in late May could possibly have been early (but I doubt it), and the third in late June followed a period of heavy rains that would have washed away most exuviae. The paucity of adult Gomphids observed and exuviae collected suggests that those streams visited (Cannon, Zumbro, Whitewater, Root) are relatively depauperate in riverine dragonflies. This may be because of agricultural runoff, the presence of carp or trout in some of the streams, or possibly the hardness of the water emanating as they do from limestone bedrock.

Although I visited several sites along the lower Mississippi, the river is simply too enormous to explore thoroughly without motorcraft. Early century reports (Whedon, 1914) of large emergences of gomphids near Wabasha suggest that such populations may still occur. Indeed, I have seen gomphids patrolling the river on canoe trips made in the 1970's and 1980's. Undoubtedly, Army Corps of Engineering dredging and heavy motorboat and barge traffic have altered the character of the river, but some refuges for riverine dragonflies must remain. Given that much of the lower Mississippi is a Federal Wildlife Sanctuary it would be good to know what the Sanctuary holds.

My surveys along selected eastern Minnesota rivers leaves the remainder of the state nearly unexplored (save for the work of Hamrum, Anderson, and colleagues from Gustavus Adolphus). Additional rivers and watersheds that deserve attention are numerous and include the Minnesota, Blue Earth, Des Moines, Cottonwood, Yellow Medicine, Rock, Ottertail, Crow Wing, Crow, Big and Little Fork, and the Red River to name just a few. Also unexplored are the numerous moraine lakes and ponds of west and northcentral Minnesota and the enormous peatlands with their springs, seeps, and bogs of northwestern Minnesota.

SPECIES

The Gomphidae is a primitive family with many of its species confined to river habitats. River species of wide distribution and abundance and apparently secure include *Hagenius brevistylus*, *Dromogomphus spinosus*, *Ophiogomphus earolus*, *Ophlogomphus eolubrinus*, *Ophiogomphus rupinsulensis*, *Hylogomphus adelphus*, *Gomphurus fraternus*, *Gomphurus vastus*, *Gomphus lividus*, and *Gomphus quadricolor*. *Ophiogomphus howei*, *Ophiogomphus sabrinus*, and *Hylogomphus viridifrons* all have large populations but are only common along a stretch of the St. Croix. More at risk, or at least in need of additional study are *Gomphurus ventricosus*, *Stylurus amnicola*, *Stylurus spiniceps*, and *Stylurus notatus*. The last is on a Federal 'watch list'? *Gomphurus externus* and *Gomphus graslinellus* may well be common in the state--but not in the watersheds I explored. I suspect that *Gomphurus externus* may be at home along the Minnesota and Blue Earth rivers, and *Gomphus graslinellus* may be common in the moraine lakes and streams? of west-central Minnesota. A variety of *Gomphurus fraternus* var. *manitobianus* may occur along the Red River in northwest Minnesota, and perhaps a couple of new state records may be present along Minnesota's southern border. The remaining species of gomphids are all inhabitants of lentic waters, and with the exception of *Arigomphus furcifer* appear to be common in the appropriate habitat.

None of the few Aeshnidae inhabiting rivers appear to be threatened. I found the early summer *Basiaeshna janata* to be common at a variety of streams. I have few collections of *Boyeria grafiana* and *Boyeria vinosa*, but both these species are primarily northeastern and occur in late summer, and that area and season received little attention.

Only two species of Cordulegastridae are reported for the state. *Cordulegaster maculata* is common at a variety of streams in the northeast, but my collection of *Cordulegaster obliqua* at a seep near William O'Brien State park is the only record for the state, and given the common name 'Elusive River Cruiser' more effort could be expended searching for this species.

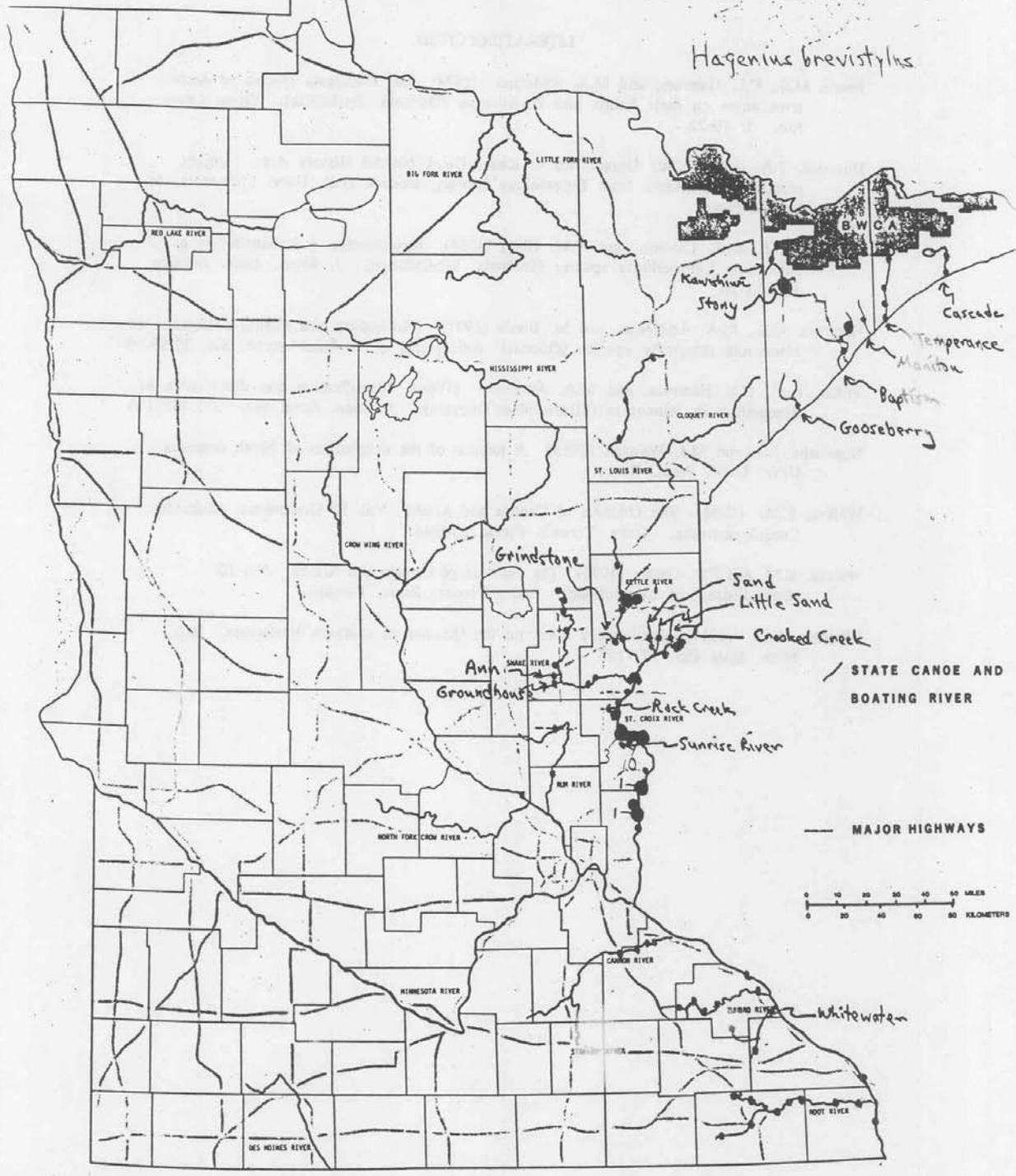
Of the two species of Macromiidae reported for the state, both appear to be common and in no danger. *Macromia illinoensis* is common along the St. Croix and also occurs along a variety of other rivers (e.g. Kettle, St. Louis, Grindstone, Sand). *Didymops transversa* is apparently more northern in distribution but also widely distributed (e.g. Kawishiwi, Baptism, St. Louis, Snake, Kettle, Sand, Little Sand).

Most of the Corduliidae inhabit lentic waters, and several of the species are abundant. Those in need of additional work are *Neurocordulia* spp, and *Somatochlora* spp.

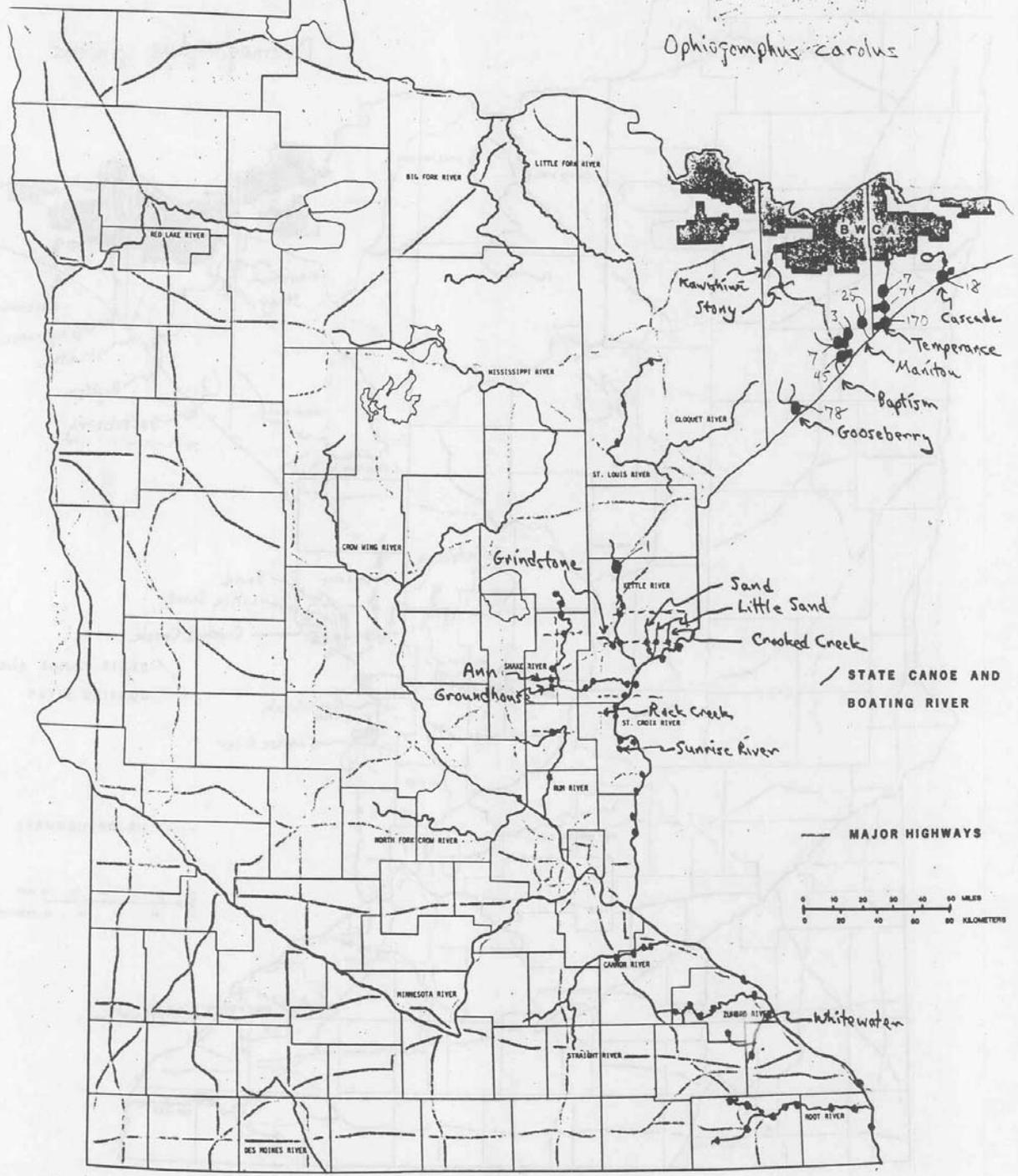
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Hagenius brevistylus

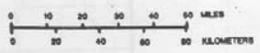


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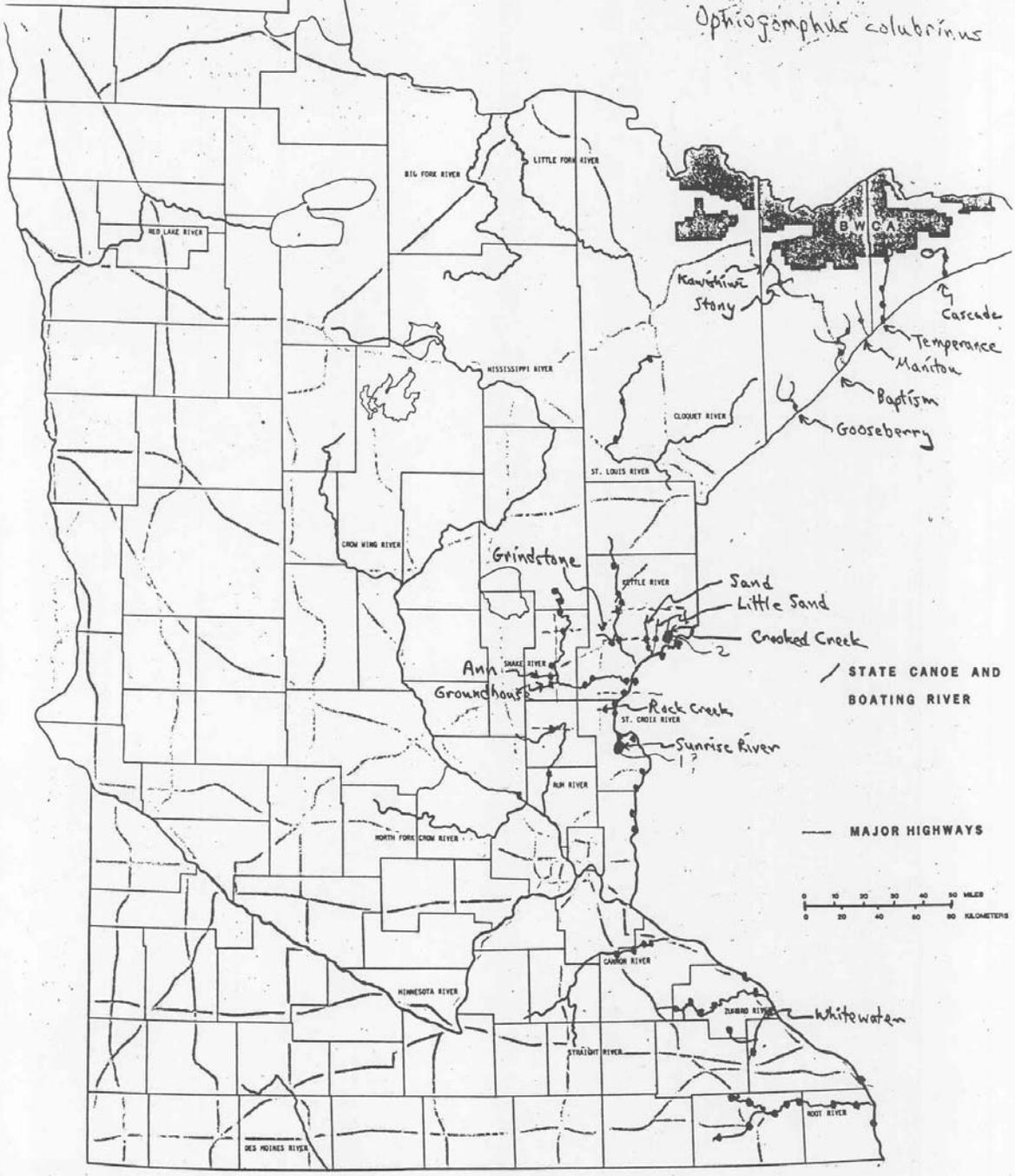


