

21. *Unio iris* Lea. Frequent.
22. *Unio subrostratus* Say. Abundant.
23. *Unio fabalis* Lea. Eagle Lake and Pike Lake.
24. *Unio cylindricus* Say. A single specimen was taken in the outlet of Eagle Lake.
25. *Unio luteolus* Lamarck. Abundant.
26. *Unio ventricosus* Barnes. A single specimen (dead) was found in the outlet of Pike Lake.
27. *Unio rubiginosus* Lea. Common in Eagle Lake and in the outlet of Eagle Lake. None taken from other waters.
28. *Unio clavus* Lamarck. Rare in outlet of Eagle Lake.
29. *Unio glans* Lea. Common.
30. *Margaritana rugosa* Barnes. Outlet of Eagle Lake.
31. *Anodonta edentula* Say. Six.
32. *Anodonta grandis* Say. Common in Eagle and Pike Lakes.
33. *Anodonta footianæ* Lev. Abundant in Pike Lake, rare in Center Lake, not found in the streams.
34. *Anodonta ferrusaciana* Lea. Abundant in Pike Lake.

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B. ADDITIONS TO THE INDIANA LIST OF DRAGONFLIES, WITH A  
FEW NOTES.—NO. II.\*

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ADDITIONS.

1. *Enallagma aspersum* Hagen. A single female was taken June 27, 1901, in the woods on Chapman Hill, near Winona Lake. The female of this species of *Enallagma* is so distinctively colored that I do not hesitate to record the species for the State on such scanty material. I think this species will be found to be extremely local in di-tribution.

2. *Domogomphus spoliatus* Hagen. Old canal feeder along the St. Joseph River, and St. Joseph River, Robison Park, Ft. Wayne, July 19 and August 11, 1901. Abundant; both sexes taken; several exuviae gathered from piles at boat landings in Robi-on Park; observed feeding on adult imagoes of the following insects: *Pieris rapae*, white cabbage butterfly, and the two dragonflies, *Hetaerina americana* and *Argia putrida*. An active, inquisitive species, relentless in love

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\* No. I was published in last year's proceedings (1900), pp. 173-178.

and war, more wary than *D. spinosus*, and most numerous about the water from 9 a. m. to 4 p. m., where they are conspicuous by reason of the yellow or reddish-yellow seventh to ninth abdominal segments.

3. *Gomphus villosipes* Selys. Tippecanoe River, near Warsaw, June 23, 1901, 3 males. Holliday and Williamson.

4. *Gomphus dilatatus* Rambur. Tippecanoe River, near Warsaw, June 23, 1901, 5 males, 1 female. Williamson and Holliday. This species was found only near the P., Ft. W. & C. R. R. bridge over Tippecanoe River, and only on this one date. The bridge was being repaired, and the dragonflies were taken resting on some of the timbers, usually near the water, which flowed swiftly here. Possibly half the number seen were captured. They did not patrol the river, apparently, and, when frightened, they usually left the river, disappearing over the fields on either side.

5. *Gomphus spiniceps* Walsh. Old canal feeder along the St. Joseph River, near Ft. Wayne, July 19, 1901, one teneral female taken, another teneral seen, and two exuviae found in grass clumps two or three feet from the water.

6. *Sympetrum corruptum* Hagen. Near Winona Lake, August 10, 1901, 1 male. Miss N. O. Harrah.

Ninety-seven species of dragonflies are now recorded for Indiana. If *semioquea* (or the form usually known by this name) and *assimilatum* should be regarded as distinct from *Tetragoneuria cynosura* and *Sympetrum rubicundulum* respectively, then the Indiana list numbers 99 species.

#### NOTES AND CORRECTIONS.

1. *Argia translata* Hagen. Pl. I, Fig. 1. Ab., male 30, female 28; h. w., male 22, female 23. A dark colored species; post-ocular spots small, not connected; thorax nearly to first lateral suture black, narrow antehumeral and post-humeral pale stripes, the latter only above; these stripes wider and the post-humeral longer in the female; sides of thorax pale, second lateral suture with a black stripe. Abdomen black; pale, narrow, interrupted basal rings on 3-7; male with a blue basal spot on 8 and 9, spot apically three-pointed, one point on either side (half the length of the segment on 8, nearly the entire length on 9), and the middle one on the dorsum; female with a pale lateral stripe the length of the abdomen, interrupted at bases and apices of segments, and placed lower on 6 and 7. The distribution of this species, as now known, is such as to make its discovery in Indiana possible.

2. *Nehalennia irene* Hagen. Winona Lake, June 22, 1901; Wooden Lake, July 4, 1901. Clarence Kennedy.

