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Distribution and habitat preference of Minnesota dragonfly species (Odonata, Anisoptera) II.

CHARLES L. HAMRUM,* MYRON A. ANDERSON,** AND MARILEE BOOLE***

ABSTRACT—Five of the 70 Anisopteran species listed in this study represent new Minnesota recordings. Habitat zones are described and distribution of species within these zones are recorded by county of occurrence.

In an earlier study (Carlson *et al.*, 1967) the authors presented a list of Anisopteran species resident in Minnesota as well as a summary of the geographic and seasonal distribution of these species. Subsequent collections have effected changes in the species list and distribution patterns, and have shown extended flying periods for several species. These additional records are pooled with the data presented in Carlson *et al.* (1967). In this study our aims are: (1) to update the list of Anisopteran species known to occur in Minnesota; (2) to present the distribution of these species by listing the Minnesota counties in which each species has been collected; and (3) to demonstrate habitat preferences of these species within Minnesota.

In all areas of the state the aquatic situations that serve Odonata are many and varied, so that resident Anisopteran species are not uniformly distributed throughout Minnesota. It has been quite a problem to describe this distribution of dragonflies in terms of familiar ecological categories, (i.e., oligotrophic fauna, prairie species, etc.) A particular species may be found in several habitats, but only within a portion of the state. Such localized occurrence may occasionally be explained if habitat selection and species dispersal is an adult function, in which case migration may account for the presence of a particular species in a portion of the state. Corbet (1962) suggests that habitats which become abruptly unsuitable after a generation are probably colonized annually by migrants.

Kormondy (1958) described the distribution of Michigan odonate species as upper peninsula, in one or both lower peninsula zones, or statewide. He also divided the Michigan odonates into three general North American regional groups; namely, eastern, transcontinental, and northwestern species groups. In 1967 we adopted the position that the distribution of Minnesota Anisoptera is largely influenced by the nature of the aquatic environments open to the immatures of the species. A map showing general vegetation zones was used to indicate gross habitat preference for Minnesota species. These zones did correlate with the chemical analysis of Minnesota waters by Moyle (1956) in which he found a general pattern of increasing concentration of chemicals from the soft water lakes of northeastern Minnesota towards the west and

south. Nevertheless, we have abandoned the vegetation zones for the precipitation less evaporation zones of Meyer (1942), fully recognizing that any single parameter for zoning the state in accordance with its Anisopteran species distribution is inadequate.

In Minnesota, rainfall varies from 20 inches in the northwest to about 32 inches in the southeast. The evaporation rate has an important effect in concentrating salts in the water. Lakes in the northeast receive about 10 inches of rainfall in excess of moisture lost through surface evaporation. Runoff waters also are more abundant in the easterly portions of the state, supplying lakes with adequate waters to maintain active outlets. The waters therefore are constantly diluted. In southwestern lakes, evaporation from open surfaces exceeds precipitation by approximately 10 inches annually, resulting in generally intermittent outlets or landlocked conditions. The precipitation less evaporation zones are shown in Figure 1. These zones provide a more accurate estimate of the aquatic habitats of these regions. In zone I softwater lakes predominate, hardwater to alkaline lakes are the rule in zone II, and alkaline waters are expected in zone III. The habitat zones and flying season will follow the county records in the species list. For listing purposes, whole counties have been assigned to the zone which covers the bulk of the county. All distribution data has been obtained from adult specimens.

SPECIES LIST

Cordulegasteridae

Cordulegaster maculatus Selys. Lake, St. Louis, Zone I. June-July.

Gomphidae

Dromogomphus spinosus Selys. New State Record. Cook, Lake, St. Louis, Zone I. July-August.

Gomphus brevis Hagen. Cook, Lake, Zone I. June-July.

Gomphus cornutus Tough. Lake, Itasca, Zone I. Beltrami, Clearwater, Otter Tail, Winona, Sibley, Nicollet, Zone II. June-July.