STATE CANOE AND BOATING RIVER

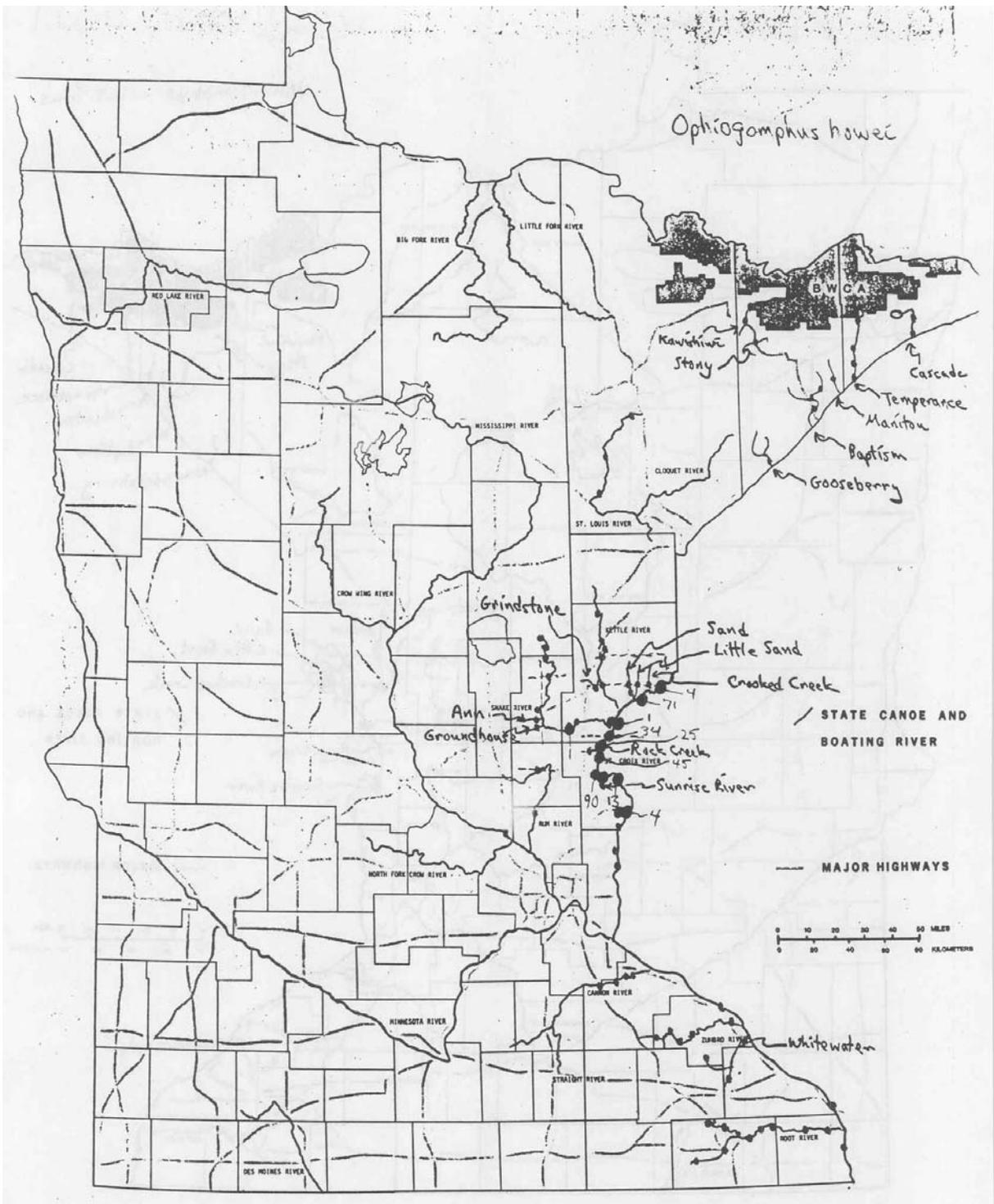
MAJOR HIGHWAYS



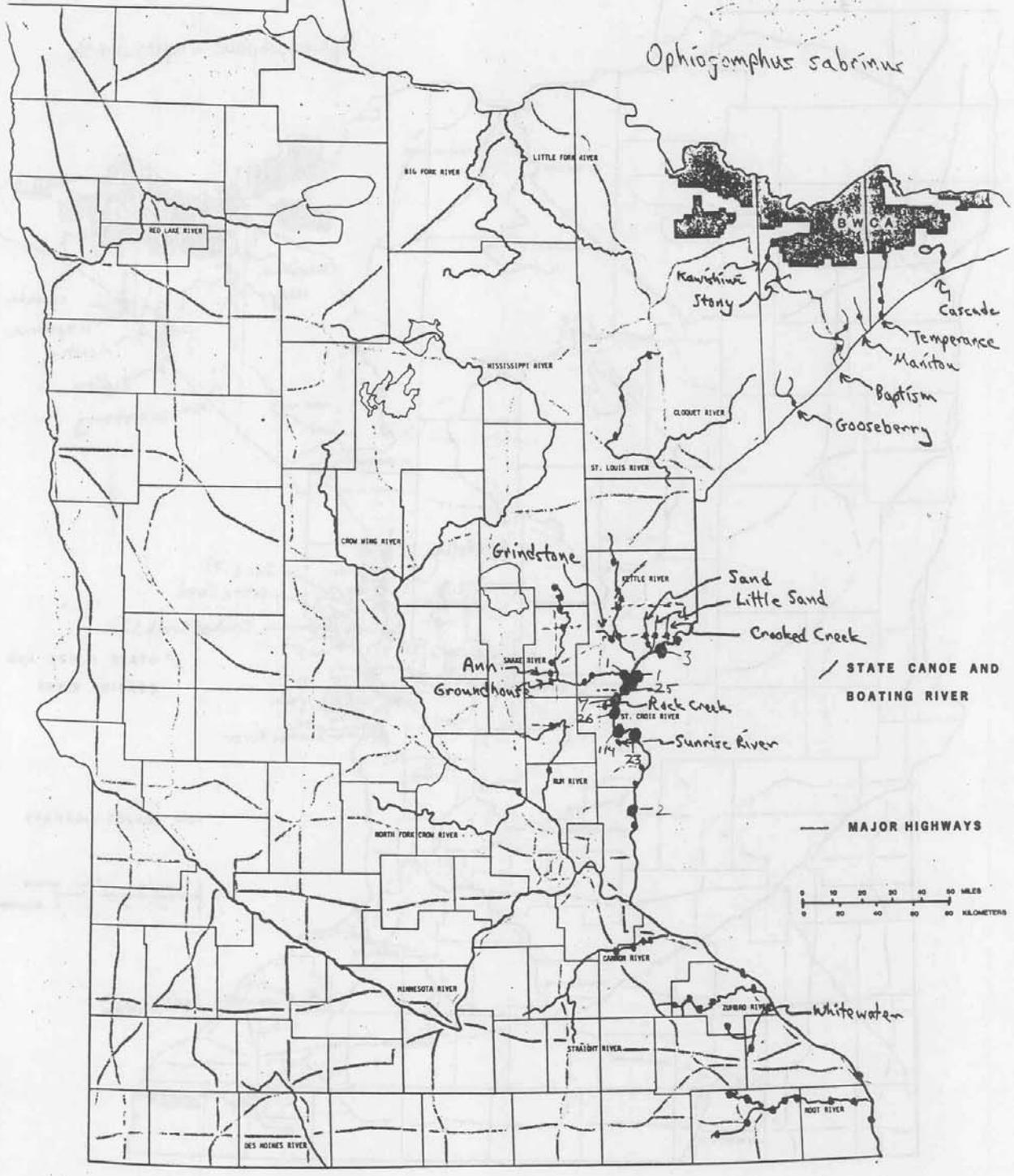
Ophiogomphus colubrinus

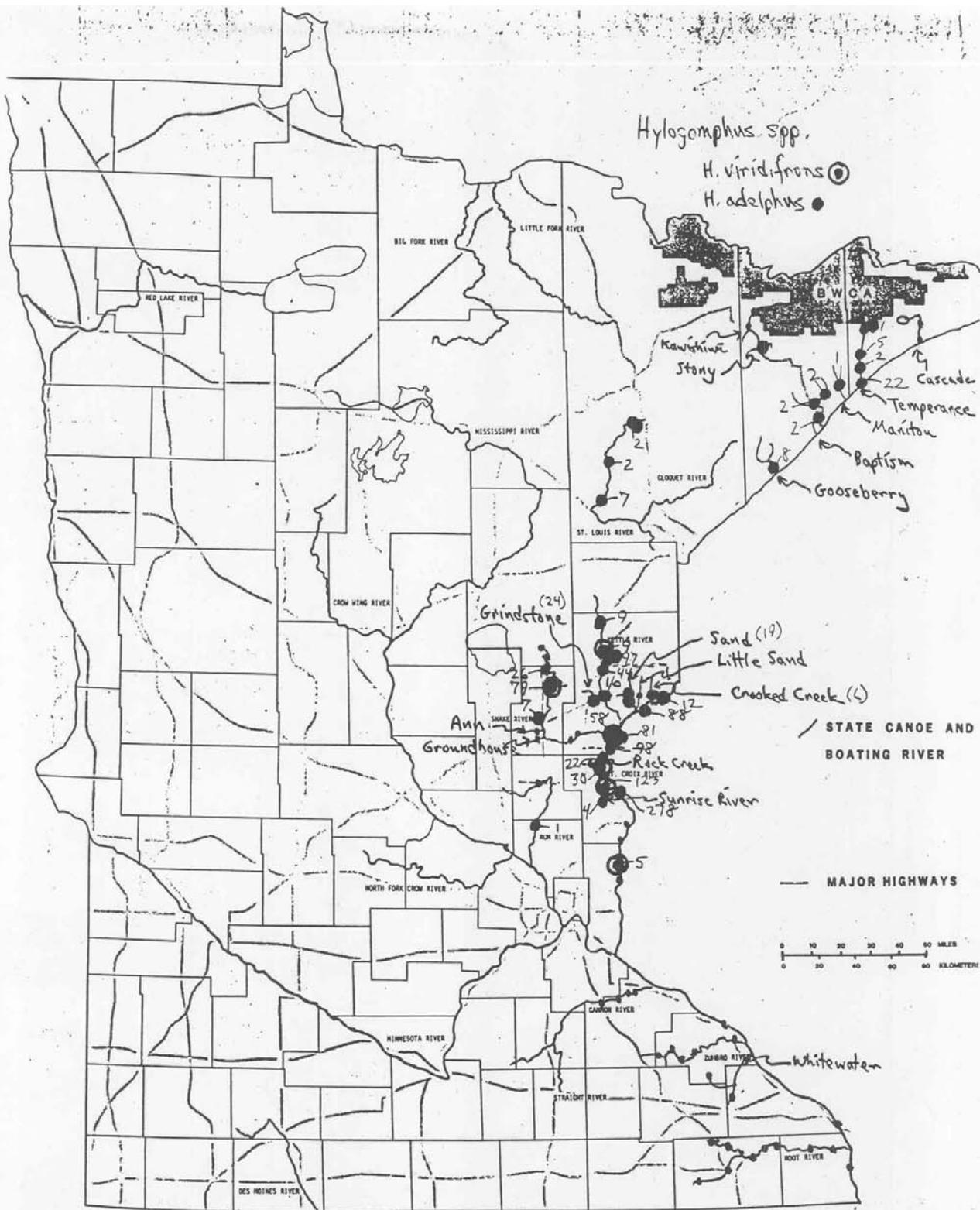


Ophiogomphus howei

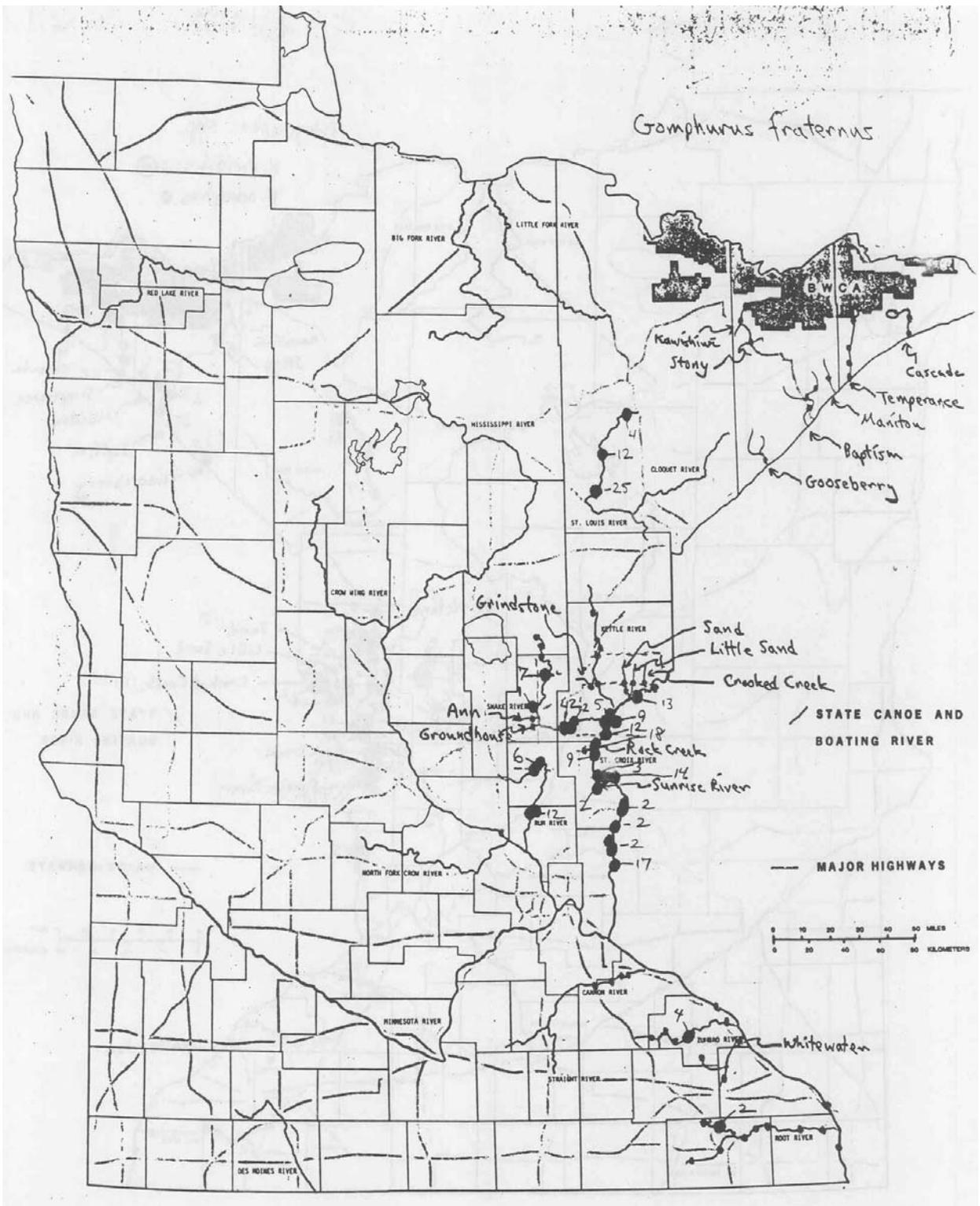


Ophiogomphus sabrinus

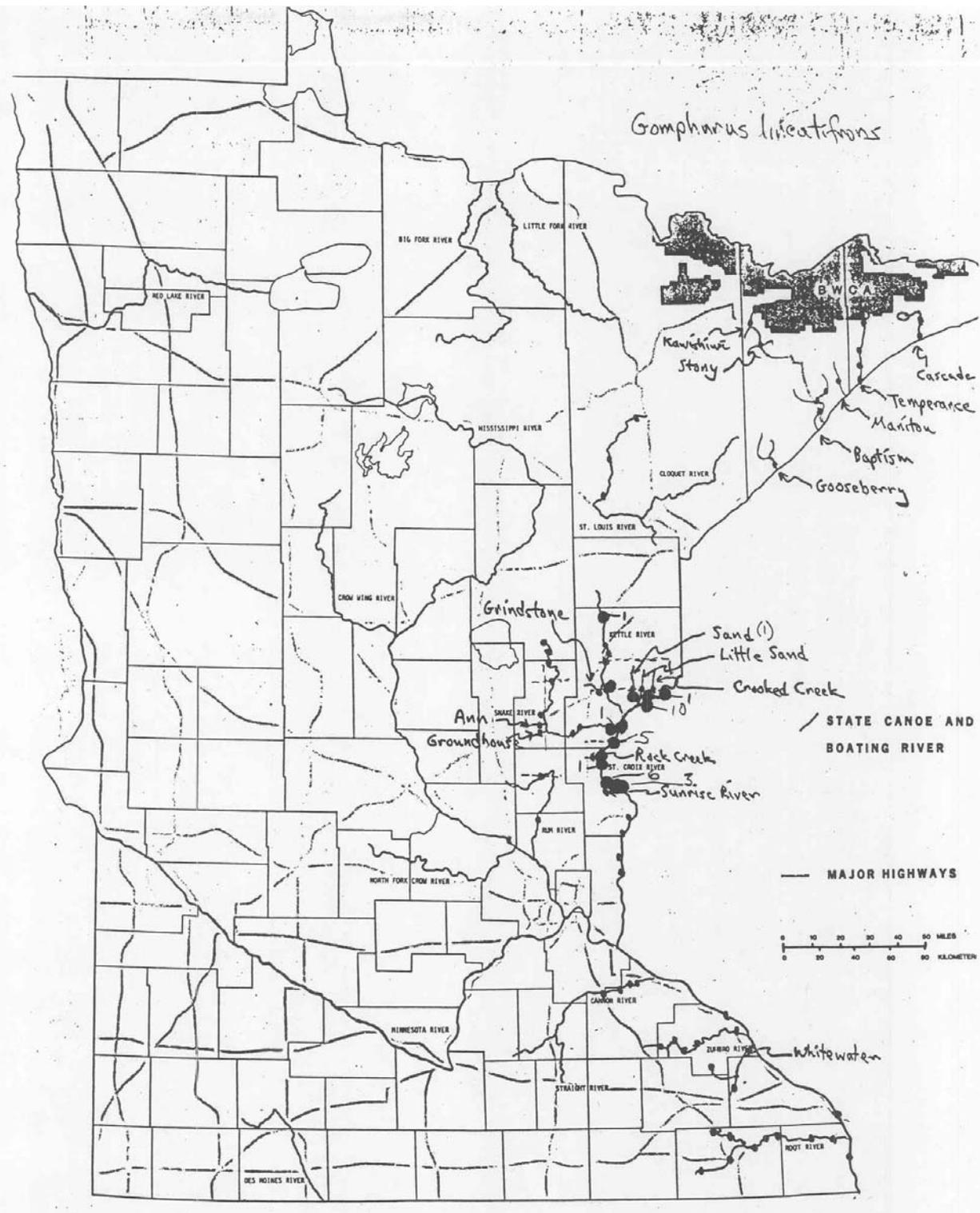




