

AN ANNOTATED LIST OF THE ODONATA
OF THE DAKOTAS¹GEORGE H. BICK², JUANDA C. BICK², LOTHAR E. HORNUFF³

ABSTRACT

Adult odonates were collected daily from 23 June to 3 August 1976 in most major areas of the Dakotas. These collections, museum specimens, and the literature yielded 77 species for the 2 states, 53 for North Dakota (ND), 65 for South Dakota (SD). Among these are 7 from ND, 27 from SD for which there are no previous published state records. County records are presented for the 77 substantiated species, range limits of many are described, and continental distributions analyzed. The Dakota fauna is 49% transcontinental, 29% western, 14% eastern, 8% central. However, the number of eastern and western components become similar when species recorded in the Dakotas only from the Black Hills are subtracted from the eastern and western lists. Lists of unconfirmed and of deleted species are presented.

Distribution studies of many Nearctic species of Odonata have been impeded by a scarcity of information from the Dakotas, for which there are no comprehensive published state lists and few definite locality records. This paper attempts to remedy this situation by presenting results of our own intensive collecting in both states and by bringing the scattered museum and literature records together in order to define range limits of certain species more precisely and to analyze the continental distribution of the Dakota fauna.

Muttkowski (1910), Needham and Heywood (1929), Walker (1953, 1958) and Walker and Corbet (1975) occasionally refer to one or both of the Dakotas when defining the range limits of certain species. In their comprehensive treatment of Anisoptera, Needham and Westfall (1955) list only 8 species for North Dakota (ND), 8 for South Dakota (SD). Montgomery (1967) updates these records with a list of 25 species of Odonata for ND. There are few published records giving counties or specific localities for the Dakotas: Walker (1912, 1951), Kormondy (1957, 1960), Bick and Hornuff (1972), Johnson (1973, 1974). Even though the last 3 authors add 23 species to the SD and 2 to the ND lists, the number of species of Odonata recorded for the Dakotas in the published literature is small when compared with states where collecting has been more thorough, and it scarcely indicates the true diversity of the fauna. The only work dealing specifically with one of the Dakotas, ND, is Alby's (1968) unpublished MS thesis which unfortunately is not generally available.

Adult odonates were collected daily from 23 June to 3 August 1976 in most major areas of both states. The 122 collections produced 37 species from ND and 60 from SD. Representatives of some common species were discarded, a sample was deposited in the E. B. Williamson Collection in the Museum of Zoology, University of Michigan, and others remain in the authors' collections.

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In addition, with the kind assistance of Mrs. L. K. Gloyd, records of Dakota specimens deposited in the E. B. Williamson Collection were obtained. Drs. M. Westfall and C. Johnson kindly sent county records of Dakota species in the Florida State Collection of Arthropods. Nearly all of these were collected by Mr. Milan Alby for his thesis at North Dakota State University. He has graciously given full cooperation, permitting use of his unpublished thesis and of the maps on which much of it was based. Specimens were borrowed from Cornell University through the courtesy of Dr. L. L. Pechuman, and Drs. D. G. Huggins, M. L. May and D. Paulson allowed the use of unpublished material. To all of these we acknowledge our sincere appreciation.

The literature, museum specimens, and the 1976 collections yielded 77 species for the Dakotas (53 for ND, 65 for SD). These are the substantiated species, for each of which there is at least one county record. Among these are 7 species from ND and 27 species from SD for which there are no previous published records. For each species, references giving county records are presented, but those naming only the state are excluded. Counties are listed alphabetically, followed by documentation from literature and museum specimens. Number of collections of each species and individuals of each sex relate only to material which we actually collected. Whenever there are records for a particular species from 20 or more counties in one state, individual counties are not listed, but only their total number and the sources of information. It should be understood that such species are frequent and widespread in that state.

Our collections in Wyoming (WY) (Bick and Hornuff 1972), Montana (MT) (Bick and Hornuff 1974, and unpublished) and Oklahoma (OK) (Bick and Bick 1957, and unpublished), and records of Pruess (1967) for Nebraska (NB), Hamrum et al. (1971) for Minnesota (MN), Johnson (1972) for Texas (TX) and Huggins et al. (1976) for Kansas (KS) made it possible to describe range limits of certain of the Dakota species. When considering ranges, we often refer to the Northern Great Plains, a very large area which includes southern Saskatchewan (Sask.) and Manitoba (Man.), most of ND and SD, as well as eastern MT and WY. The list of substantiated Dakota species is followed by a faunal analysis and by lists of unconfirmed and deleted species. Additional state abbreviations used in the text are: Arkansas (AR), Arizona (AZ), California (CA), Colorado (CO), Iowa (IA), Missouri (MO), Nevada (NV), Utah (UT), Washington (WA), British Columbia (B.C.).

Counties are given in capitals, GHB refers to unpublished records by the authors in states other than the Dakotas, an asterisk indicates a previously unpublished record for the state, CU refers to the Cornell University Collection, EBW to the E. B. Williamson Collection, University of Michigan, and FSCA to the Florida State Collection of Arthropods.

SUBSTANTIATED SPECIES

Gomphus (Arigomphus) cornutus Tough

ND: GRAND FORKS, TRAILL (Alby 1968, EBW).

This central species, recorded from Winnipeg, Man. (Walker 1958) and rather frequent in MN (Hamrum et al. 1971), barely reaches ND where records are only from the extreme east.

Gomphus (Gomphurus) externus Hagen

ND: CASS, TRAILL (Kormondy 1960, EBW).

*SD: YANKTON (1 coll.: 1 male).

The northwestern limit of this central species extends from Winnipeg, Man. (Walker 1958) through BIG HORN, southern MT (Bick and Hornuff 1972) to BOX ELDER, northwestern UT (Musser 1962).

Gomphus (Gomphus) graslinellus Walsh

ND: DUNN-MERCER line, MOUNTRAIL, PEMBINA (Alby 1968, 1 coll.: 1 male).

SD: BROOKINGS, CUSTER, FALL RIVER (Bick and Hornuff 1972, 3 colls.: 4 male, 1 female, 1 pr.).

