

The Distribution and Relative Seasonal Abundance of Indiana Species of Five Families of Dragonflies (Odonata, Calopterygidae, Petaluridae, Cordulegasteridae, Gomphidae and Aeshnidae)

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Three previous papers (Montgomery, 1942, 1944, 1945) have indicated the relative seasonal abundance of the adults of the Indiana species of Agrionidae, Cordulidae and Libellulidae. These studies have been based upon the frequency of collection and observation of the several species during the 41-year period of 1900 to 1940 inclusive. The present paper continues these studies to all other families of Odonata found in Indiana, except the Lestidae.

Tabulations have been made from the records preserved in the notebooks of the late E. B. Williamson and of the author. The two charts presented here (Fig. 1 and 2) consist of time-frequency graphs for all Indiana species of the five families indicated. The graphs were constructed by tabulating the records for the entire 41 years by thirds of months and plotting the resulting frequencies at the midpoints (5th, 15th and 25th respectively) of these thirds.

During the period from 1900 to 1940, 51 species of the five families were collected or observed in Indiana. Six of these have been recorded in the state but once. No species was recorded for all of the 41 years; *Anax junius* (Drury) was reported for 35 years, *Calopteryx maculata* (Beauvois) for 34, and *Hetaerina americana* (Fabricius) and *Gomphus grasilinellus* Walsh for 30 years each. The number of species of these five families recorded each year has varied from two, in 1923, to 27, in 1932. A few of these species are rather abundant, but many, including all the species belonging to the Petaluridae and Cordulegasteridae and many of the Gomphidae, are quite rare. The number of years in which each species was found is indicated immediately following the species name in the list below.

List of Species with Notes on Distribution and an Indication of the
Number of Years Each Species Was Collected from
1900 to 1940 Inclusive

Calopterygidae

Calopteryx aequabile Say—15; transcontinental in southern Canada and the northern half of the United States, but the eastern (typical) subspecies appears to be confined to the region from Maine to Iowa.
C. angustipenne (Selys)—1; Pennsylvania and Indiana to Georgia.