Gomphurus fraternus

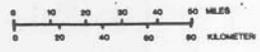


Gomphurus lineatiformis

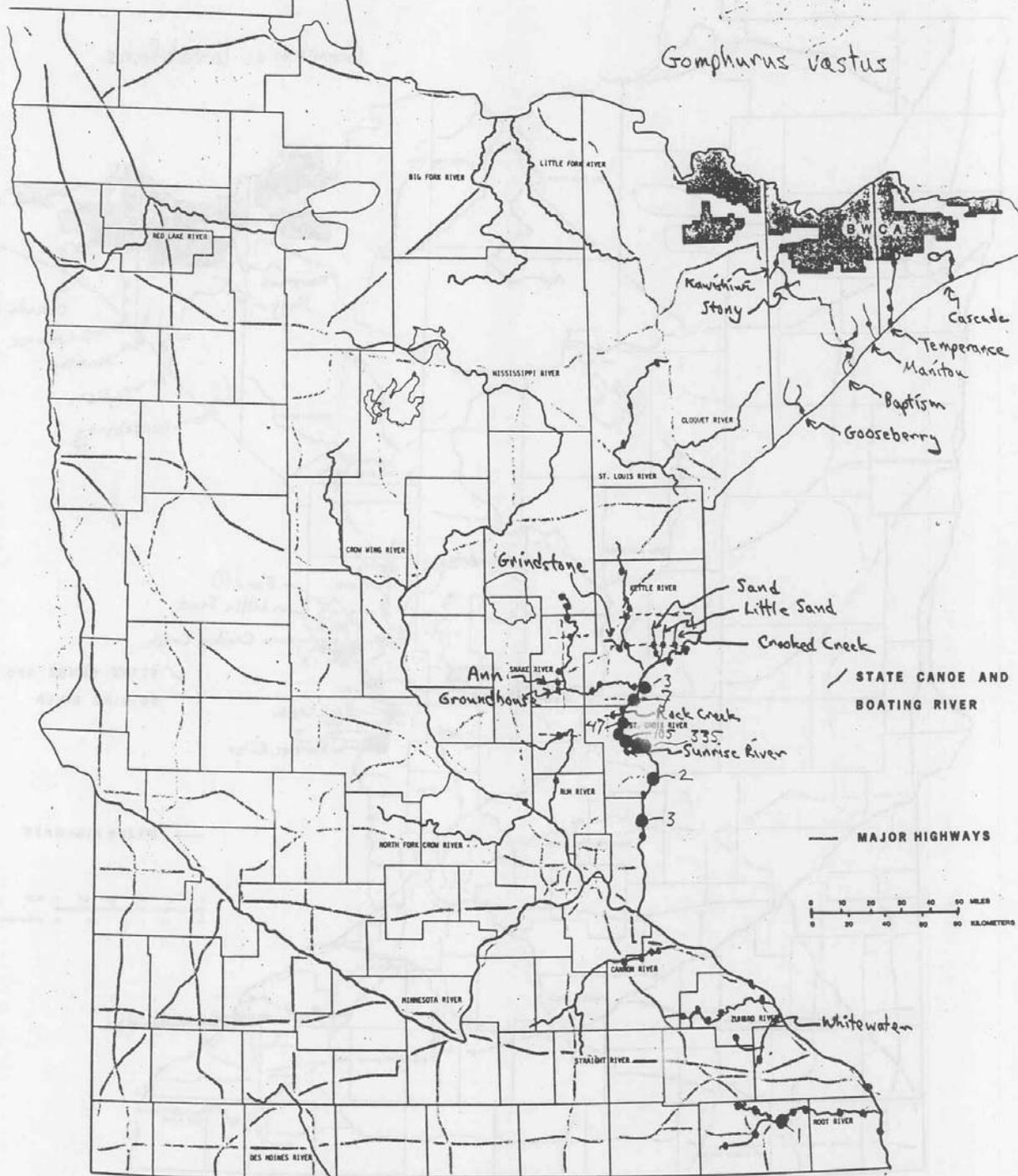


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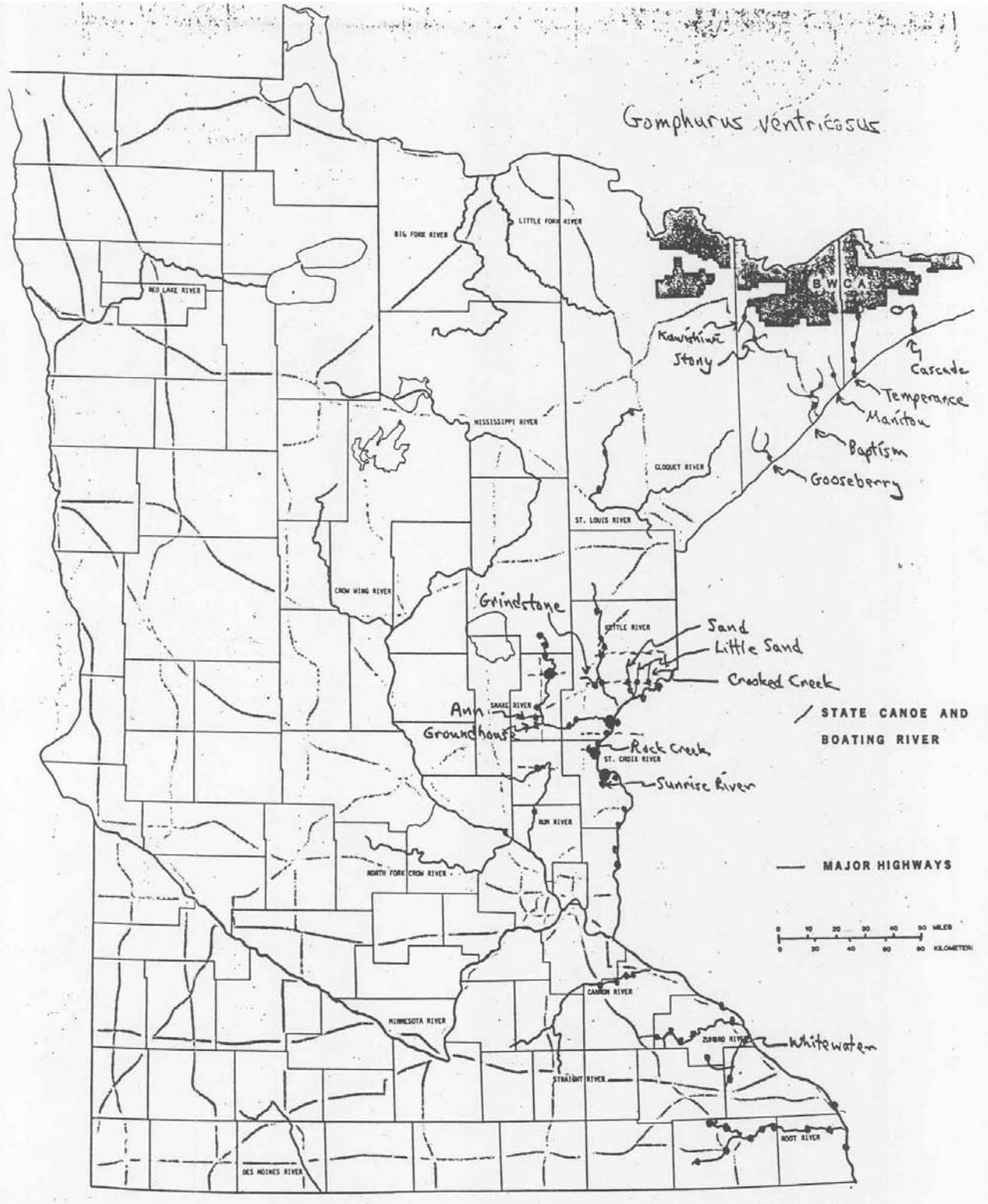
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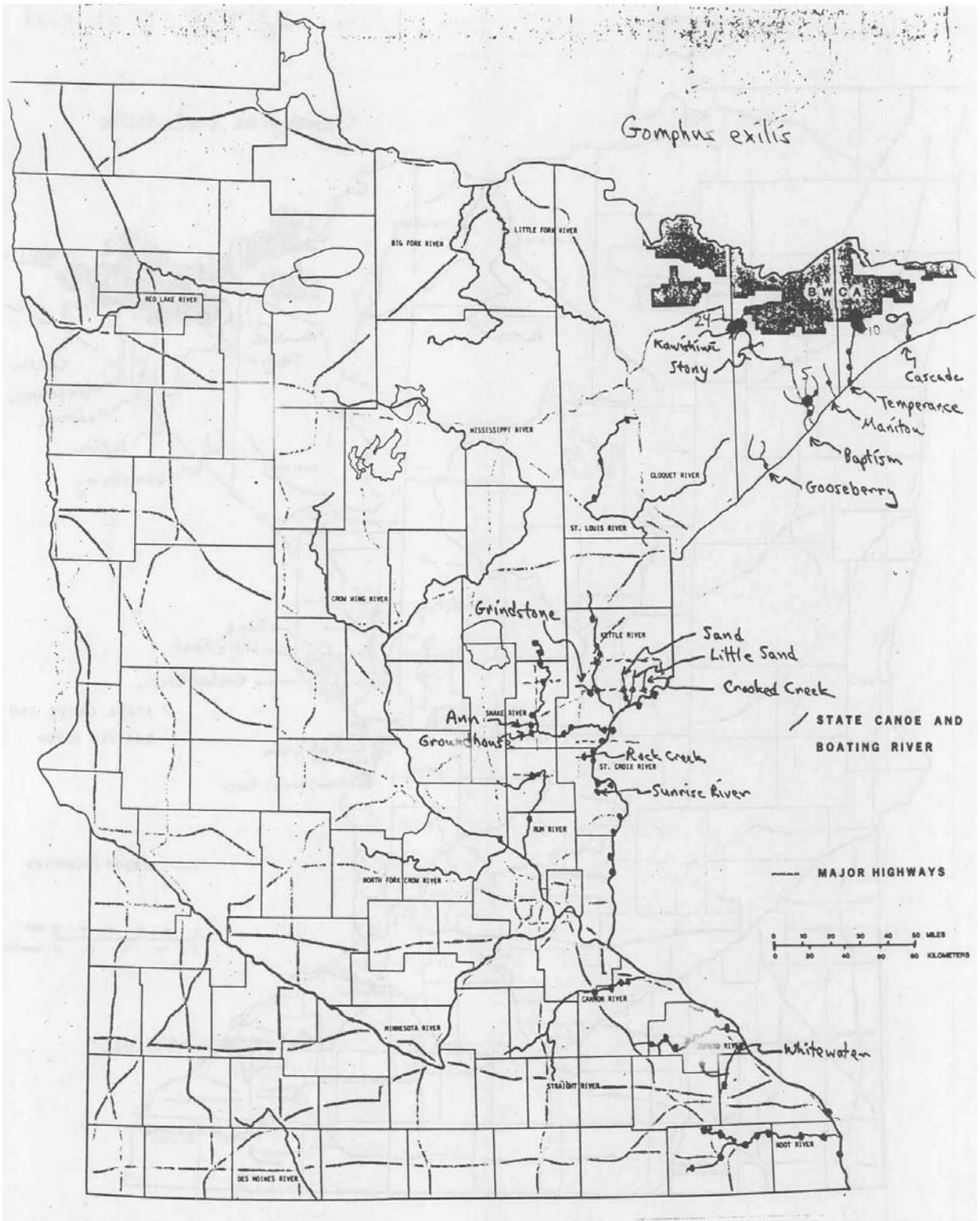
Gomphurus vastus