The western limit of the main range of this central species extends from Treesbank, southern Man. (Walker, 1958) through the Black Hills, SD, and BARTON, central KS (Huggins et al. 1976) to MURRAY, southcentral OK (Bick and Bick 1957). Records from B.C. and WA (Needham and Westfall 1955, Walker 1958) are widely separated from the main range.

Gomphus (Stylurus) intricatus Hagen

*SD: FALL RIVER (1 coll.: 1 female).

Kennedy (1917a) records this species from warm, muddy, sluggish rivers in NV, and the records of Huggins, et al., (1976) in KS also appear to be from sluggish streams. In contrast, the SD specimen was from a clear, swift, spring fed creek, smaller than the clear, swift, Niobrara River, CHERRY, northern NB, where we also collected this species.

Ophiogomphus severus severus Hagen

SD: CUSTER, LAWRENCE (Kormondy 1957, 3 colls.: 3 male, 5 female, 1 pr.).

The SD records of this western subspecies are along its eastern range limit which extends from Prince Albert, northern Sask. (Walker 1958) through the Black Hills to HAMILTON, Western KS (Huggins et al. 1976). Our collections were at lotic waters.

Aeshna californica Calvert

*SD: CUSTER (CU).

This is the easternmost record of this western species whose northern and eastern range limits extend from B.C. (Walker 1958) to southwestern SD and south to COCHISE, southeastern AZ (Walker 1912).

Aeshna constricta Say

ND: BARNES, BENSON, CASS, DICKEY, EDDY, FOSTER, GRAND FORKS, GRIGGS, LAMOURE, MORTON, NELSON, RAMSEY, RANSOM, RICHLAND, SARGENT, STEELE, STUTSMAN, TOWNER, TRAILL (Walker 1912, Alby 1968, EBW, FSCA).

SD: BROOKINGS (Walker 1912).

This transcontinental species which Alby (1968) found common late in the season was absent in our collections probably because of its late flight season.

Aeshna eremita Scudder

*ND: ROLETTE (3 colls.: 2 male, 3 female).

The distribution of this species which crosses Canada seems to be interrupted in the Northern Great Plains of the U.S. We did not encounter it in eastern MT, eastern WY or anywhere in SD, and collected it only in northernmost ND. At the International Peace Gardens, 2 were collected flying among a large swarm of *A. interrupta*.

Aeshna interrupta Walker

ND: 29 counties (Walker 1912, Alby 1968, EBW, FSCA, 10 colls.: 21 male, 13 female).

SD: CUSTER (Bick and Hornuff, 1972, as *A.i. interna* Walker). All of our ND specimens checked well with the subspecies *A.i. lineata* Walker. On

14, July at the International Peace Gardens, ROLETTE, we encountered a swarm of several hundred flying back and forth, hawking over the narrow, tree-bordered road. In 15 min 13 male, 8 female were collected, many more released. On 10, July a smaller swarm flew along a highway in the Devil's Lake area, EDDY, ND.

Aeshna multicolor Hagen

*SD: CHARLES MIX, FALL RIVER, YANKTON (4 colls.: 4 male, 3 female).

The northern range limit of this western species extends from southern B.C. (Walker 1958) through BIG HORN, southeastern MT (GHB) across southern SD to YANKTON. One collection was along a clear, swiftly flowing, spring fed creek.

Aeshna palmata Hagen

*SD: CUSTER, LAWRENCE, PENNINGTON (EBW; 5 colls.: 9 male, 1 female).

Walker (1958) states that *A. palmata*, a denizen of the forest, does not enter the Canadian prairies east of the Rocky Mts. except for one wooded area in Sask. Likewise, in the Dakotas, it was only in the wooded Black Hills.

Aeshna umbrosa Walker

ND: ADAMS, CASS, HETTINGER, RICHLAND, STARK (Alby 1968).

Alby collected this transcontinental species only after mid August, a late seasonal occurrence which may account for its absence in our collections.

Anax junius (Drury)

ND: CASS, DICKEY, MCHENRY, RICHLAND, ROLETTE (Alby, 1968; 1 sighting).

*SD: BROOKINGS, BROWN, BUTTE, CUSTER, DAY, FALL RIVER, YANKTON (2 colls.: 2 male; 9 sightings).

This species is now recorded from every state with the possible exception of Delaware. It is present in southern Man. (Walker 1958), rather frequent in SD, but we sighted it only once in ND. Alby (1968) collected only 3 adults in ND and considered that the species has decreased in the State in recent years.

Epitheca spinigera (Selys)

*ND: ROLETTE (1 coll.: 1 female).

Although this species crosses Canada (Walker and Corbet 1975), Kormondy (1959) states that it is unknown from the plains and Rocky Mt. areas of the U.S. but predicts its occurrence in these areas. The ROLETTE site in the wooded Turtle Mts. of northernmost ND is so close to sites in MN (Hamrum et al., 1971) and Man. (Walker and Corbet 1975) that this collection scarcely fulfills Kormondy's prediction.

Somatochlora ensigera Martin

ND: ADAMS, GRAND FORKS, LAMOURE, LOGAN, SHERIDAN, STARK (Alby 1968, 1 coll.: 1 male).

The LOGAN collection was from a habitat contrasting with those noted by Needham and Westfall (1955) and Walker and Corbet (1975). Rather than a mountain torrent or a forest stream, this collection was from a heavily cultivated, open prairie area where *S. ensigera* cruised along a narrow, shallow, mud-bottom creek which, because of drought, was actually a series of potholes.

Somatochlora minor Calvert

SD: CUSTER, LAWRENCE (Bick and Hornuff 1972, 1 coll.: 5 male).

These records from the Black Hills are along the southern range limit of this northern transcontinental species.

Brechmorhoga mendax (Hagen)

*SD: FALL RIVER (1 coll.: 1 female; 1 sighting).