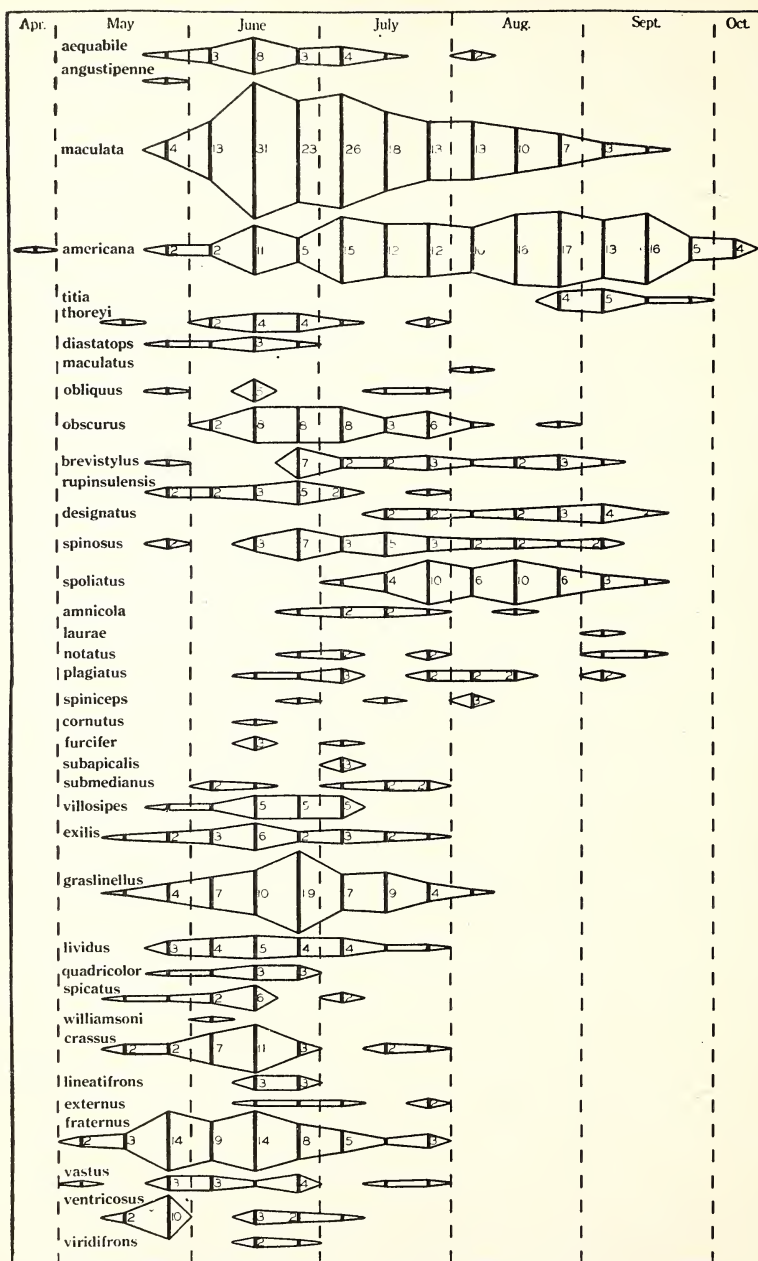


Fig. 1. The range of the flight season (or period of adult life) and the relative seasonal abundance of species of Calopterygidae (Calopteryx and Hetaerina), Petaluridae (Tachopteryx), Cordulegasteridae (Cordulegaster), and Gomphidae (Progomphus, Hagenius, Ophiogomphus, Erpetogomphus, Dromogomphus, Stylurus and Gomphus) in Indiana. Numbers near each bar indicate the number of collections of each species in each third of a month during the period of 1900 to 1940 inclusive; where no number is given the number of collections is one.

C. maculata (Beauvois)—34; Maritime Provinces and Manitoba to Florida and New Mexico.

Hetaerina americana (Fabricius)—30; Quebec and California to Guatemala. *H. titia* (Drury)—8; New Jersey and Michigan south and southwest to the West Indies and Central America.

Petaluridae

Tachopteryx thoreyi (Hagen)—9; New Hampshire and Michigan to Florida and Missouri.

Cordulegasteridae

Cordulegaster diastatops (Selys)—3; Maritime Provinces and Ontario to South Carolina. *C. maculatus* Selys—1; Maritime Provinces and Michigan to Florida. *C. obliquus* (Say)—6; Maine, Quebec and Wisconsin to New Jersey and Kansas.

Gomphidae

Progomphus obscurus (Rambur)—21; Massachusetts and Iowa to Florida and eastern Texas.

Hagenius brevistylus Selys—11; Maritime Provinces and Minnesota to Florida and Oklahoma.

Ophiogomphus rupinsulensis (Walsh)—10; New Brunswick and Saskatchewan to Tennessee and Missouri.

Erpetogomphus designatus Hagen—9; Ohio and Nevada to Florida and Mexico.

Dromogomphus spinosus Selys—14; Maine, Quebec and Wisconsin to Florida and Oklahoma. *D. spoliatus* (Hagen)—25; Ohio and Wisconsin to Georgia and Texas.

Stylurus amnicola (Walsh)—3; Quebec and Minnesota to North Carolina and Kansas. *S. laurae* Williamson—Michigan to Virginia and Georgia. *S. notatus* (Rambur)—6; Quebec and Manitoba to North Carolina and Tennessee. *S. plagiatus* (Selys)—5; New York and Michigan to Florida and Texas. *S. spiniceps* (Walsh)—4; Massachusetts, Quebec, and Wisconsin to South Carolina and Missouri.

Arigomphus cornutus (Tough)—1; Quebec and Manitoba to Indiana and Iowa. *A. fureifer* (Hagen)—4; Quebec to New Jersey and Iowa. *A. subapicalis* (Williamson)—2; Indiana, Illinois, Oklahoma and Texas. (Gloyd, 1941, has shown that this species is identical with *lentulus* Needham). *A. submedianus* (Williamson)—5; Michigan to Oklahoma. *A. villosipes* (Selys)—13; Massachusetts and Minnesota to Maryland and Indiana.