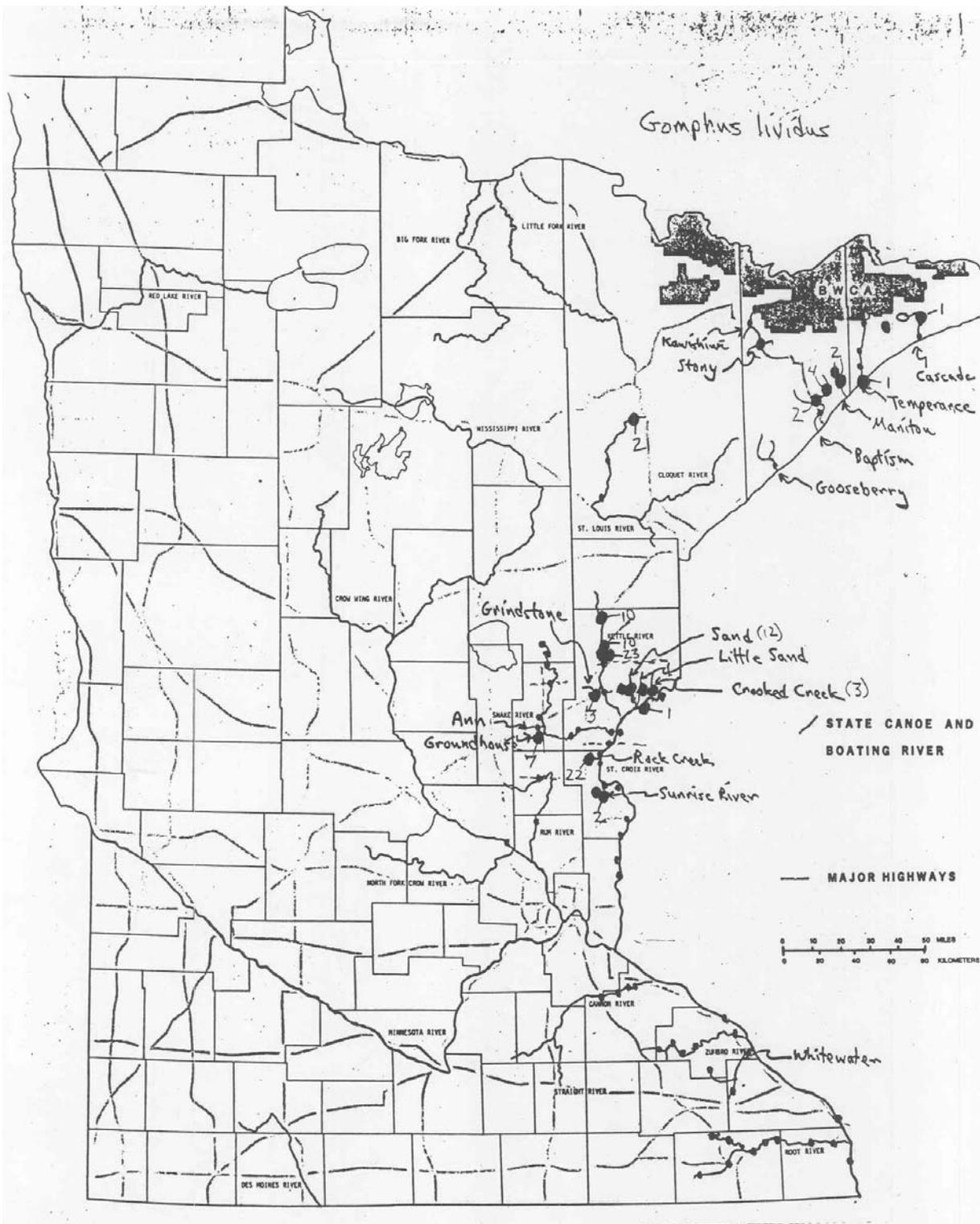
Gomphurus ventriosus



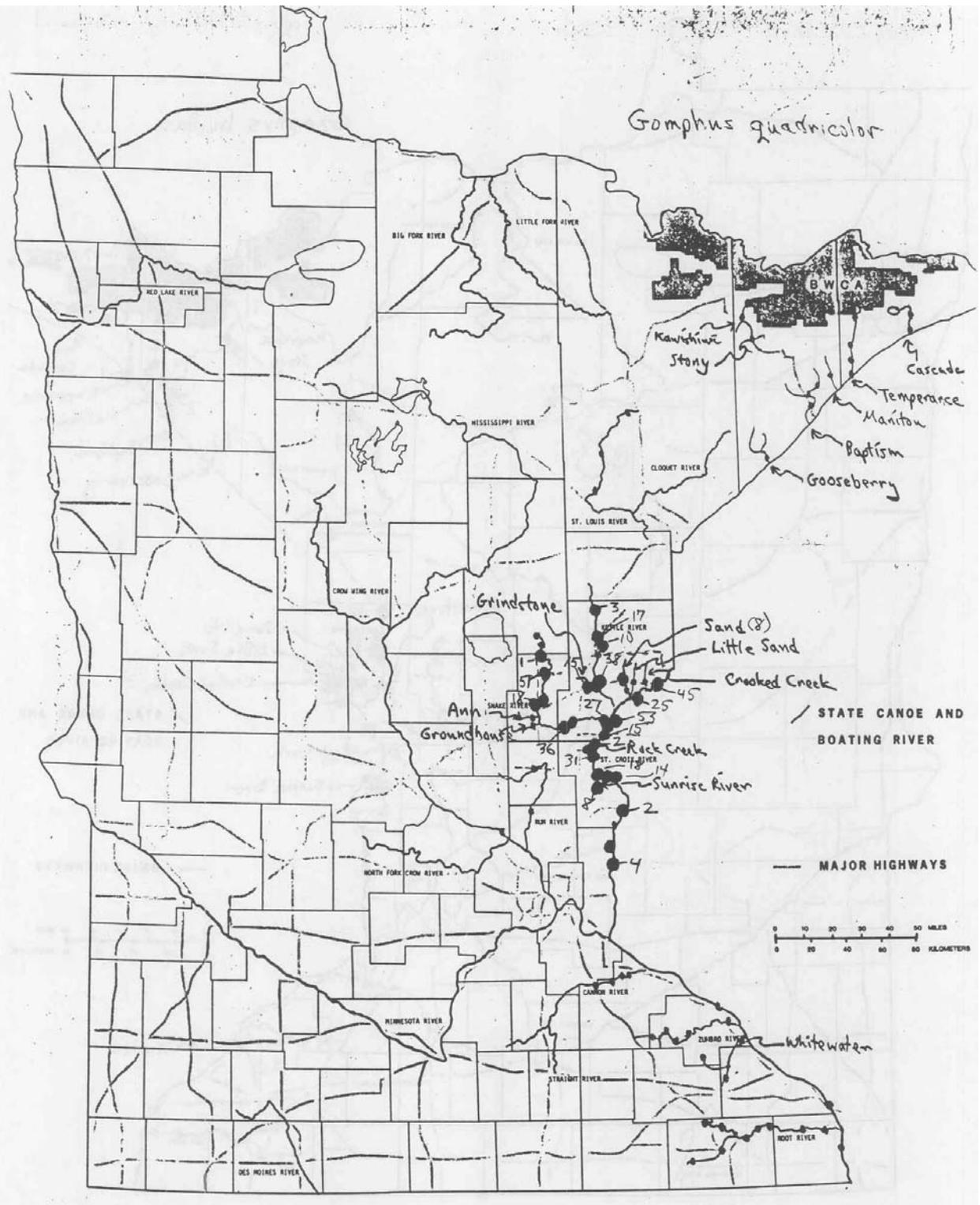
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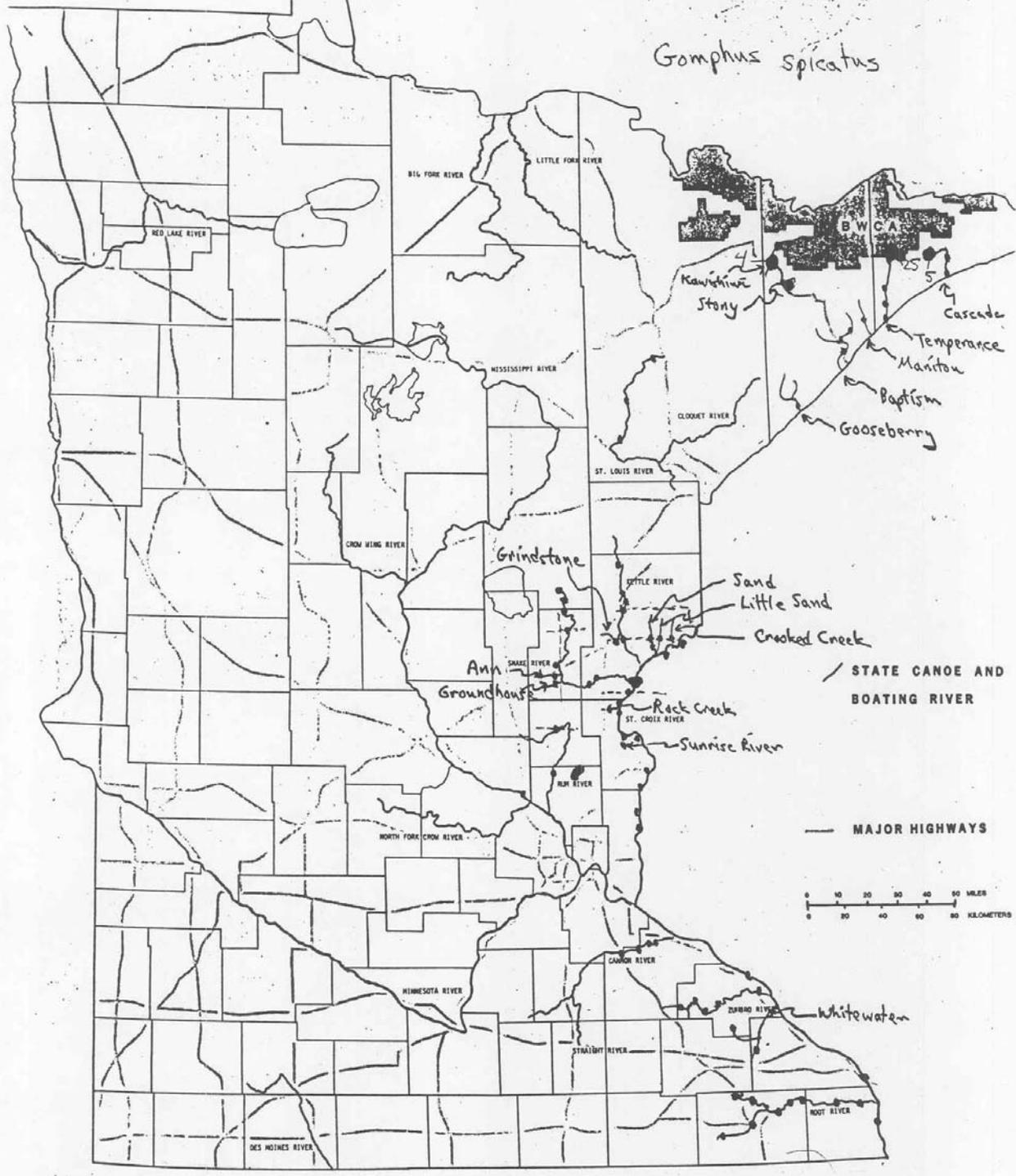
Gomphus lividus



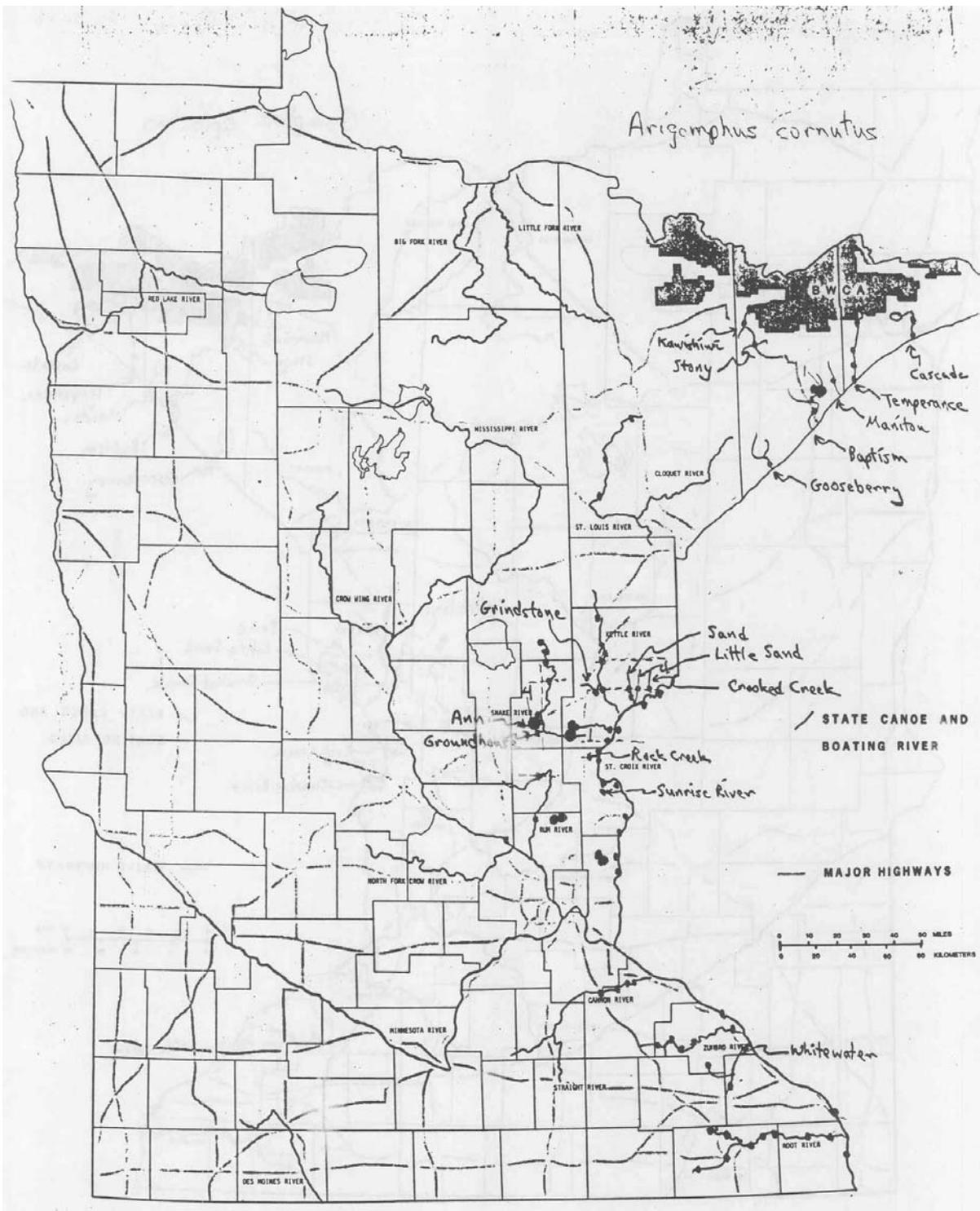
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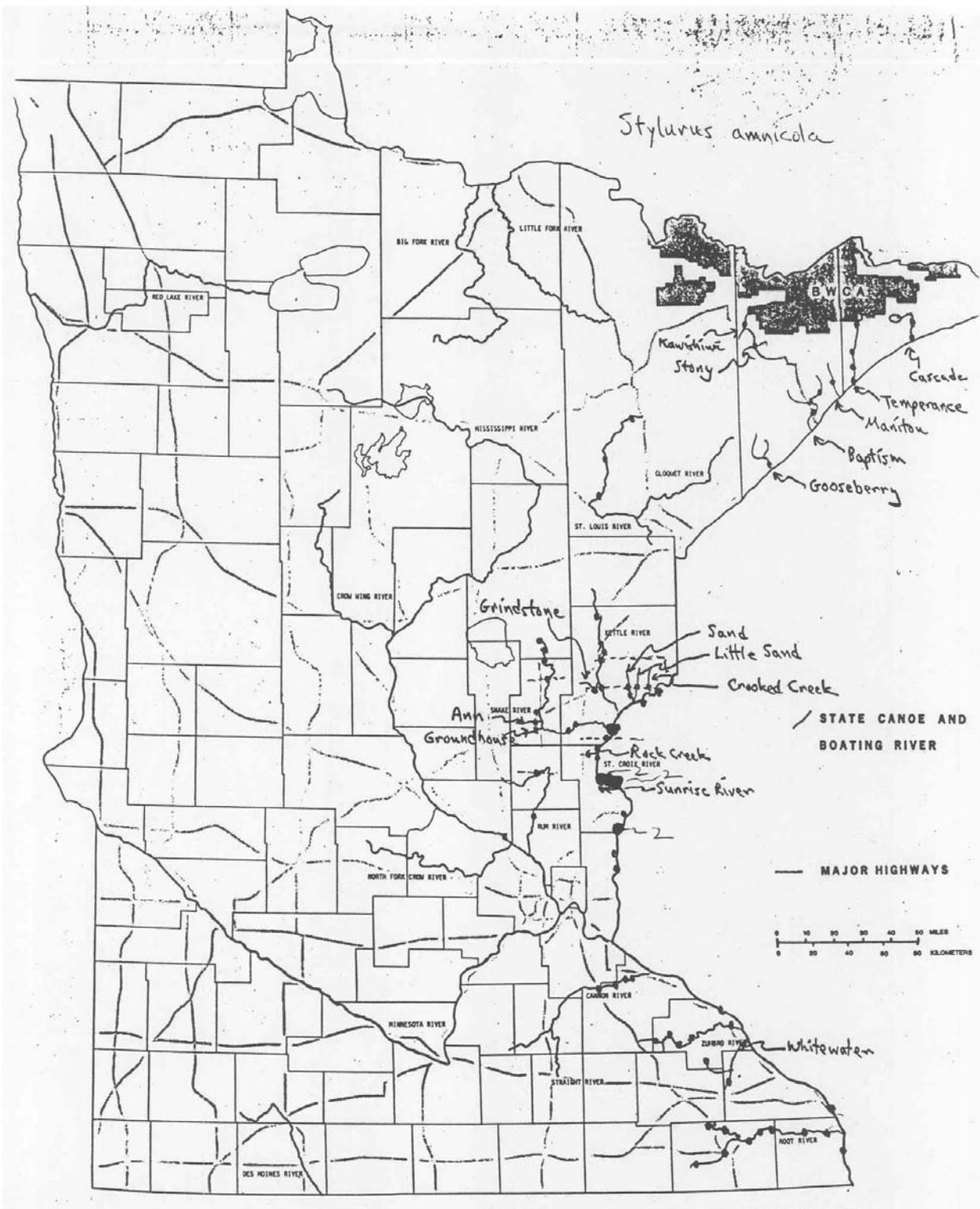