Gomphus exilis Selys. Cook, Lake, St. Louis, Zone I. Stearns, Zone II. June-August.

Gomphus externus Hagen. Otter Tail, Winona, Nicollet, Le Sueur, Blue Earth, Martin, Zone II. June-July.

Gomphus fraternus (Say). Pine, Koochiching, Zone I. Winona, Nicollet, Le Sueur, Martin, Zone II. June-July.

Gomphus graslinellus Walsh. Cook, Koochiching, Zone I. Otter Tail, Zone II. June-July.

Gomphus lividus Selys. Lake, St. Louis, Pine, Zone I. June-July.

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- Gomphus quadricolor* Walsh. New State Record. Lake, Zone I. One specimen collected June 30.
- Gomphus spicatus* Hagen. Cook, St. Louis, Pine, Koochiching, Itasca, Aitkin, Zone I. Beltrami, Clearwater, Otter Tail, Douglas, Stearns, Zone II. May-July.
- Gomphus vastus* Walsh. Koochiching, Zone I. Winona, Nicollet, Zone II. June-August.
- Gomphus ventricosus* Walsh. New State Record. Winona, Zone II. One specimen collected June 5.
- Hagenius brevistylus* Selys. Cook, Lake, St. Louis, Koochiching, Zone I. Cass, Zone II. June-August.
- Ophigomphus carolus* Needham. Cook, Lake, Zone I. June-July.
- Ophiogomphus colubrinus* Selys. Cook, Lake, St. Louis, Zone I. June-August.
- Ophigomphus rupinsulensis* (Wash). Lake, St. Louis, Pine, Zone I. Pennington, Zone II. June-July.

Aeshnidae

- Aeshna canadensis* Walker. Cook, Lake, St. Louis, Pine, Koochiching, Itasca, Aitkin, Zone I. Roseau, Beltrami, Cass, Crow Wing, Clearwater, Hubbard, Mahnomen, Hennepin, Kandiyohi, Nicollet, Le Sueur, Zone II. Redwood, Zone III. Statewide, June-October.
- Aeshna constricta* Say. Pine, Lake of the Woods, Itasca, Zone I. Roseau, Cass, Crow Wing, Marshall, Polk, Clearwater, Todd, Washington, Mahnomen, Clay, Becker, Stearns, Hennepin, Pope, Kandiyohi, McLeod, Nicollet, Le Sueur, Blue Earth, Waseca, Faribault, Freeborn, Watonwan, Zone II. Redwood, Zone III. Statewide, July-September.
- Aeshna eremita* Scudder. Cook, Lake, Zone I. Polk, Clearwater, Zone II. June-September.
- Aeshna interrupta* Walker. Cook, Lake, Pine, Lake of the Woods, Koochiching, Itasca, Zone I. Roseau, Crow Wing, Kittson, Red Lake, Polk, Clearwater, Anoka, Clay, Pope, McLeod, Nicollet, Le Sueur, Faribault, Watonwan, Zone II. Grant, Redwood, Zone III. Statewide, June-September.
- Aeshna tuberculifera* Walker. Pine, Itasca, Zone I. Beltrami, Crow Wing, Clearwater, Zone II. July-August.
- Aeshna Umbrosa* Walker. Cook, Lake, Pine, Itasca, Zone I. Roseau, Beltrami, Crow Wing, Clearwater, Hubbard, Todd, Norman, Nicollet, Le Sueur, Watonwan, Zone II. Grant, Zone III. Statewide, July-November.
- Aeshna verticalis* Hagen. Itasca, Zone I. One specimen, presently missing.
- Anax junius* (Drury). Pine, Lake of the Woods, Zone I. Beltrami, Crow Wing, Marshall, Polk, Clearwater, Benton, Ramsey, Washington, Clay, Douglas, Stearns, Hennepin, Winona, Houston, Pope, Kandiyohi, Fillmore, Renville, Nicollet, Le Sueur, Faribault, Watonwan, Martin, Zone II. Grant, Redwood, Cottonwood, Big Stone, Zone III. Statewide, April-October.
- Basiaeshna janata* (Say). Cook, Lake, St. Louis, Pine, Zone I. Otter Tail, Zone II. June-July.
- Boyeria grafiana* Williamson. New State Record. Cook, Lake, Zone I. July-August.
- Boyeria vinosa* (Say). St. Louis, Zone I. August.