Hitherto, the northern recorded limit of this species extended from HUMBOLDT, northern CA (Cruden 1964) through WASHINGTON, southwestern UT (Musser 1962) to PAYNE, northern OK (Bick and Bick 1957). The present collection from southwestern SD is approximately 900 km north of OK. The undisturbed SD site was a beautiful, clear, swiftly flowing, spring fed stream bordered with maidenhair ferns and containing abundant aquatic plants, primarily *Nasturtium* and *Eleocharis*. Here, 14 species of Odonata were recorded, 3 (*B. mendax*, *L. saturata*, *A. immunda*) well beyond their previously recorded range limits. The only individual of *B. mendax* collected was a teneral clinging to low vegetation, but a mature male, readily recognized by the pale abdominal marking, was seen defending territory along the creek.

Erythemis simplicicollis (Say)

ND: STARK (Alby 1968 considered the single specimen from a student collection questionable).

*SD: CHARLES MIX, YANKTON (3 colls.: 4 male).

Walker and Corbet (1975) state that this common, often abundant species may be absent in the Dakotas. Indeed, it is scarce in SD, doubtfully present in ND. Considering *E. collocata* (Hagen) a distinct species, the western limit of the eastern *E. simplicicollis* extends from CLEARWATER, northern MN (Hamrum, et al. 1971) through CHERRY, northern NB (GHB) to LUBBOCK, western TX (GHB) and southward.

Leucorrhinia borealis Hagen

ND: ROLETTE (Alby 1968).

In the U.S., this species has been reported only from the Rocky Mts. of UT (Musser 1962), WY (Bick and Hornuff 1972) and CO (Bick and Hornuff 1974). However, it is frequent in southern Man. (Walker and Corbet 1975) where it is reported from Ninette, only 56 km from the above ND site.

Leucorrhinia intacta (Hagen)

ND: BOTTINEAU, CASS, DICKEY, EDDY, FOSTER, GRAND FORKS, MCHENRY, MOUNTRAIL, NELSON, PEMBINA, RANSOM, RICHLAND, ROLETTE, STEELE, TRAILL (Alby 1968, EBW, FSCA, 5 colls.: 3 male, 6 female).

SD: BROOKINGS, BUTTE, DAY, LAWRENCE, MEADE, YANKTON (5 colls.: 5 male, 2 female; 3 sightings).

Leucorrhinia proxima Calvert

*ND: ROLETTE (2 colls.: 3 male).

The distribution of this northern transcontinental species appears to be interrupted in the Northern Great Plains of the United States. We did not collect it in eastern MT or WY or anywhere in SD and the above record is only 80 km south of the one from Treesbank (Aweme), Man. (Walker and Corbet 1975).

Libellula forensis Hagen

*SD: BUTTE, MEADE (1 coll.: 1 male; 1 sighting).

These records of this western species are at the northeastern corner of its range whose northern limit extends from B.C. (Walker and Corbet 1975) through LAKE, BIG HORN, YELLOWSTONE, MT (GHB) to southwestern SD, and whose eastern limit extends through NB (Pruess 1967) to the Pecos River, eastern NM (Kormondy 1960). At both SD sites, *L. forensis* occurred with *L. pulchella*.

Libellula luctuosa Burmeister

ND: DICKEY, RICHLAND (Alby 1968, 1 sighting).

SD: BUTTE, CHARLES MIX, MEADE, WASHABAUGH, YANKTON (4 colls.: 4 male; 3 sightings).

Libellula pulchella Drury

ND: CASS, DICKEY, GRAND FORKS, LOGAN, MCHENRY, MCINTOSH, MCLEAN, NELSON, RAMSEY, RICHLAND, ROLETTE, SLOPE, TRAILL (Kormondy 1960, Alby 1968, EBW, FSCA, 2 colls.: 2 male; 3 sightings).

SD: BROOKINGS, BROWN, BUTTE, CHARLES MIX, CUSTER, DAY, FALL RIVER, HARDING, LAWRENCE, MEADE, ROBERTS, WASHABAUGH, YANKTON (Kormondy 1960, EBW, 12 colls.: 10 male, 2 female; 15 sightings).

Libellula quadrimaculata L.

ND: BENSON, BOTTINEAU, CAVALIER, EDDY, GRAND FORKS, LOGAN, MCHENRY, NELSON, PEMBINA, RICHLAND, ROLETTE, SLOPE, TRAILL (Kormondy 1960, Alby 1968, EBW, FSCA, 6 colls.: 7 male, 1 female, 1 sighting).

SD: CUSTER, DAY, LAWRENCE (Kormondy 1957, 4 colls.: 2 male, 2 female, 3 sightings).

Libellula saturata Uhler

SD: FALL RIVER (Provonsa and McCafferty 1977, 1 coll.: 6 male, 1 female; 2 sightings).

The northern limit of this western species extends from GRANITE, western MT (GHB) to southwestern SD, and the eastern limit of the main range, through MORTON, southwestern KS (Huggins, et al. 1976) to KINNEY, southwestern TX (Dunkle 1975) and southward. The MO locality (Needham and Westfall 1955) is widely separated from the main range. These SD records were from clear, flowing spring fed streams, one of which was the only warm (27°C) water stream encountered and one, the beautiful site described for *B. mendax*. The population of *L. saturata* at the latter site is apparently well established since much pairing and ovipositing was noted.

Pachydiplax longipennis (Burmeister)

*SD: CHARLES MIX, YANKTON (1 coll.: 1 male; 1 sighting).

This transcontinental species, now recorded from nearly every state except ND, is very scarce in the Northern Great Plains. The very few SD records are only from the southeast; we did not collect it at all in eastern MT and eastern WY, and there is but one record from Man. (Walker and Corbet 1975).

Perithemis tenera (Say)

*SD: CHARLES MIX, DOUGLAS (2 colls.: 1 male, 2 female).

These records of this common eastern species are along its western limit which extends from HUBBARD, northern MN (Hamrum et al. 1971) through southeastern SD and CHEYENNE and MORTON, western KS (Huggins, et al. 1976) to LUBBOCK, western TX (GHB) and southward.

Plathemis lydia (Drury)

ND: RICHLAND (Alby 1968, FSCA).

SD: BROOKINGS, CHARLES MIX, CUSTER, FALL RIVER, WASHABAUGH, YANKTON (Kormondy 1960, EBW, 6 colls.: 7 male; 4 sightings).