Gomphus spicatus

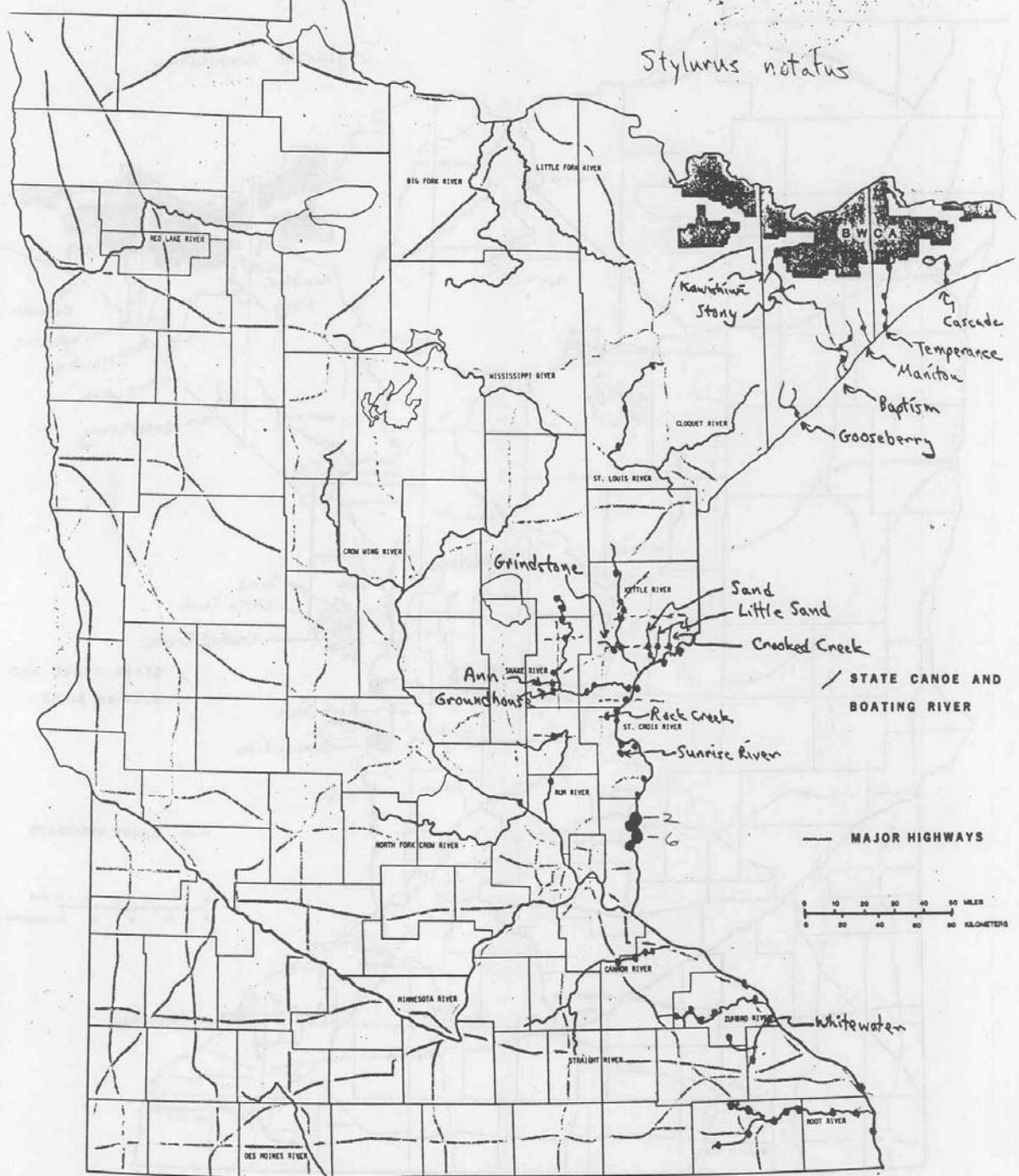


Arigomphus cornutus

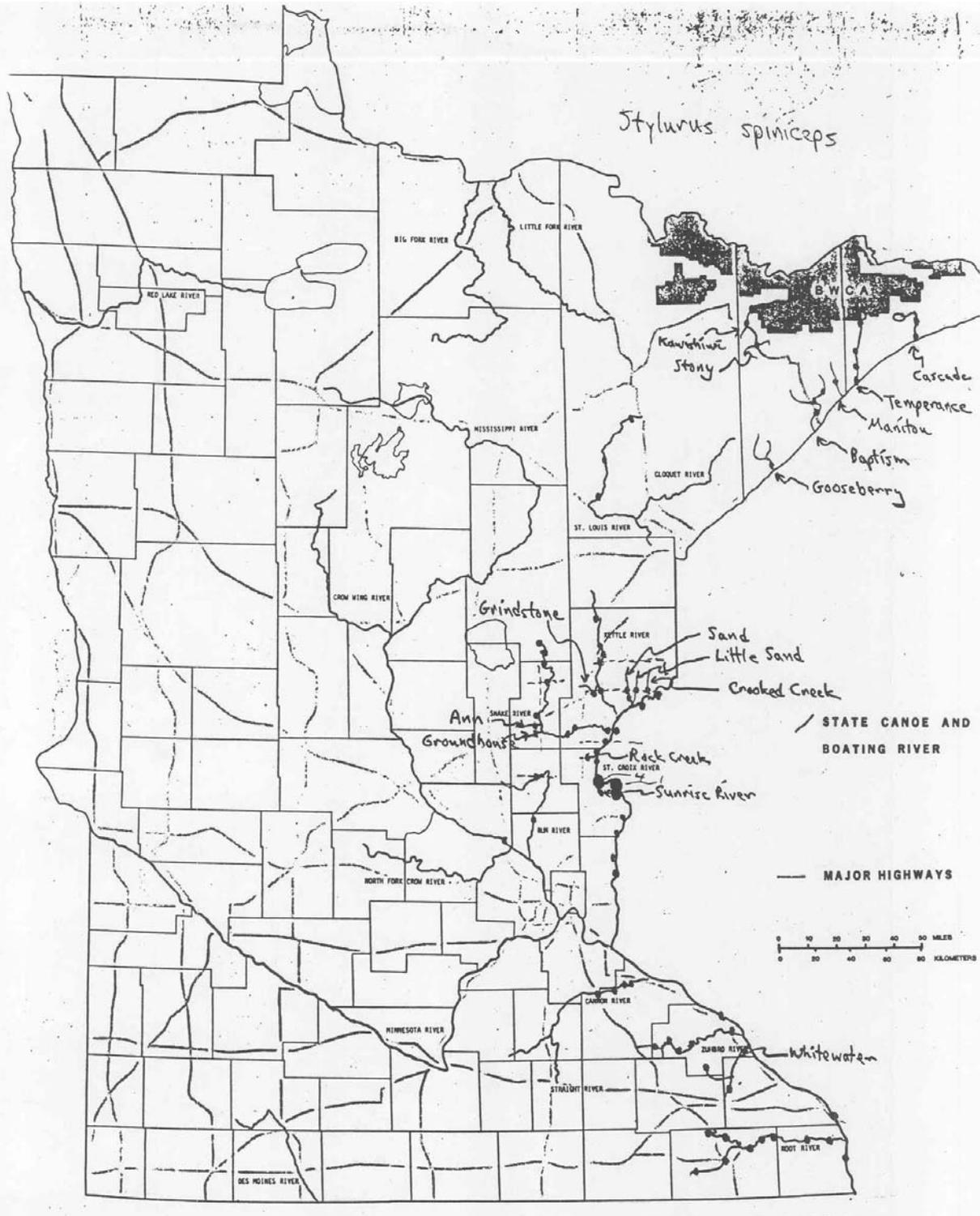




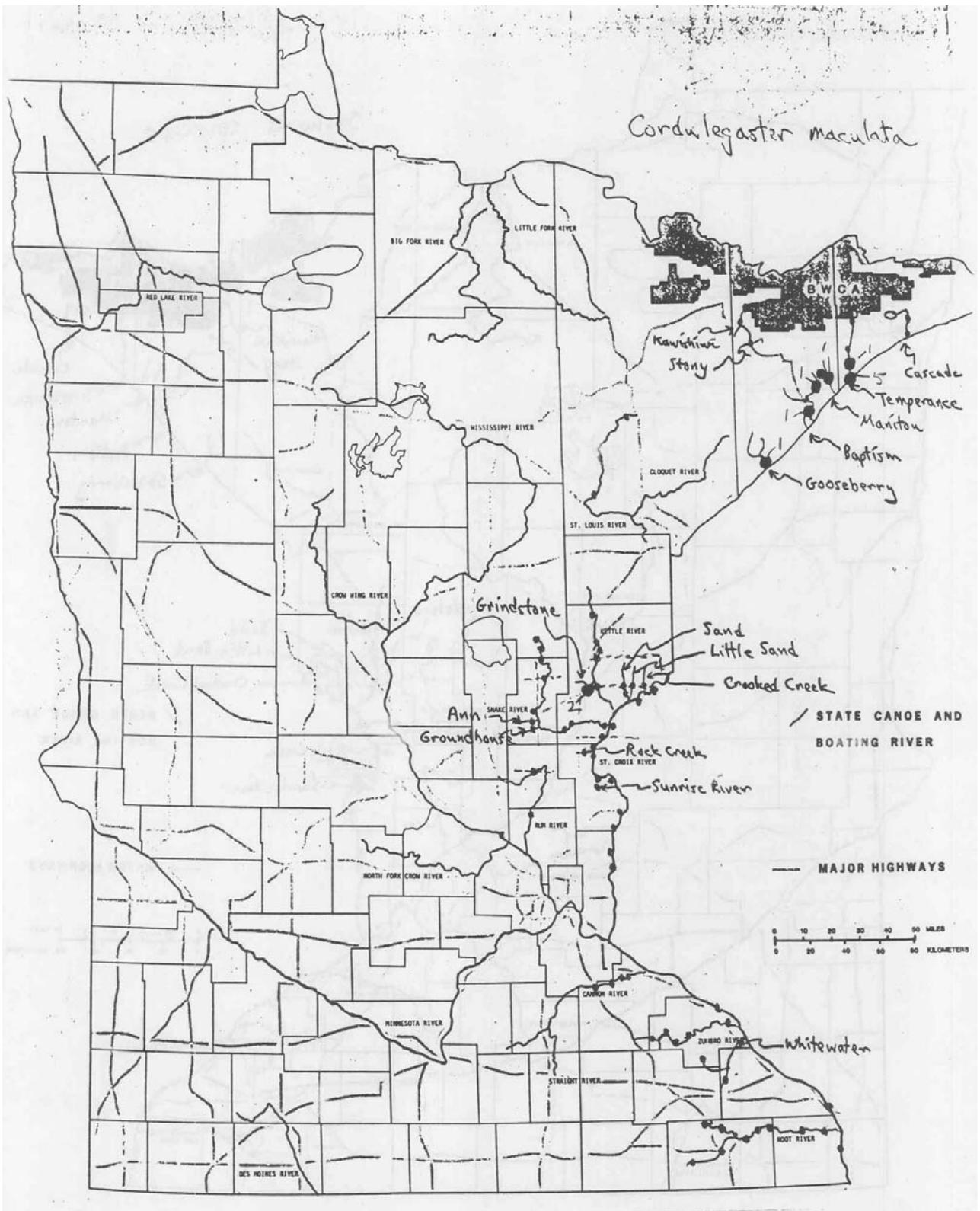
Stylurus notatus



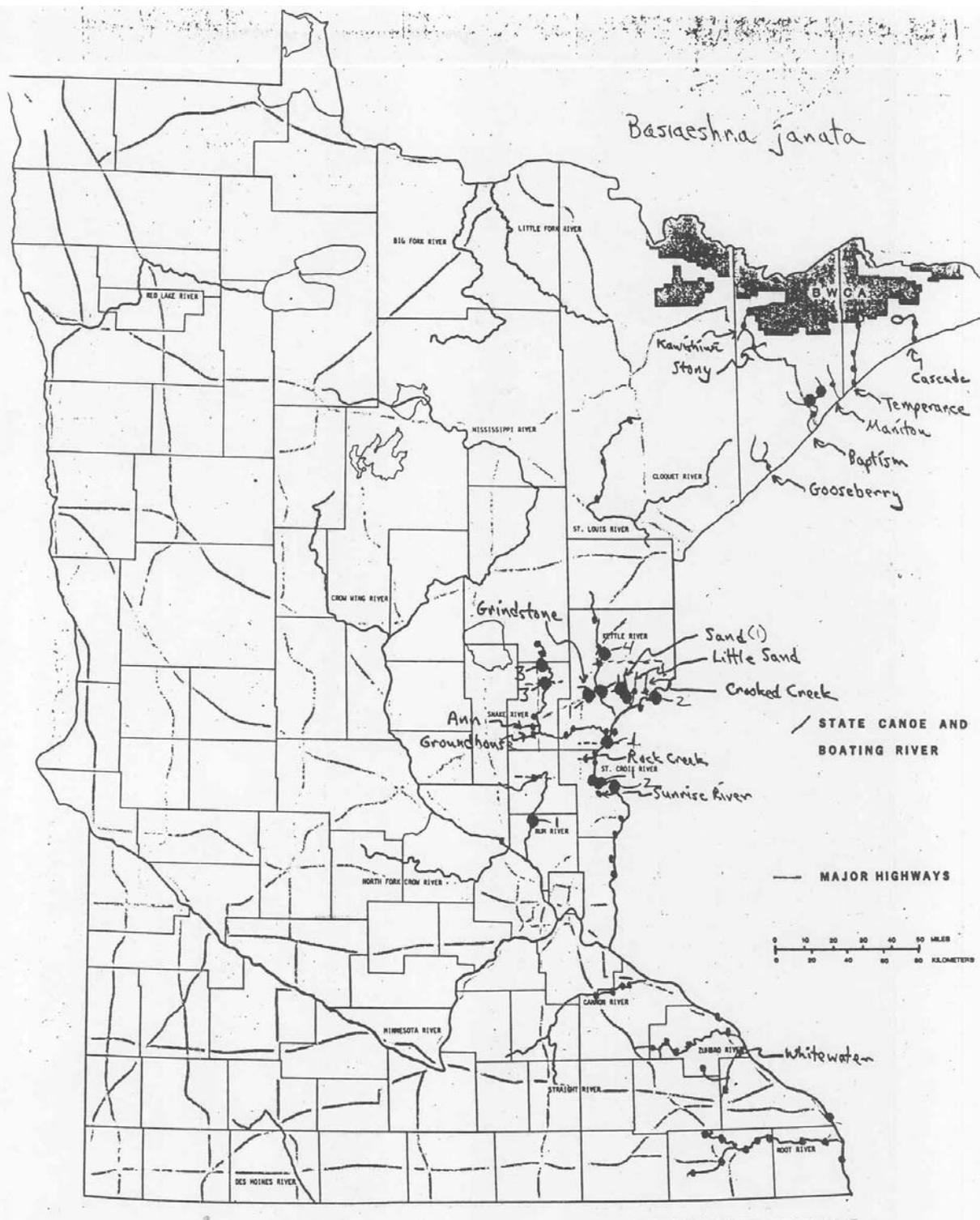
Stylurus spiniceps

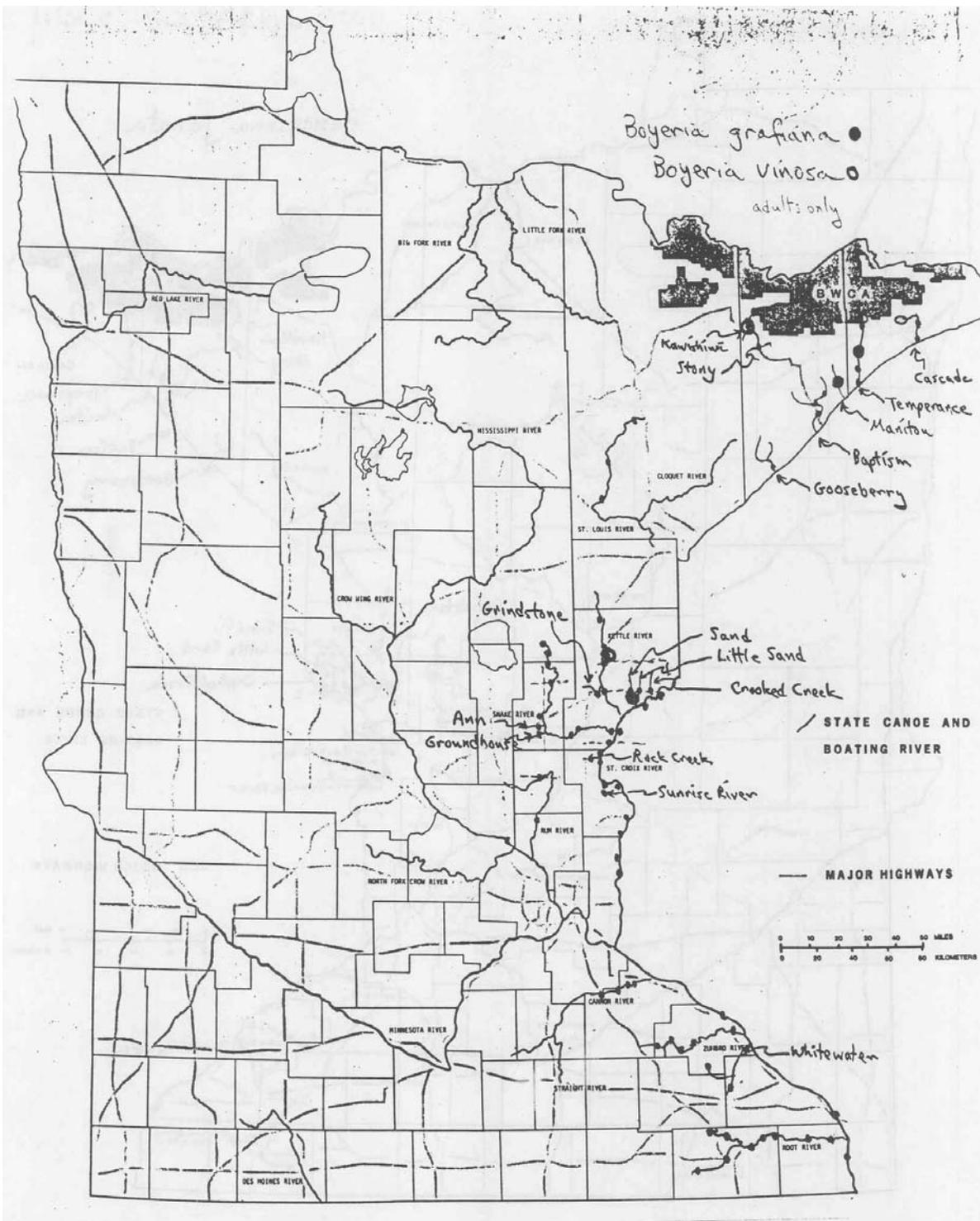