Libellulidae, Macrominae

- Didymops transversa* (Say). Cook, Lake, Pine, Zone I. Crow Wing, Ramsey, Zone II. June-July.
- Macromia illinoensis* Walsh. Lake, St. Louis, Pine, Itasca, Zone I. June-July.

Cordulinae

- Cordulia shurtleffi* Scudder. Cook, Lake, St. Louis, Zone I. June-July.
- Dorocordulia libera* (Selys). Cook, Lake, Aitkin, Zone I. Crow Wing, Clearwater, Zone II. June-July.
- Epithea (Epicordulia) princeps* (Hagen). Pine, Zone I. Beltrami, Clearwater, Otter Tail, Hennepin, Houston, Zone II. June-August.
- Epithea (Tetragoneuria) canis* MacLachlan. Lake, St. Louis, Koochiching, Itasca, Zone I. June.
- Epithea (Tetragoneuria) cynosura* (Say). Cook, Lake, St. Louis, Pine, Itasca, Zone I. Beltrami, Cass, Crow Wing, Clearwater, Ramsey, Otter Tail, Wright, Hennepin, Winona, Le Sueur, Zone II. June-July.
- Epithea (Tetragoneuria) spinigera* Selys. Cook, Lake, St. Louis, Pine, Itasca, Aitkin, Zone I. Beltrami, Crow Wing, Clearwater, Sherburne, Washington, Otter Tail, Hennepin, Carver, Kandiyohi, Nicollet, Zone II. June-July.
- Neurocordulia molesta* Walsh. New State Record. Winona, Zone II. One specimen, June 23.
- Somatochlora ensigera* Martin. Cook, Lake of the Woods, Zone I. Polk, Zone II. July-August.
- Somatochlora franklini* (Selys). Koochiching, Zone I. June.
- Somatochlora minor* Calvert. Cook, Lake, St. Louis, Zone I. June-July.
- Somatochlora walshii* (Scudder). Itasca, Zone I. July.
- Somatochlora williamsoni* Walker. Cook, Lake, St. Louis, Zone I. Clearwater, Zone II. July-August.

Libellulinae

- Celithemis elisa* (Hagen). Pine, Zone I. Crow Wing, Clearwater, Hubbard, Otter Tail, Zone II. June-August.
- Celithemis eponina* (Drury). Pine, Aitkin, Zone I. Crow Wing, Chisago, Clearwater, Hubbard, Otter Tail, Douglas, Stearns, Wright, Hennepin, Goodhue, Winona, Houston, Nicollet, Zone II. Grant, Zone III. Statewide, July-August.
- Erythemis simplicicollis* (Say). Crow Wing, Clearwater, Becker, Otter Tail, Douglas, Wright, Hennepin, Winona, Houston, Nicollet, Le Sueur, Zone II. June-August.
- Ladona julia* (Uhler). Cook, Lake, St. Louis, Pine, Itasca, Aitkin, Zone I. Beltrami, Cass, Crow Wing, Clearwater, Becker, Otter Tail, Zone II. June-July.
- Leucorrhinia frigida* (Hagen). Cook, Lake, Itasca, Zone I. Crow Wing, Clearwater, Winona, Zone II. June-August.
- Leucorrhinia glacialis* Hagen. Cook, Lake, Pine, Zone I. Clearwater, Zone II. June-July.
- Leucorrhinia hudsonica* (Selys). Cook, Lake of the Woods, Zone I. Clearwater, Zone II. June-July.
- Leucorrhinia intacta* (Hagen). Pine, Itasca, Aitkin, Zone I. Beltrami, Cass, Crow Wing, Pennington, Clearwater, Hubbard, Ramsey, Becker, Otter Tail, Hennepin, Wabasha, Winona, Kandiyohi, Rice, Nicollet, Zone II. May-August.
- Leucorrhinia proxima* Calvert. Cook, Lake, St. Louis, Pine, Koochiching, Itasca, Zone I. Beltrami, Crow Wing, Clearwater, Hubbard, Zone II. June-August.
- Libellula luctuosa* Burmeister. Otter Tail, Stearns, Wright, Hennepin, Wabasha, Winona, Nicollet, Le Sueur, Zone II. Cottonwood, Zone III. June-August.
- Libellula pulchella* Drury. Pine, Itasca, Zone I. Chisago, Clearwater, Hubbard, Mahnomen, Otter Tail, Stearns,