Walker and Corbet (1975) exclude this transcontinental species from the Dakotas and MT. In addition to the above Dakota records, Newell (1970)

reports it from MT where we collected it from FLATHEAD, LAKE, MISSOULA, CARTER.

Sympetrum corruptum (Hagen)

ND: BENSON, BILLINGS, BOTTINEAU, DICKEY, DUNN, EDDY, FOSTER, GRAND FORKS, MCINTOSH, MCLEAN, RAMSEY, RICHLAND, ROLETTE, SHERIDAN, SLOPE, STUTSMAN, WILLIAMS (Kormondy 1960, Alby 1968, EBW, FSCA, 2 colls.: 2 male, 1 female; 3 sightings).

SD: BROOKINGS, BUTTE, DAY, MEADE, PENNINGTON, YANKTON (EBW; 6 colls.: 7 male, 1 female, 1 pr.; 2 sightings).

Sympetrum costiferum (Hagen)

ND: 22 counties (Kormondy 1960, Alby 1968, EBW, FSCA, 1 coll.: 1 female).

SD: PENNINGTON, YANKTON (Bick and Hornuff 1972, EBW).

Alby (1968) considers this northern transcontinental species common in ND late in the season. Its late flight season probably accounts for its scarcity in our collections.

Sympetrum danae (Sulzer)

ND: RICHLAND, ROLETTE (Kormondy 1960, Alby 1968, EBW, FSCA).

*SD: PENNINGTON (EBW).

Although frequent in Man. (Walker and Corbet 1975), this circumboreal species is now recorded from only 3 Dakota counties and we did not collect it in the Dakotas or in eastern WY or MT. Alby (1968) records a very late flight season, but its scarcity in the Northern Great Plains is not due entirely to scanty late season collecting. Kormondy (1960) reports it for ND in July and we collected it during that month in mountain areas of both western MT and WY.

Sympetrum internum Montgomery

ND: 47 counties (Alby 1968, EBW, FSCA, 38 colls.: 144 male, 8 prs.).

*SD: BROOKINGS, BROWN, CHARLES MIX, CUSTER, DAY, FALL RIVER, HARDING, LAWRENCE, WASHABAUGH, YANKTON (17 colls.: 45 male, 4 prs.).

This transcontinental species was the most frequent and abundant anisopteran in the Dakotas.

Sympetrum madidum (Hagen)

ND: BENSON, BILLINGS, BOTTINEAU, EDDY, FOSTER, LOGAN, PIERCE, ROLETTE, SLOPE, TRAILL (Alby 1968, FSCA).

The BOTTINEAU and ROLETTE sites in northern ND are near those in Man. (Walker and Corbet 1975) which are the northernmost for this western species.

Sympetrum obtrusum (Hagen)

ND: BENSON, BOWMAN, GRAND FORKS, RICHLAND, ROLETTE, TRAILL (Alby 1968, FSCA, 5 colls.: 14 male, 1 pr.).

*SD: BROOKINGS, CHARLES MIX, HARDING, PENNINGTON (EBW; 3 colls.: 12 male).

Sympetrum occidentale fasciatum Walker

ND: GRANT, MCKENZIE, RICHLAND, SLOPE (Kormondy 1960, Alby 1968, EBW, FSCA).

SD: BUTTE, CHARLES MIX, FALL RIVER, MEADE, WASHABAUGH, YANKTON (Walker 1951, EBW, 8 colls.: 10 male, 4 female; 1 sighting).

The ND records of this central species are along its northern range limit

which extends from Suffield, southeastern Alta. (Walker and Corbet 1975) to HENNEPIN, southeastern MN (Hamrum et al. 1971).

Sympetrum pallipes (Hagen)

*ND: BOWMAN (2 colls.: 6 male, 1 female).

*SD: HARDING, LAWRENCE (2 colls.: 7 male, 2 female).

These records of this western species extend its range slightly east of MC CONE and CARTER, eastern MT (GHB) and WESTON, eastern WY (Bick and Hornuff 1972).

Sympetrum rubicundulum (Say)

ND: SARGENT (Alby, 1968).

This species was recorded from SD (Calvert 1893 as *Diplax assimolata* Uhler, Williamson 1900, Muttkowski 1910, Needham and Heywood 1929) before Williamson (1933) differentiated it from *S. decisum* Hagen (= *S. internum* Montgomery). *S. rubicundulum* is evidently scarce in ND where Alby (1968) collected only 1 male.

Sympetrum vicinum (Hagen)

ND: RICHLAND, WARD (Alby 1968, FSCA, 1 coll.: 1 male).

Walker and Corbet (1975) consider that the main range of this species is the eastern half of the continent with a distinct population in WA and B.C. The WARD record is at the northwestern limit of the main range.

Tramea lacerata Hagen

SD: BROOKINGS, CHARLES MIX, YANKTON (2 colls.: 2 male; 2 sightings).

Tramea onusta Hagen

*SD: BROOKINGS, YANKTON (1 coll.: 1 male; 2 sightings).

T. lacerata and *T. onusta*, transcontinental in southern U.S., are apparently scarce in the Northern Great Plains. Neither was encountered in ND, eastern MT or eastern WY. They were collected only in southeastern SD, were common at only 1 site and were never seen ovipositing or in tandem.

Calopteryx aquabilis Say

ND: GRAND FORKS, NELSON, PEMBINA (Alby 1968, Johnson 1974, FSCA, 7 colls.: 8 male, 5 female).

SD: BENNET, CUSTER, LAWRENCE, MEADE (Johnson 1974, 4 colls.: 6 male, 6 female).

This northern transcontinental species is recorded only from northeastern ND and southwestern SD, restrictions associated with its requirement of lotic water.

Calopteryx maculata Beauvais

SD: BENNET, YANKTON (Johnson 1974, 1 coll.: 1 male; 1 sighting).

Johnson (1974) details the distribution of this eastern species showing that the northwestern limit of its main range extends from Waugh, southeastern Man., to BENNET, southwestern SD. In addition, Newell (1970), Johnson (1974), and Roemhild (1975) report it from MT. Johnson states, however, that this record from FLATHEAD is based on a badly damaged specimen, and we did not collect this species during a summer of intensive effort in the FLATHEAD area.