Cordulegaster maculata

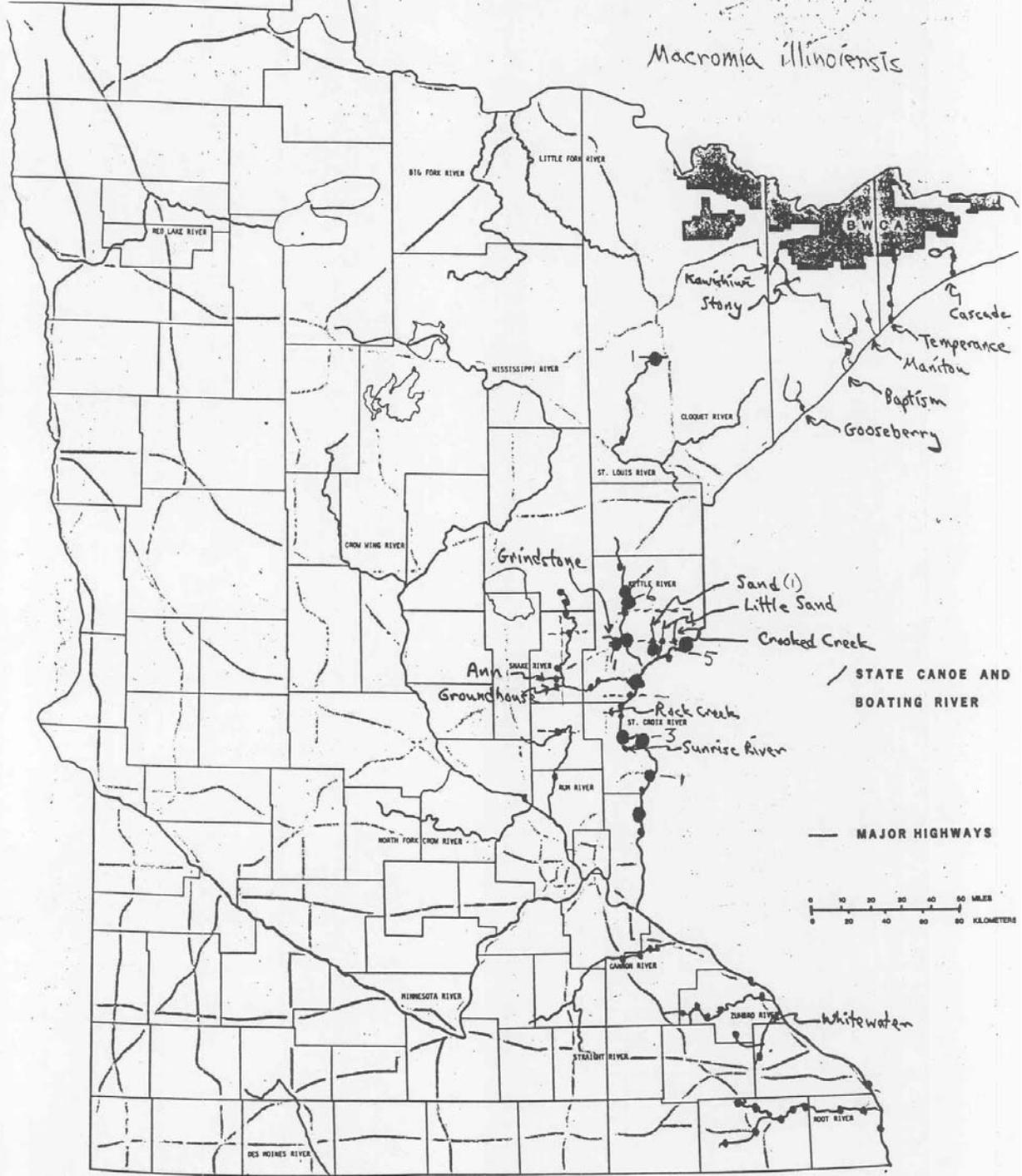


Basiaeshna janata





Macromia illinoensis

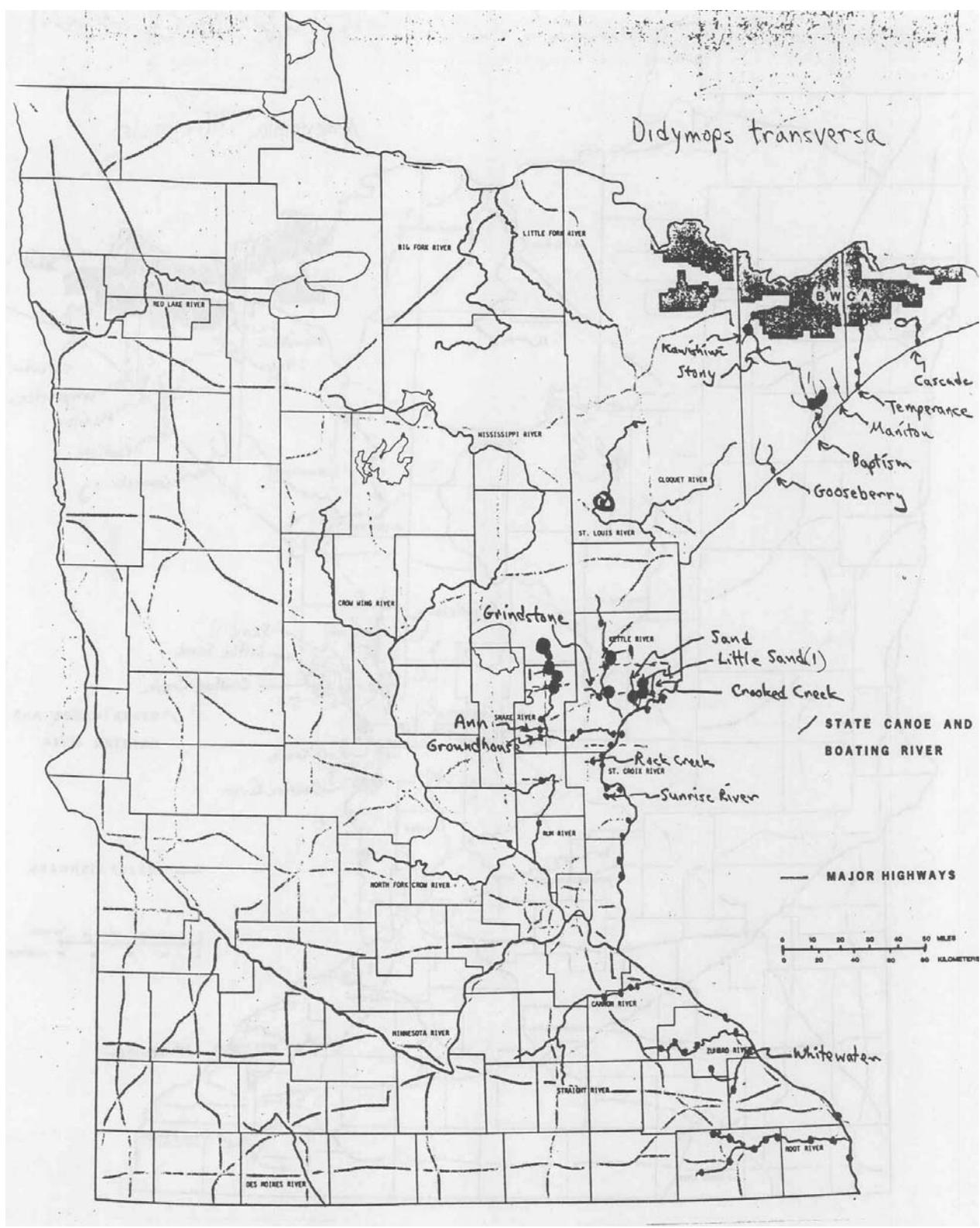


STATE CANOE AND BOATING RIVER

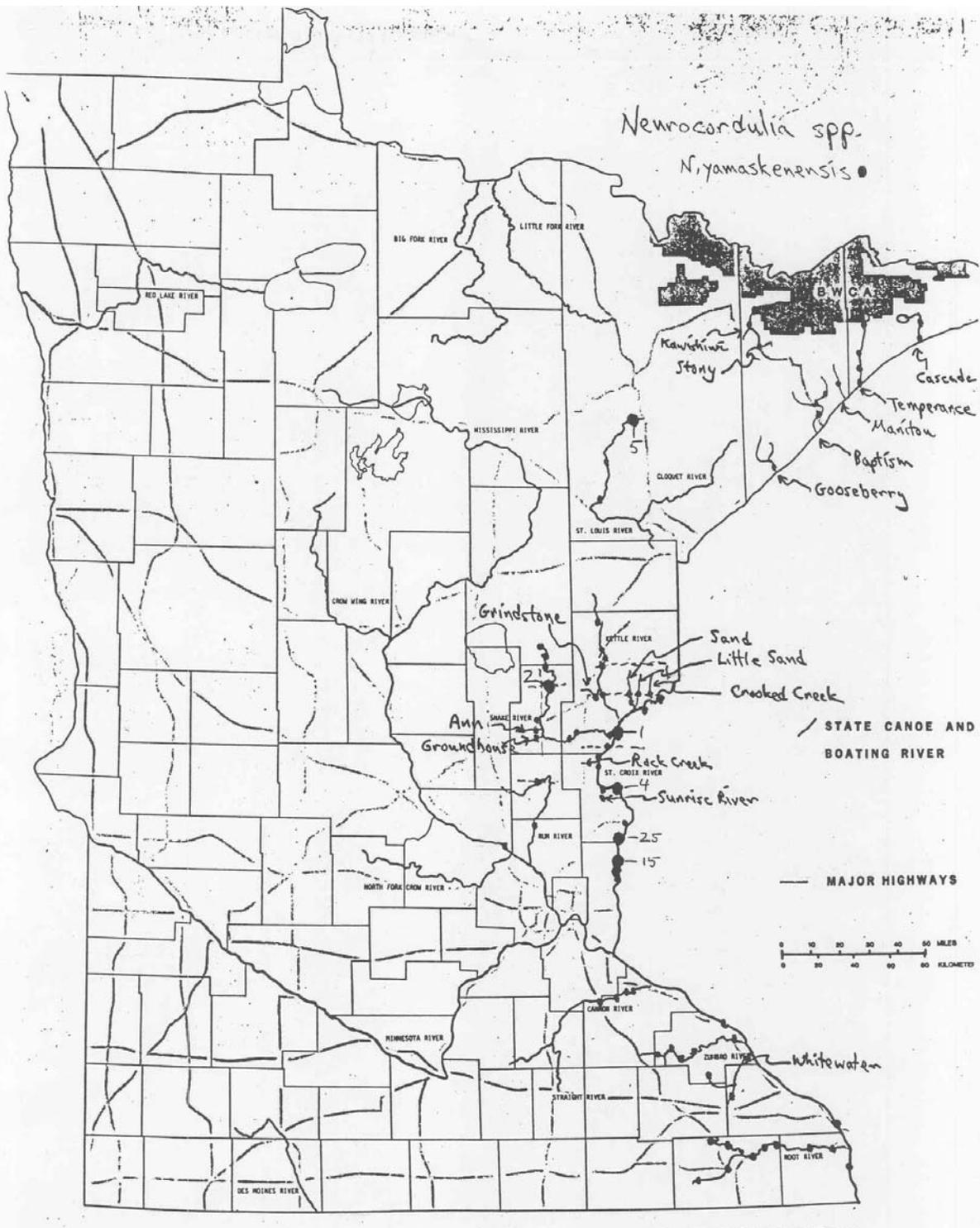
MAJOR HIGHWAYS



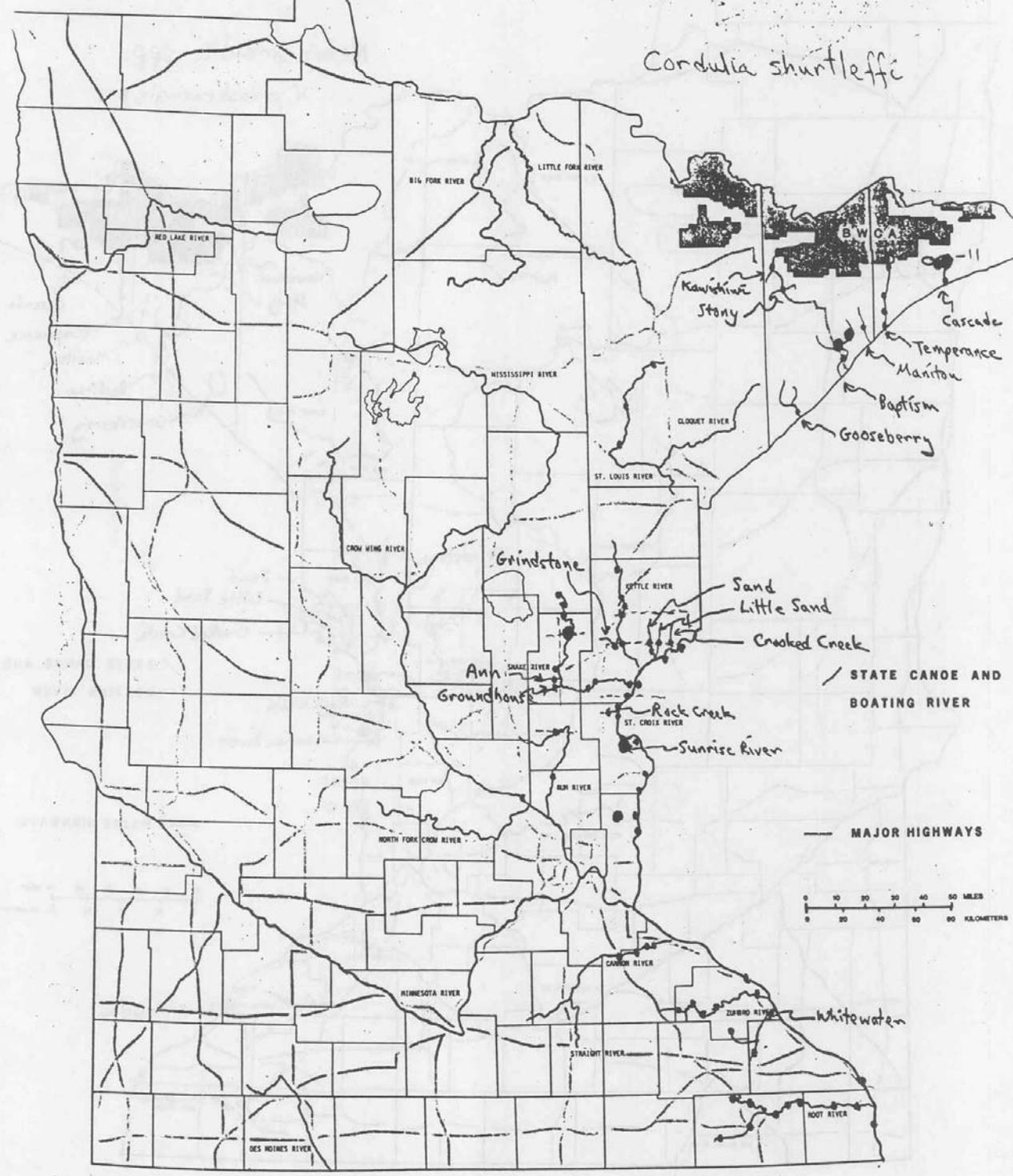
Didymops transversa