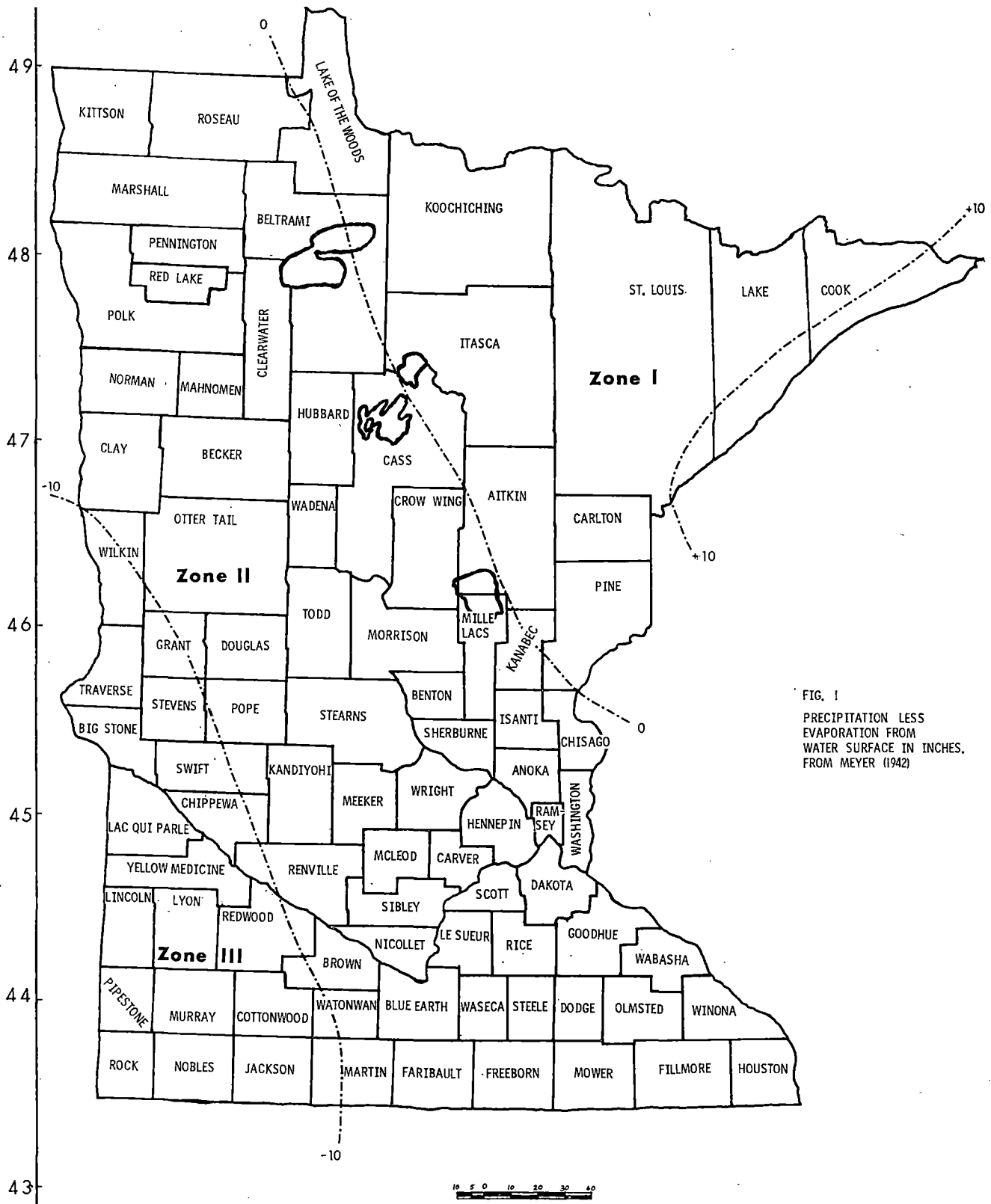


FIG. 1
PRECIPITATION LESS
EVAPORATION FROM
WATER SURFACE IN INCHES.
FROM MEYER (1942)

Wright, Hennepin, Winona, Houston, McLeod, Carver, Renville, Nicollet, Le Sueur, Faribault, Freeborn, Watowan, Zone, II. Wilkin, Grant, Chippewa, Cottonwood, Traverse, Big Stone, Zone III. Statewide, June-September.

Libellula quadrimaculata Linnaeus. Cook, Lake, St. Louis, Pine, Koochiching, Itasca, Zone I. Beltrami,

Cass, Crow Wing, Mille Lacs, Marshall, Clearwater, Washington, Mahnommen, Becker, Otter Tail, Stearns, Winona, Kandiyohi, Nicollet, Le Sueur, Watowan, Zone II. Grant, Zone III. Statewide, May-August.

Pachydiplax longipennis (Burmeister). Itasca, Zone I. Cass, Clearwater, Hubbard, Douglas, Hennepin, Kandiyohi, Nicollet, Le Sueur, Zone II. July-September.

Pantala flavescens (Fabricius). Clearwater, Nicollet, Zone II. Traverse, Zone III. July-August.

Pantala hymenea (Say). Nicollet, Le Sueur, Zone II. Cottonwood, Zone III. June-August.

Perithemis tenera (Say). Hubbard, Becker, Otter Tail, Wright, Hennepin, Winona, Houston, Le Sueur, Zone II. Grant, Zone III. July-August.