Hetaerina americana (Fabricius)

ND: RANSOM, RICHLAND (Alby 1968, Johnson 1973).

SD: BENNET, FALL RIVER, TODD, TURNER, YANKTON (Johnson 1973, Provonsha and McCafferty 1977, 4 colls.: 5 male, 2 female).

Although this southern transcontinental species extends west to eastern MT (Johnson 1973, Roemhild 1975) and eastern WY (Bick and Hornuff 1972), it was infrequent in our Dakota collections, abundant only at the one warm (27°C) water site encountered.

Archilestes grandis (Rambur)

*SD: CUSTER (D. Paulson Collection).

Dr. D. Paulson will discuss the distribution of this species in a forthcoming paper.

Lestes congener Hagen

ND: 29 counties (Alby 1968, EBW, FSCA, 5 colls.: 6 male).

*SD: BUTTE, CHARLES MIX, CUSTER, DAY, FALL RIVER, HARDING (M. May Collection; 6 colls.: 15 male, 2 prs.).

Lestes disjunctus disjunctus Selys

ND: 27 counties (Alby 1968, FSCA, 24 colls.: 95 male, 7 prs.).

SD: CUSTER, LAWRENCE, PENNINGTON (Kormondy 1957, EBW, 6 colls.: 18 male, 1 pr.).

This northern transcontinental subspecies was frequent in ND, surprisingly localized in SD where it is recorded only from the Black Hills.

Lestes dryas Kirby

ND: 24 counties (Alby 1968, EBW, FSCA, 7 colls.: 19 male, 3 female, 1 pr.).

SD: BROOKINGS, DAY, HARDING (3 colls.: 1 male, 1 female, 1 male *ungiculatus* female *dryas* pr. in tandem).

Lestes forcipatus Rambur

*SD: CHARLES MIX (1 coll.: 1 male).

This species was recorded from ND (Muttkowski 1910, Needham and Heywood 1929, Byers 1930) before Walker (1952) differentiated it from *L. d. disjunctus* Selys and *L. d. australis* Walker. There are no recent records of *L. forcipatus* from ND. The species is apparently scarce throughout the Northern Great Plains being represented by only 1 collection each from eastern WY (Bick and Hornuff 1972), eastern MT (Bick and Hornuff 1974) and SD.

Lestes rectangularis Say

ND: TRAILL (Alby 1968).

The western range limit of this eastern species extends from eastern ND, through NB (Pruess 1967) to WOODWARD, western OK (GHB).

Lestes unguicalatus Hagen

ND: 40 counties (Alby 1968, EBW, FSCA, 26 colls.: 94 male, 4 prs.).

SD: BROOKINGS, BUTTE CHARLES MIX, DAY, FALL RIVER, HARDING, LAWRENCE, MEADE, YANKTON (Kormondy 1957, 14 colls.: 70 male, 4 normal pairs, 1 male *unguicalatus* female *dryas* pr. in tandem).

Amphiagrion sp.

*ND: CASS (Alby, 1968, as *A. abbreviatum* (Selys)).

SD: BROOKINGS, CHARLES MIX, CUSTER, FALL River, LAWRENCE, MEADE, YANKTON (Kormondy 1957, as *A. abbreviatum* (Selys); Provonsha and McCafferty 1977, EBW; 18 colls.: 26 male, 6 female, 6 prs.).

Mrs. L. K. Gloyd's study of the genus *Amphiagrion* indicates that there are 3 species, the one from the central area being undescribed. Because her manuscript has not yet been published no specific name is here given.

Argia alberta Kennedy

SD: FALL RIVER, LAWRENCE, WASHABAUGH, YANKTON (Bick and Hornuff, 1972; Provonsha and McCafferty 1977, EBW; 6 colls.: 27 male, 1 female, 7 prs.).

YANKTON in southeastern SD is the northeasternmost record of this western species whose northern and eastern limits extend from SANDERS, northwestern MT (GHB) to YANKTON, and southward through LEAVENWORTH, northeastern KS (EBW) to OTTAWA, northeastern OK and JEFFERSON, southcentral OK (GHB). All collections were along lotic waters.

Argia apicalis (Say)

ND: CASS, GRAND FORKS (Alby 1968, EBW).

*SD: CHARLES MIX, YANKTON (5 colls.: 6 male, 5 female, 1 pr.).

The ND records are the northwesternmost for this ecologically tolerant species whose western limit extends from eastern ND through CHEYENNE, western KS (Huggins et al. 1976) to LUBBOCK, western TX (Johnson 1972) and southward.

Argia emma Kennedy

SD: CUSTER, MEADE, PENNINGTON (Bick and Hornuff 1972, EBW, 2 colls.: 7 male, 1 female, 2 prs.).

The SD records of this western species are along its northeastern range limit which extends from southern B.C. (Walker 1953) through FLATHEAD, northwestern MT (Roemhild 1975) to BLAINE, northern NB (GHB). *A. emma* was collected only at lotic waters.

Argia fumipennis violacea (Hagen)

*SD: FALL RIVER, LAWRENCE (2 colls.: 2 male).

Although reported from MN (Walker 1953), eastern MT (Roemhild 1975) and eastern WY (Bick and Hornuff 1972), this species was absent from the ND collections, rare in SD, where both collections were along swiftly flowing streams.

Argia immunda (Hagen)

SD: CUSTER, FALL RIVER (Provonsha and McCafferty 1977, FSCA, 4 colls.: 18 male, 4 female, 1 pr.).

In the U.S., *A. immunda* is reported from TX (Johnson 1972), OK (Bick and Bick 1957) and recently from southwestern SD as a disjunct northern population (Provonsha and McCafferty 1977). Although their map shows this species in NM, KS, AR, we know of no published records from these states. The southwestern SD collections are approximately 1030 km north of WASHITA, southwestern OK (Bick and Bick 1957), the northernmost published locality in the main range. Provonsha and McCafferty suggest that the warm water at Hot Brook, SD provided the unique environment for the presence of this species in a northern climate. Because one of our collections was 59 km from Hot Brook, it appears that more than one population of this species occurs in SD. Further, only one of our 4 collections was associated with warm (27°C) water. Clearly this species is more widespread in SD than formerly realized and seemingly is not dependent on warm water.