Gomphus exilis Selys—15; Maritime provinces and Wisconsin to Georgia. *G. grastlinellus* Walsh—Ontario and Manitoba to Maryland and Ok-

lahoma, British Columbia. *G. lividus* Selys—14; Quebec and Wisconsin to Florida. *G. quadricolor* Walsh—7; Massachusetts and Wisconsin to Tennessee. *G. spicatus* Hagen—6; Maine, Quebec and Minnesota to New Jersey and Indiana. *G. williamsoni* Muttkowski—1; Wells County, Indiana.

Gomphurus crassus (Hagen)—17; Ontario to Tennessee and Iowa (Wilson's record from Red Wing, Minnesota, "A single female . . . in company with *G. vastus*", needs confirmation before this species is considered a member of the Minnesota fauna). *G. lineatifrons* (Calvert)—2; Michigan to Kentucky. *G. externus* (Hagen)—3; Michigan and Manitoba to Kentucky, Texas and Utah. *G. fraternus* (Say)—Quebec and Manitoba to Pennsylvania and Iowa. *G. vastus* (Walsh)—8; Quebec and Minnesota to Maryland and Kansas. *G. ventricosus* (Walsh)—Massachusetts to Wisconsin and Illinois. *G. viridifrons* (Hine)—Pennsylvania to Indiana.

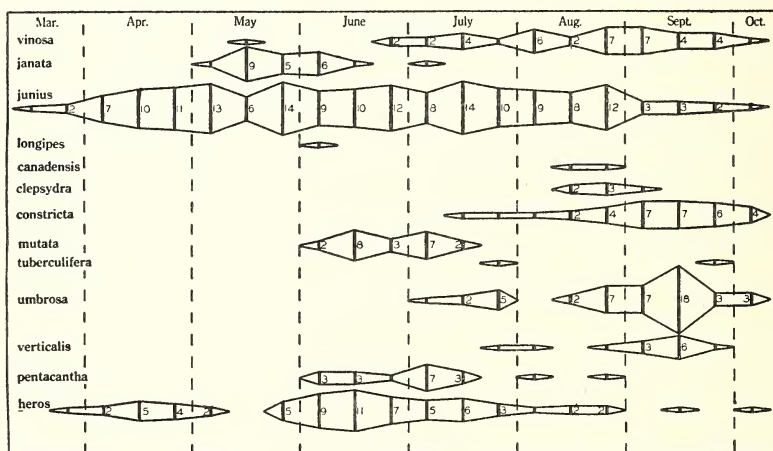


Fig. 2. The range of the flight season (or period of adult life) and the relative seasonal abundance of species of Aeshnidae (genera *Boyeria*, *Basiaeschna*, *Anax*, *Aeshna*, *Nasiaeschna* and *Epaeschna*) in Indiana. Numbers near each bar indicate the number of collections of each species in each third of a month during the period of 1900 to 1940 inclusively; where no number is given the number of collections is one.

Aeshnidae

Boyeria vinosa (Say)—21; Nova Scotia and Michigan to Florida and Arkansas.

Basiaeschna janata (Say)—12; Maritime Provinces and Wisconsin to Georgia and Oklahoma.

Anax junius (Drury)—35; North America from Alaska to Costa Rica and West Indies; Pacific Islands, and the west coast of Asia. A.

longipes Hagen—1; east coast from Massachusetts to Brazil; occasional inland records west to Indiana.

Aeshna canadensis Walker—1; transcontinental in Canada, southward in United States to Indiana and Missouri. *A. clepsydra* Say—4; Nova Scotia and Wisconsin to New Jersey and Indiana. *A. constricta* Say—17; Maritime Provinces to British Columbia, southward into New England, Kansas and Nevada. *A. mutata* Hagen—10; Massachusetts to Michigan and Indiana. *A. tuberculifera* Walker—2; New England and Quebec to Wisconsin and Indiana; British Columbia. *A. umbrosa* Walker—25; transcontinental in Canada, southward to South Carolina, Oklahoma and Nevada. *A. verticalis* Hagen—11; Maritime Provinces and Wisconsin to Maryland and Illinois; California.