Plathemis lydia (Drury). Pine, Itasca, Zone I. Beltrami, Cass, Hennepin, Winona, Houston, Carver, Nicollet, Le Sueur, Zone II. Grant, Redwood, Cottonwood, Zone III. Statewide, May-August.

Sympetrum costiferum (Hagen). Cook, St. Louis, Pine, Lake of the Woods, Koochiching, Itasca, Zone I. Beltrami, Crow Wing, Polk, Clearwater, Benton, Anoka, Ramsey, Becker, Otter Tail, Stearns, Wright, Hennepin, Wabasha, Winona, Kandiyohi, Nicollet, Le Sueur, Zone II. Wilkin, Grant, Redwood, Traverse, Big Stone, Zone III. Statewide, July-October.

Sympetrum danae (Sulzer). St. Louis, Koochiching, Zone I. Beltrami, Washington, Otter Tail, Zone II. July-August.

Sympetrum internum Montgomery. Lake, Carlton, Pine, Koochiching, Itasca, Aitkin, Zone I. Roseau, Beltrami, Crow Wing, Kittson, Marshall, Red Lake, Polk, Clearwater, Hubbard, Anoka, Ramsey, Mahnomon, Clay, Otter Tail, Stearns, Winona, Kandiyohi, Rice, Renville, Nicollet, Le Sueur, Zone II. Grant, Jackson, Traverse, Lac Qui Parle, Rock, Zone III. Statewide. June-September.