Argia plana Calvert

SD: YANKTON (Bick and Hornuff 1972, EBW, 7 colls.: 14 male, 2 female).

These records are the northernmost for this southwestern species which was not collected at the numerous lotic waters of the Black Hills, but

only in the southeastern corner of the State where all collections were along clear, rapidly flowing streams.

Argia vivida Hagen

SD: CUSTER FALL RIVER, LAWRENCE, MEADE (Kormondy 1957, Provonsha and McCafferty 1977, EBW, 10 colls.: 26 male, 1 female, 5 prs.).

A. vivida, like *A. plana*, occurred along clear, rapidly flowing streams but in southwestern rather than in southeastern SD.

Coenagrion angulatum Walker

ND: 27 counties (Alby 1968, EBW, FSCA).

*SD: DAY (1 coll.: 1 male).

Coenagrion resolutum (Hagen)

ND: 31 counties (Alby 1968, EBW, FSCA, 11 colls.: 32 male, 4 prs.).

*SD: DAY (1 coll.: 2 male).

Enallagma anna Williamson

SD: CUSTER, FALL RIVER, LAWRENCE, MEADE, WASHBAUGH, YANKTON (Kormondy 1957, Provonsha and McCafferty 1977, EBW, 13 colls.: 61 male, 4 prs.).

The northern range limit of this western species extends from FLATHEAD, northwestern MT (GHB) through CARTER, southeastern MT (Roemhild 1975) and YANKTON; to STORY, central IA (specimen seen through courtesy of D. G. Huggins). All of our collections were at lotic waters.

Enallagma antennatum (Say)

ND: BOWMAN, DUNN-MERCER line, GRAND FORKS, WALSH (Alby 1968, FSCA, 3 colls.: 6 male).

*SD: HAMLIN, LAWRENCE, ROBERTS, YANKTON (7 colls.: 26 male, 5 female, 1 pr.)

This eastern species crosses both Dakotas almost reaching the western limits in MT and WY described by Bick and Hornuff (1974). Nine of the 10 collections were along rapidly or slowly flowing, clear streams.

Enallagma boreale (Selys)

ND: 25 counties (Alby 1968, EBW, FSCA, 16 colls.: 81 male, 12 prs.).

*SD: BROOKINGS, CUSTER, DAY, MARSHALL (EBW, 4 colls.: 6 male).

E. boreale, *E. ebrium* and *E. hageni* were the only odonates collected at the strongly saline Stump Lake, NELSON, ND.

Enallagma carunculatum Morse

ND: ADAMS, BOWMAN, RICHLAND, SLOPE, STUTSMAN, WARD (Alby 1968, 2 colls.: 4 male).

SD: BUTTE, CUSTER, LAWRENCE, MARSHALL, MEADE, PENNINGTON, SANBORN, YANKTON (Bick and Hornuff 1972, EBW, FSCA, 10 colls.: 34 male, 11 prs.).

Enallagma civile (Hagen)

ND: BARNES, BILLINGS, BOWMAN, CASS, DICKEY, EDDY, FOSTER, GRAND FORKS, MCINTOSH, MCLEAN, NELSON, PEMBINA, RAMSEY, RICHLAND, WILLIAMS (Alby 1968, 6 colls.: 9 male, 1 pr.).

SD: BROOKINGS, BROWN, BUTTE, CHARLES MIX, CUSTER, DAY, DOUGLAS, HAMLIN, MARSHALL, MEADE, SANBORN, WASHABAUGH, YANKTON (EBW, 33 colls.: 111 male, 27 prs.).

Enallagma clausum Morse

ND: BENSON, BURLEIGH, EMMONS, FOSTER, KIDDER, RAMSEY (Alby 1968, EBW, 4 colls.: 32 male, 6 female, 12 prs.).

*SD: DAY, HAMLIN, MARSHALL, YANKTON (4 colls.: 8 male, 8 female).

The present records are the easternmost in the U.S. for this species which extends much further east in Canada becoming extremely local east of Man. (Walker 1953).

Enallagma cyathigerum (Charpentier)

ND: 20 counties (Alby 1968, EBW, 23 colls.: 37 male, 13 prs.).

SD: BROOKINGS, BUTTE, CUSTER, DAY, DOUGLAS, FALL RIVER, MARSHALL, MEADE, YANKTON (Calvert 1901-8, 16 colls.: 21 male, 9 prs.).

Enallagma ebrium (Hagen)

ND: 42 counties (Alby 1968, EBW, FSCA, 48 colls.: 298 male, 37 prs.).

SD: BROOKINGS, BROWN, CHARLES MIX, CUSTER, DAY, HAMLIN, HARDING, LAWRENCE, MEADE, ROBERTS (Bick and Hornuff 1972, 15 colls.: 23 male, 1 normal pr., 1 male *ebrium* male *hageni* pr. in tandem).

This northern transcontinental species was the most frequent and abundant zygopteran in ND.

Enallagma exsulans (Hagen)

ND: GRAND FORKS (1 coll.: 2 male).

This record of this eastern species is at the northwesternmost limit of its range which extends from eastern ND through ELLIS, western KS (Kennedy 1917b) to VALVERDE, southwestern TX (Johnson 1972) and southward.

Enallagma hageni (Walsh)

ND: 31 counties (Alby 1968, EBW, FSCA, 20 colls.: 85 male, 8 prs.).

SD: BROOKINGS, BROWN, CHARLES MIX, CUSTER, DAY, HARDING, LAWRENCE, LYMAN, MARSHALL, MEADE, PENNINGTON, ROBERTS, SANBORN, YANKTON (Kormondy 1957, EBW, 39 colls.: 273 male, 3 female, 24 normal prs., 1 male *ebrium* male *hageni* pr. in tandem).