Nasiaeschna pentacantha (Rambur)—15; New England and Quebec to Florida and Texas.

Epieaeschna heros (Fabricius)—26; Maine, Quebec and Wisconsin to Florida and Mexico.

Both of the genera of Calopterygidae represented in Indiana are large, each containing more than 50 species. Calopteryx is Holarctic; six species are found in North America. The three species not recorded from Indiana are limited in their distribution to the Atlantic coastal states and *angustipenne* should be classed with these as eastern, as opposed to the more wide ranging *aequabile* and *maculata*. However, it should be noted that the transcontinental *aequabile* shows tendencies to subspeciation as four varieties have been described and the typical form does not appear to be found west of Iowa, nor in the far North (Walker, 1933, 1940, 1941.) Hetaerina is an American genus with the greatest number of species in Brazil. About ten species are found in Mexico, almost all of which range southward into Central America, or even in northern South America, but only four extend northward into the United States and two of these only into the border states.

Tachopteryx, the only genus of the family Petaluridae in eastern North America, is generally considered as monospecific. Kennedy (1917) erected a genus for two species, each of somewhat restricted range in the western states and Japan respectively, which were formerly included in this genus.

Cordulegaster, one of four genera of the family Cordulegasteridae, includes 23 species and subspecies according to the most recent revision (Fraser 1929). Nine of these species are North American; the others are distributed from the British Isles across southern Europe and Asia to China.

Of the genera of Gomphidae listed, two, Hagenius and Dromogomphus are restricted to the central and eastern states, two, Progomphus and Erpetogomphus are widely distributed in the new world and one, Ophiogomphus is Holarctic. Stylurus, Arigomphus and Gomphurus are generally not accorded full generic rank, but, if considered as distinct at all, are considered subgenera of Gomphus.

Progomphus includes about 25 described species ranging from Massachusetts and Oregon to Argentina with its metropolis in Brazil (Byers 1939). Three species occur in the United States; one of these appears to have a limited range in Florida, and the second is widely distributed throughout the region west of the range of *obscurus*. Ophiogomphus contains almost 30 species, of which approximately half are North American. Seven of these are limited to areas along or near the Atlantic Coast and seven occur in the far western states; *rupin-sulensis* although it extends far into the central plains, is eastern and does not overlap the range of any western species. Dromogomphus includes only one species in addition to the two found in Indiana and the range of this third species is a very limited area in the southeastern region (Georgia).

Gomphus (*sens. lat.*) is a Holarctic genus of more than 125 nominal species. Of approximately 50 North American species only about five occur west of the Mississippi basin. The subgenera are rather distinct, although there has been some disagreement in the placement of certain species.

Of the six genera of Aeschnidae occurring in Indiana, three, Basiaeschna, Nasiaeschna and Epiaeschna are monotypical. Boyeria is a Holarctic genus of five species, two from North America and three from the Old World. Anax and Aeshna are large cosmopolitan genera with about 33 and 80 species, respectively. Five species of Anax and 26 of Aeshna occur in North America, north of Mexico.

In groups considered in earlier studies in this series—Agrionidae (Montgomery 1942, 1944), Cordulidae and Libellulidae (Montgomery 1945)—traces of correlation between the seasonal range of the species in Indiana and their geographical range or their evolutionary level were shown. No such relationships are evident in the groups treated in this paper, although there is some tendency for wide ranging species to have long seasonal ranges. *A. junius* with the most extensive geographical range of any Indiana species, except *Pantala flavescens* (Fabricius), has the longest seasonal range in the state, although only slightly longer than that of *E. heros*. The species of Gomphus, including Arigomphus and Gomphurus, which are generally quite restricted in geographical range, have rather short, early seasons of adult flight. However, the species of Stylurus with approximately equal areas of geographical distribution have an entirely different pattern of adult flight period. In certain groups—Enallagma, Cordulidae and Libellulidae—northern species show a tendency to reach their maximum abundance, in Indiana, during the early season (Montgomery 1942, 1945), but the species of Aeshna which, except for *umbrosa*, reach their southern limit in Indiana, have late summer seasons of flight.

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