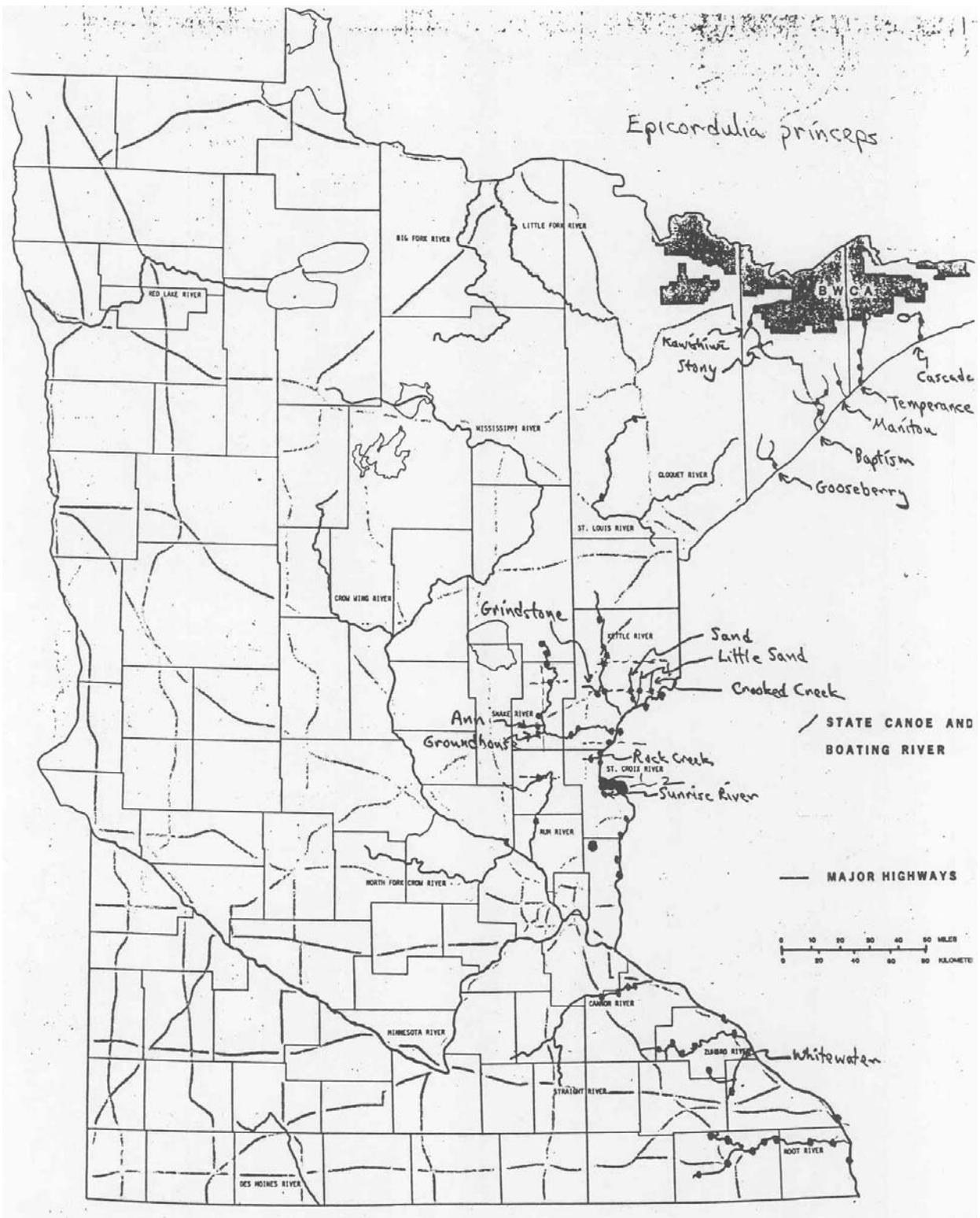


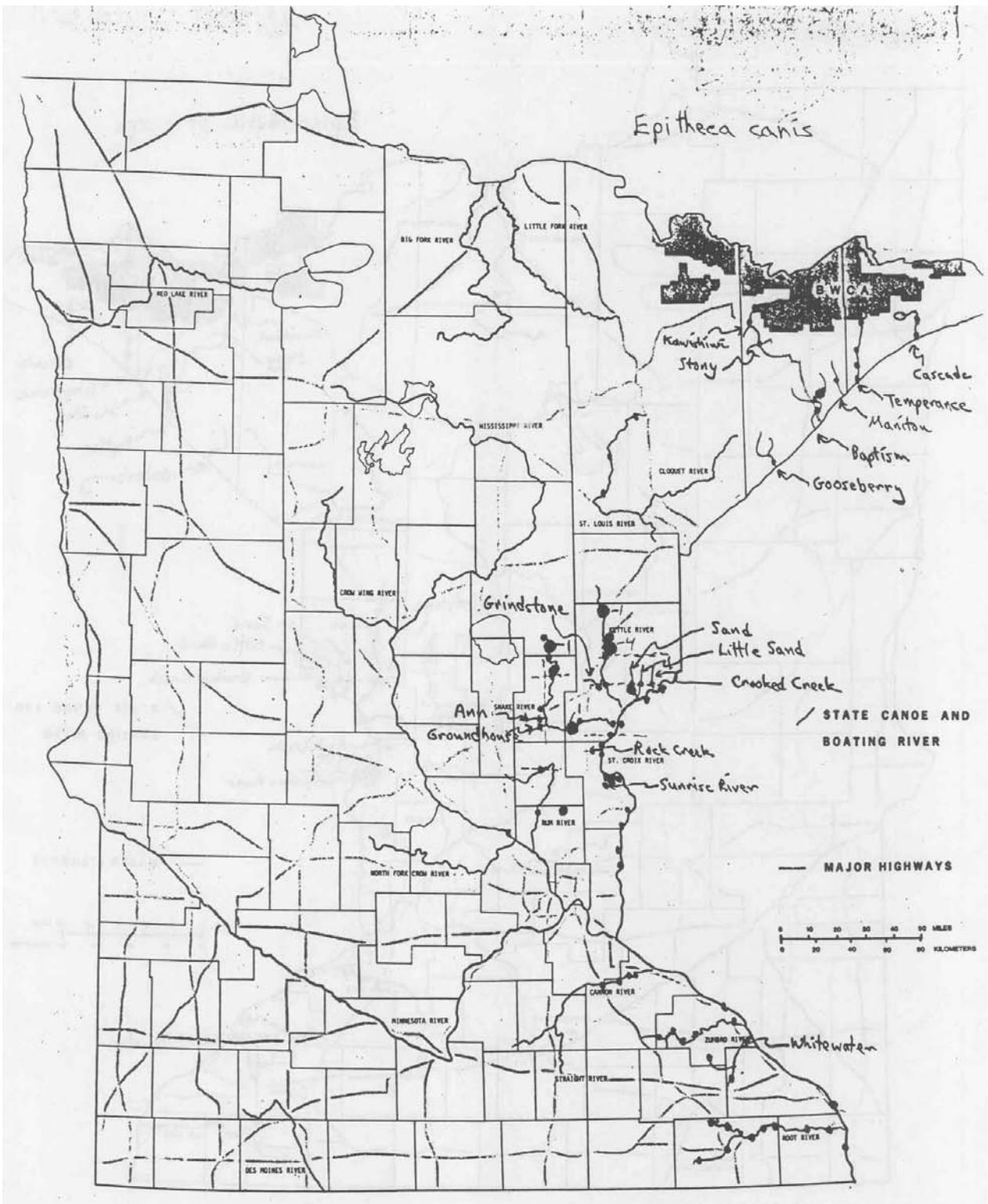
Neurocordulia spp.
N. yamaskenensis ●



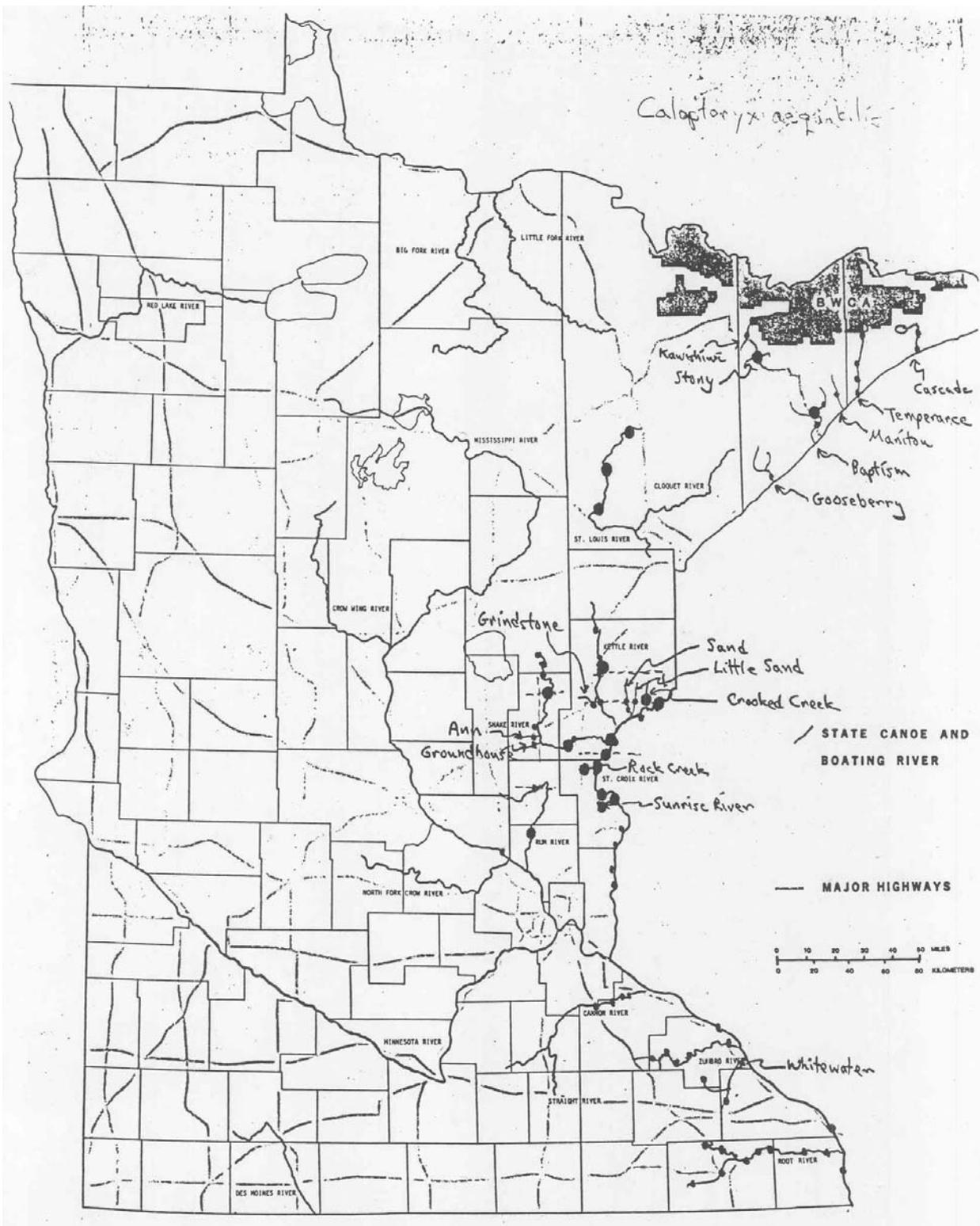
Cordulia shurtleffi



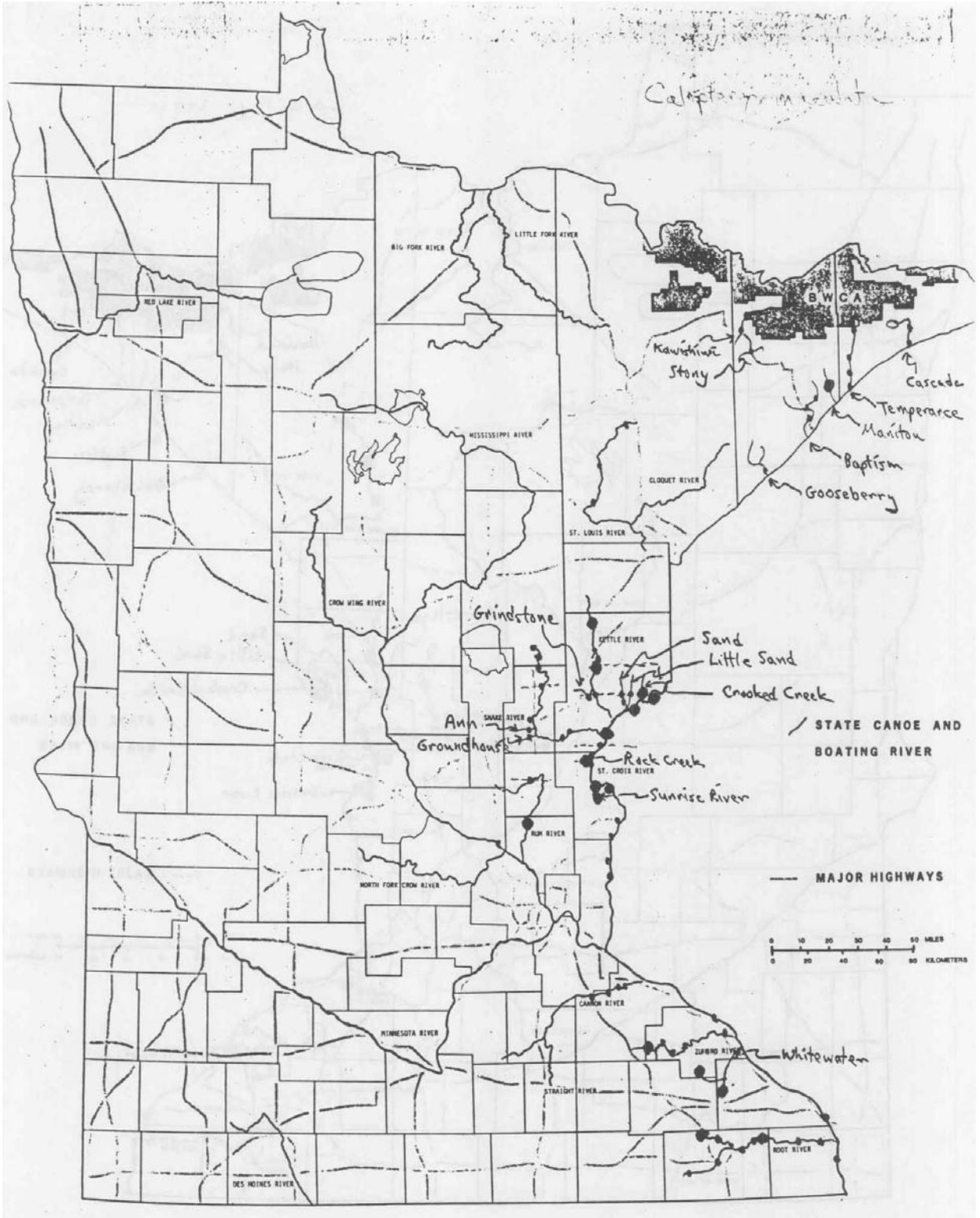




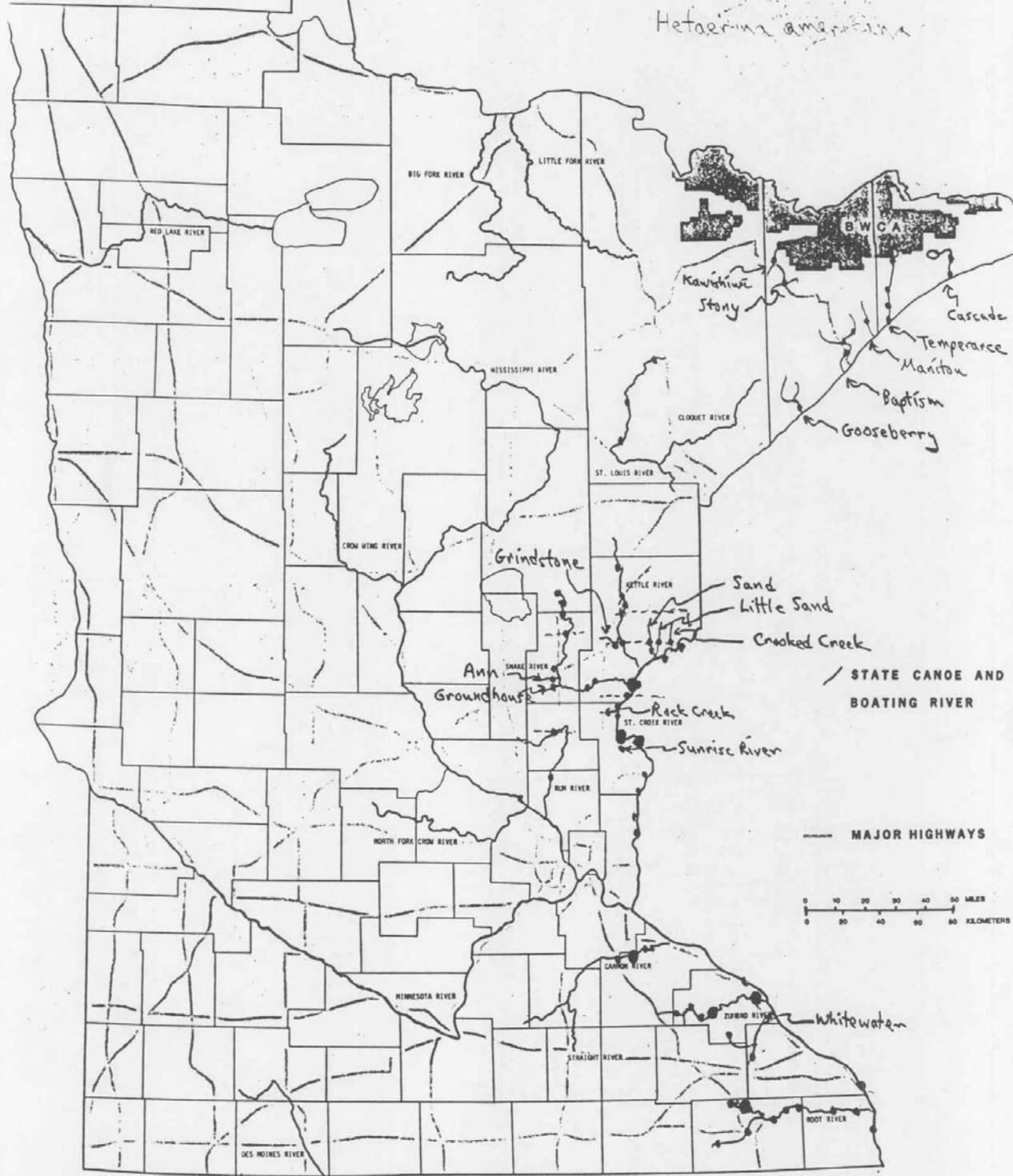
Calopteryx aequabilis