Sympetrum obtusum (Hagen). Lake, Pine, Lake of the Woods, Koochiching, Itasca, Aitkin, Zone I. Beltrami, Cass, Crow Wing, Isanti, Pennington, Clearwater, Washington, Clay, Becker, Otter Tail, Hennepin, Winona, Kandiyohi, Rice, Nicollet, Le Sueur, Freeborn, Zone II. Grant, Lac Qui Parle, Zone III. Statewide, June-October.

Sympetrum occidentale Bartenev. Hennepin, Nicollet, Watonwan, Zone II. Redwood, Traverse, Zone III. July-August.

Sympetrum rubicundulum (Say). Carlton, Pine, Zone I. Roseau, Kittson, Pennington, Anoka, Norman, Clay, Becker, Otter Tail, Douglas, Winona, Houston, Pope, Kandiyohi, Rice, Olmsted, Nicollet, Le Sueur, Freeborn, Zone II. Grant, Redwood, Zone III. Statewide, June-September.

Sympetrum semicinctorum (Say). Beltrami, Crow Wing, Kandiyohi, Zone II. July-August.

Sympetrum vicinum (Hagen). Cook, Pine, Itasca, Zone I. Beltrami, Isanti, Chisago, Anoka, Ramsey, Washington, Stearns, Wright, Hennepin, Winona, Kandiyohi, Nicollet, Le Sueur, Zone II. Grant, Stevens, Zone III. Statewide, July-October.

Tarnetrum corruptum Hagen. Pine, Itasca, Zone I. Crow Wing, Marshall, Pennington, Clearwater, Otter Tail, Stearns, Hennepin, Winona, McLeod, Renville, Nicollet, Le Sueur, Watonwan, Martin, Zone III. Cottonwood, Big Stone, Zone III. Statewide, April-October.

Tremea lacerata Hagen. Houston, Nicollet, Le Sueur, Freeborn, Watonwan, Zone II. Redwood, Zone III. June-September.

Tremea onusta Hagen. Winona, Nicollet, Le Sueur, Watonwan, Zone II. June-September.

Five of the seventy Anisopteran species represent first state records. These species are *Dromogomphus spinosus*, *Gomphus quadricolor*, *Gomphus ventricosus*, *Boyeria grafiana*, and *Neurocordulia molesta*. Fifty-eight species

are found in Zone I, fifty-five in Zone II, twenty-one in Zone III, and only fifteen are found in all three zones. These records indicate that the collecting in Zone III should be extended. It seems most unlikely that only fifteen species have a statewide distribution. Several libellulid species, e.g., *Erythemis simplicicollis*, *Leucorrhinia intacta* et al. must also occur in Zone III.

Inasmuch as six out of every seven dragonflies known to Minnesota reside in Zone I, it would appear that this environment is well suited for a wide variety of species. The lakes, bogs, and streams of this region generally have an ample supply of cool, well oxygenated water. All but two of the gomphid and cordulid species have been reported from Zone I. Among the Aeshnidae genera, the *Boyeria* species seem to be restricted to this region. Additional collections in this zone may yield other unreported gomphids and *Somatochlora* species. Actually, thirteen Minnesota species have been reported from Zone I only.

The Libellulidae species *Libellula luctuosa*, *Perithemis tenera*, and the *Pantala* and *Tremea* species are absent from northern Minnesota. Both *Pantala* and *Tremea* are known to have a short developmental period and may migrate into Minnesota from the south and establish themselves for the summer. It is difficult, however, to imagine the diminutive, weak-flying *Perithemis tenera* as a successful migrant. The migration behavior among Minnesota dragonflies is essentially unmeasured and its effect upon the distribution within the state must be considered speculative.

Additional investigations of dragonfly breeding waters are in progress. Important factors such as water temperature and oxygen content will vary considerably within the precipitation less evaporation zones, particularly spacious Zone II. The effects of various pollutants upon immature odonate life is also largely unknown. Additional study will hopefully further enrich our knowledge concerning the environmental requirements of Minnesota dragonfly species.

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