Whereas *E. ebrium* was the most common in ND, *E. hageni*, another northern transcontinental species, was the most frequent and abundant *Enallagma* in our SD collections. Similarly, Needham and Heywood (1929) consider *E. hageni* the commonest zygopteran in northeastern U.S.

Enallagma praevarum (Hagen)

*ND: BOWMAN (2 colls.: 2 male).

SD: CUSTER, FALL RIVER, LAWRENCE, MEADE, PENNINGTON, WASHABAUGH (Provonsha and McCafferty 1977, EBW, 10 colls.: 46 male, 3 prs.).

The Dakota records for this western species are along its northern and eastern limits which extend from BLAINE, northcentral MT (Bick and Hornuff 1974, Roemhild 1975) through WASHABAUGH, southwestern SD to BLANCO, central TX (Johnson 1972) and southward.

Enallagma signatum (Hagen)

*SD: YANKTON (1 coll.: 1 male).

The western limit of this eastern species extends from southeastern SD through SHERIDAN, western KS (Huggins et al. 1976) to UVALDE, western TX (Johnson 1972).

Ischnura damula Calvert

ND: DIVIDE, DUNN, EDDY, FOSTER, KIDDER, LOGAN, MCHENRY, NELSON, PEMBINA, RAMSEY, RANSOM, RICHLAND, ROLETTE, TRAILL (Alby 1968, 10 colls.: 21 male, 20 female, 2 prs.).

SD: CUSTER, DAY, MARSHALL (Kormondy 1957, 2 colls.: 4 male, 7 female). These records of this western species are along its eastern range limit which extends from the Winnipeg area, southern Man. (Walker 1953) through the eastern Dakotas to WOODWARD, western OK (GHB).

Ischnura perparva Selys

*ND: DUNN (1 coll.: 1 female).

SD: CUSTER, FALL RIVER, LAWRENCE, MEADE, WASHABAUGH, YANKTON (Kormondy 1957, Provonsha and McCafferty 1977, EBW, 11 colls: 31 male).

The northeastern range limit of this western species extends from LINCOLN, northwestern MT (Roemhild 1975) through DUNN, western ND and YANKTON, southeastern SD, to BROWN, northeastern KS (Huggins, unpublished manuscript).

Ischnura verticalis (Say)

ND: ADAMS, BOWMAN, CASS, EDDY, EMMONS, GRAND FORKS, GRANT, HETTINGER, LOGAN, MCINTOSH, MORTON, PEMBINA, RAMSEY, RICHLAND, SIOUX, SLOPE, STARK (Alby 1968, 4 colls.: 4 male, 1 female).

SD: BROOKINGS, BROWN, BUTTE, CHARLES MIX, CUSTER, DAY, DOUGLAS, FALL RIVER, LAWRENCE, MEADE, PENNINGTON, SANBORN, YANKTON (Kormondy 1957, Provonsha and McCafferty 1977, EBW, 42 colls.: 148 male, 7 female, 2 prs.).

Nehalennia irene (Hagen)

ND: 27 counties (Alby 1968, FSCA, 10 colls.: 33 male, 7 female, 6 prs.).

SD: CUSTER, DAY, MARSHALL, YANKTON (5 colls.: 13 male, 5 female).

The southwestern range limit of this northern transcontinental species extends from LAKE, northwestern MT (Bick and Hornuff 1974) through WESTON, eastern WY (Bick and Hornuff 1972) to BLAINE, northern NB (GHB) and eastward.

FAUNAL ANALYSIS

Based on continental distribution, each of the 77 species present in the Dakotas could be placed in one of the following categories. An asterisk (*) indicates a species recorded in the Dakotas only from the Black Hills, SD.

TRANSCONTINENTAL (49%). These species extend east-west across the continent in Canada, the U.S. or both. This category may be subdivided into northern and southern entities:

Northern transcontinental. The main ranges of these species are in Canada and northern U.S.: *A. constricta*, *A. eremita*, *A. interrupta*, *A. umbrosa*, *E. spinigera*, **S. minor*, *L. intacta*, *L. proxima*, *L. quadrimaculata*, *S. costiferum*, *S. danae*, *S. internum*, *S. obtrusum*, *S. rubicundulum*, *C. aequabilis*, *L. congener*, *L.d. disjunctus*, *L. dryas*, *L. unguiculatus*, *C. resolutum*, *E. boreale*, *E. cyathigerum*, *E. ebrium*, *E. hageni*, *N. irene*.

Southern transcontinental. The main ranges of these species are in the U.S. and southern Canada: *A. junius*, *L. luctuosa*, *L. pulchella*, *P. longipennis*, *P. lydia*, *S. corruptum*, *S. vicinum*, *T. lacerata*, *T. onusta*, *H. americana*, **A. grandis*, *E. carunculatum*, *E. civile*.

WESTERN (29%). The main ranges of these species extend from the Pacific to or through the Northern Great Plains: **G. intricatus*, **O. s. severus*, **A. californica*, *A. multicolor*, **A. palmata*, *L. borealis*, **L. forensis*, *S. madidum*, *S. pallipes*, *A. alberta*, **A. emma*, **A. vivida*, *E. anna*, *E. clausum*, *E. praevarum*, *I. damula*, *I. perparva*. Four species have more limited southwestern ranges: **B. mendax*, **L. saturata*, **A. immunda*, *A. plana*; one, a more limited northwestern range, *C. angulatum*.

EASTERN (14%). The main ranges of these species extend from the Atlantic to or through the Northern Great Plains: *E. simplicicollis*, *P. tenera*, *C. maculata*, *L. forcipatus*, *L. rectangularis*, *A. apicalis*, **A. f. violacea*, *E. antennatum*, *E. exsulans*, *E. signatum*, *I. verticalis*.

CENTRAL (8%). The main ranges of these species do not reach either coast and the limits of some are ill defined: *G. cornutus*, *G. externus*, *G. graslinellus*, *S. ensigera*, *S. o. fasciatum*, *Amphiagrion* sp.