Calopteryx maculata

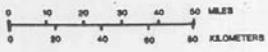


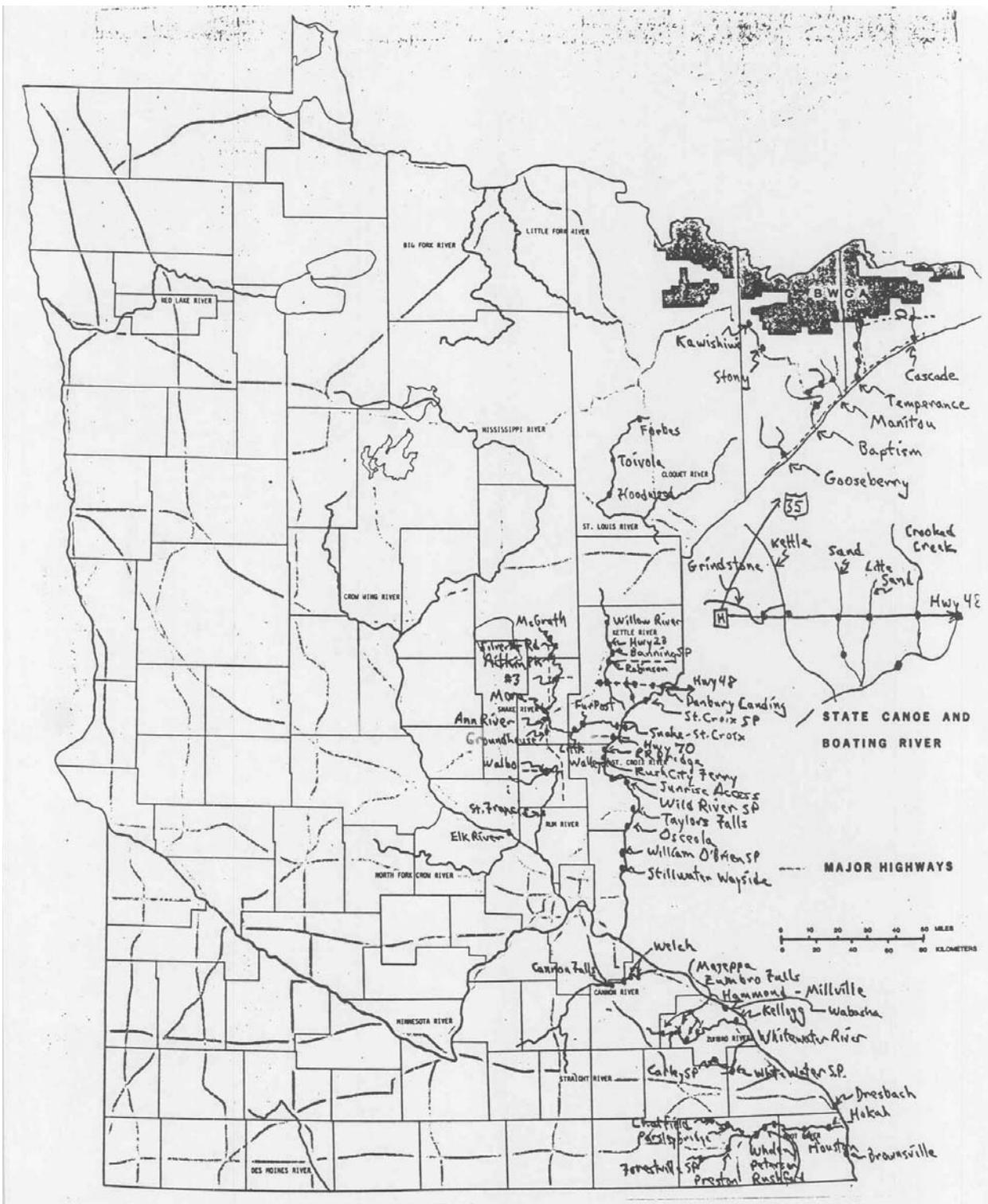
Heterom americana



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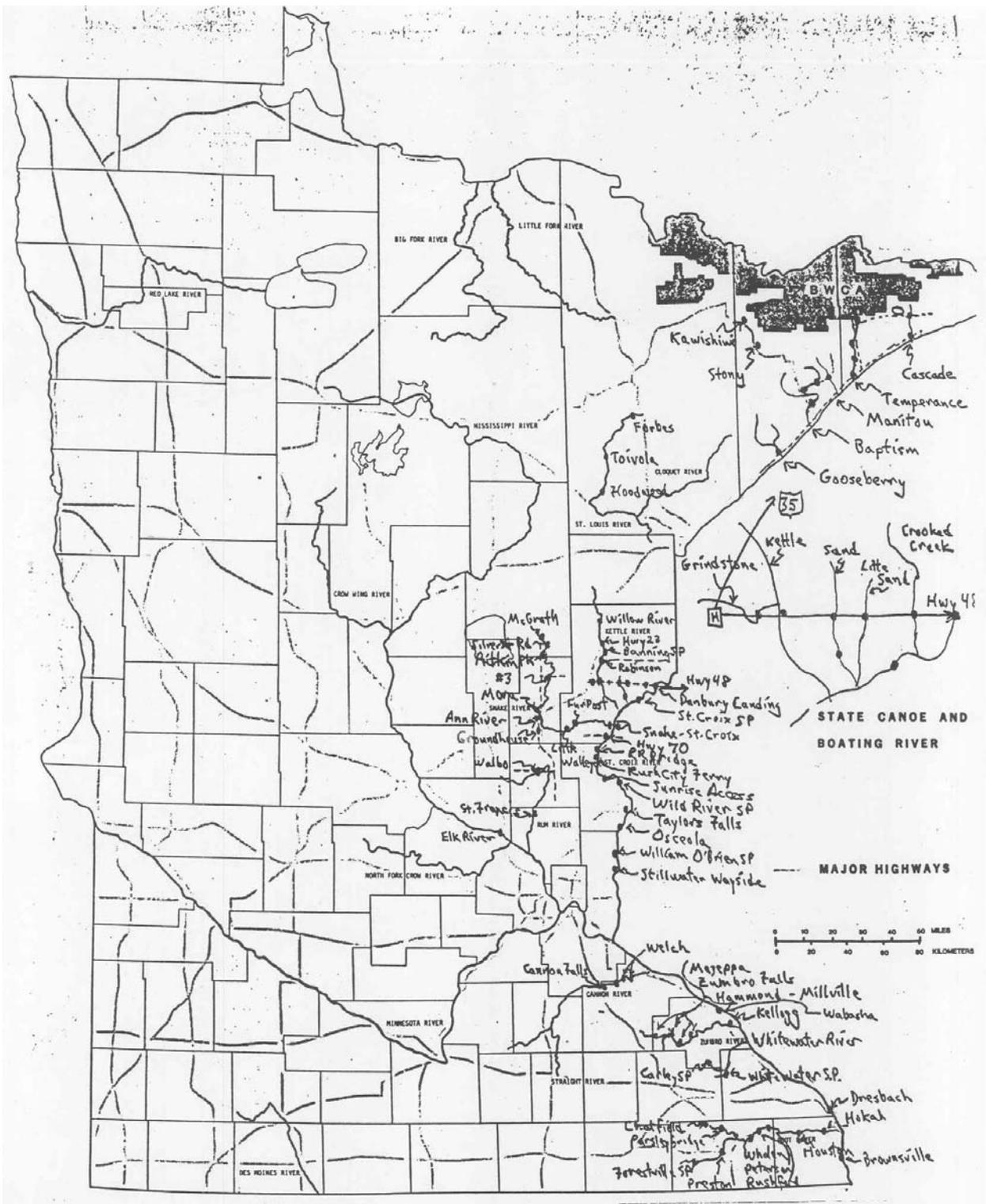


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B.W.C.A.



Heterina americana