No genus or species is endemic to the Dakotas. Rather, the fauna is primarily (49%) transcontinental with many northern species, some of which occur in Alaska, the Yukon, or the Northwest Territory. However, most representatives of this northern or boreal element range south of the Dakotas; only *A. eremita*, *E. spinigera*, *S. minor*, *L. proxima*, *S. danae* do not extend south into NB. As expected, among the transcontinental species, southern ones are fewer and most of these (*L. luctuosa*, *P. lydia*, *S. vicinum*, *T. lacerata*, *T. onusta*, *H. americana*, *A. grandis*, *E. carunculatum*) do not extend northward into Man. The Dakotas seem to be a more significant barrier to the northward spread of southern transcontinental species than the reverse.

Other species in the Dakotas have east-west continental restrictions. Of the total fauna, 29% are western, 14% eastern. The Black Hills in southwestern SD account for much of this difference. Thirteen species are reported from this area but not elsewhere in the Dakotas; 10 of these are western or southwestern species, 2 are transcontinental, 1, eastern. When the species recorded only from the Black Hills are subtracted from the eastern and western lists, the number of eastern (10) and western (12) species present in the Dakotas becomes similar.

Among the eastern species, only 3 (*A. f. violacea*, *E. antennatum*, *I. verticalis*) cross the Dakotas and reach range limits in WY or MT. This part of the Northern Great Plains restricts in some way the spread of the other 8. None of the 22 western species extends east beyond the Dakotas. These restricted eastern and western species do not meet at any particular meridian. Rather, the eastern and western faunas overlap broadly and very irregularly in the Dakotas.

Of particular interest is the presence in SD of populations of 4 southwestern species. Three (*B. mendax*, *L. saturata*, *A. immunda*) were collected only in the Black Hills, one (*A. plana*) only in southeastern SD. These populations are 475-1030 km beyond their main ranges. In SD, all 4 species were associated with spring fed streams. Kennedy (1915) points out that the seasonally uniform temperatures of such waters have allowed the northward spread of other southern species. Also, Musser (1962) states that warm water from natural springs may account for the presence of *B. mendax* in UT, and Provonsha and McCafferty (1977) regard the warm water at Hot Brook, SD as responsible for disjunct populations of many species.

In our collections, species diversity was much less in ND than SD in spite of equivalent effort. At site after site in ND, the same species were present, often with large numbers of individuals: *S. internum*, *L. d. disjunctus*, *L. unguiculatus*, *E. cyathigerum*, *E. ebrium*, *E. hageni*. This rather monotonous fauna relates to the lack of habitat diversity encountered in ND. Well vegetated lakes and ponds were numerous, yet all were essentially alike. Most streams flowed sluggishly, if at all, over mud rather than rocky or sandy bottoms, merely repeating lentic conditions. Species

characteristic of lotic waters were seldom collected. In contrast, in SD, particularly in the Black Hills and the southeast, we encountered more varied habitats, including diverse lotic conditions, and a greater diversity of genera and species. Genera present in our SD but not ND collections were: *Ophiogomphus*, *Brechmorhoga*, *Erythemis*, *Pachydiplax*, *Perithemis*, *Plathemis*, *Tramea*, *Hetaerina*, *Amphiagrion*, *Argia*. This is not merely the result of our collecting. In the total record, 23 genera are recorded for SD, 17 for ND.

UNCONFIRMED DAKOTA RECORDS

Calvert 1893 (1); Williamson 1900 (2); Calvert 1901-8 (3); Muttkowski 1910 (4); Kennedy 1917b (5); Howe 1921 (6); Needham and Heywood 1929 (7); Byers 1930 (8); Walker 1953 (9); Needham and Westfall 1955 (10); Walker 1958 (11); Montgomery 1967 (12); Walker and Corbet 1975 (13), record 14 species from the Dakotas which we did not collect and could not confirm. Specific localities are reported only for *O. rupinsulensis* from TRAILL, ND (6) and *P. hymenaea* from BROOKINGS, SD (3); the other references do not list counties. References to "Dakota" or "Dak." are omitted. The 14 unconfirmed species are:

Ophiogomphus rupinsulensis (Walsh). ND (6, 10, 11, 12 with ?).

Aeshna canadensis Walker. ND (12 with ?).

Epiaeschna heros (Fabricius). SD (4, 7, 8).

Epithea cynosura (Say). ND (4, 7).

Epithea princeps Hagen. ND (4, 7).

Celithemis eponina (Drury). ND (4, 5, 7).

Leucorrhinia frigida Hagen. ND (10, 12, 13).

Libellula (Ladona) julia Uhler. ND (10, 12 with ?).

Pantala flavescens (Fabricius). ND (4).

Pantala hymenaea (Say). SD (1, 2, 3, 10).

Lestes vigilax Hagen. ND (4, 7, 8).

Anomalagrion hastatum (Say). ND (4, 7, 8, 9).

Argia moesta (Hagen). ND (4, 8).

Ischnura posita (Hagen). ND (4, 7, 8).

DELETIONS

We did not collect the following 5 species, recorded in the literature from one or the other of the Dakotas, and we consider that they should be removed from the Dakota lists for reasons given below.

Calvert (1893) and Williamson (1900) listed *Amphiagrion saucium* (Burmeister) from SD. Mrs. L. K. Gloyd (personal communication, 2 November 1976) states, "so recorded when the genus was regarded as having but one species." It seems clear that the eastern *A. saucium* should be removed from the SD list. Alby (1968) records *Amphiagrion abbreviatum* (Selys) from CASS, ND; Kormondy (1957), from CUSTER, SD. Kormondy states that his specimens were intermediate in size between *A. saucium* and *A. abbreviatum*. Mrs. Gloyd determined specimens which we collected in CUSTER as an undescribed species. We suggest that the western *A. abbreviatum* should be removed from both the ND and SD lists.

In Hung's (1971) cytological study, *Aeshna clepsydra* Say, *A. verticalis* Hagen, *Erythrodiplax berenice* (Drury) are recorded from Grand Forks, ND. Because the determinations were based on nymphs, unverified by any odonatologist, and because GRAND FORKS is beyond the established ranges of all (spectacularly so for *E. berenice*), we believe that these 3 species should be removed from the ND list.

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