3. In plate I are figured the male abdominal appendages, lateral and dorsal views, of four species of *Enallagmas*. Two of these, *calverti* and *aspersum*, have been taken in the State, and the occurrence here of *cyathigerum* and *doubledayi* is probable. The species here designated as *cyathigerum* is the same as *annexum*. I believe that *annexum* (North American) and *cyathigerum* (European) are identical. *Hageni* and *cyathigerum* are very closely related—much more closely than *calverti* and *cyathigerum*. *Doubledayi* finds its closest allies in *carunculatum* and *civile*.

4. In the report of the State Geologist for 1897, p. 404, I have recorded *Enallagma laterale* Morse for Shriner Lake. This is a mistake in determination; the single male is *carunculatum*.

5. The seasonal range of *Enallagma traviatum* is possibly not so short. I have records of it at Winona Lake from June 24 to July 13, 1901. It is much less conspicuous than any other *Enallagma* with which I am acquainted.

6. On and about July 6, 1901, Mr. Kennedy and myself noticed on several occasions the increased activity of *Enallagma pollutum* and *signatum* as twilight came on. In the spatter-dock beds, where, during the mid-day hours only an occasional wandering male would be seen, just before sundown many pairs clung to the broad leaves or flitted in couple far out over the lake.

7. On August 25, 1901, at Cedar Lake, Whitley County, Mr. Kennedy and myself took, in two or three hours' time, 65 specimens of *Ischnura kellicotti* about water-lily beds at the southwestern end of the lake.

8. The distribution of *Herpetogomphus designatus* as now known is such that this species may be looked for in southwestern Indiana. In the key to genera, *Dragonflies of Indiana*, it will run out to *Ophiogomphus*. Professor Needham has pointed out that the two genera, *Ophiogomphus* and *Herpetogomphus*, may be distinguished by the form of the post anal cells. This character is indicated in figs. 2 and 3, pl. I. In the case of *Ophiogomphus* the two branches of the anal vein form a distinct loop. *Ophiogomphus rupinsulensis* was taken, June 23 and 30, 1901, along the Tippecanoe River, near Warsaw.

9. *Dromogomphus spinosus* has been observed during 1901, as follows: Tippecanoe River, June 23 and 30; Chapman Lake, June 30; and Ft. Wayne, along the old canal feeder, July 18. During July the species was taken several times at Winona Lake.

10. *Lanthus albistylus* Selys has been taken in Maine, Pennsylvania and Tennessee; and its occurrence in Indiana is very probable. In the *Dragonflies of Indiana* this species will run out to the genus *Gomphus*. *Lanthus* and *Gomphus* may be separated by the form of the post-anal cells (see figs. 4, 5, 6 and 7, pl. I). In *Lanthus* the portion of the second branch of the anal vein bounding the

first anal cell on its outer side (M) is longer than that portion of the anal vein bounding the outer side of the same cell (S). In *Gomphus* M is always shorter than S, unless a vein between post-anal cells meets S, as in fig. 4. The *Gomphi* occurring in Indiana can be readily separated into three groups on characters of the post-anal cells.

- I. Second branch of anal vein not angled where the first cross vein between post-anal cells meets it (at point T); normally two post-anal cells in the first series (fig. 4). (North American and European.)
- II. Second branch of anal vein angled at point T; normally one post-anal cell in first series, two in second (fig. 5). (North American.)
- III. Second branch of anal vein angled at point T; normally one post-anal cell in first two series, followed by two (fig. 6). (North American.)

*Lanthus* is similar to this Group III of the genus *Gomphus*. It may be separated by the character indicated above.

The species of *Gomphi* known to occur or possibly occurring in Indiana may be arranged in these three groups, as follows:

I. brevis.	II. (?) pallidus.	III. externus.
viridifrons.	villosipes.	fraternus.
quadricolor.	(?) cornutus.	crassus.
exilis.		ventricosus.
sordidus.		vastus.
spicatus.		dilatatus.
graslinellus.		amicola.
furcifer.		plagiatus.
(?) pallidus.		notatus.
		spiniceps.

Prof. Hine and Mr. Tough have studied *G. cornutus* and *G. pallidus* for me. From their sketches I believe both species will come in Group II, but the material is so scanty I can not be sure of this.

11. *Gomphus viridifrons* Hine. Pl. I, figs. 16 and 17. Described in the *Ohio Naturalist*, Vol. I, No. 4, p. 60, Feb., 1901. The color description is quoted below:

"Length of the abdomen, about 33 mm.; hind wing about 27 mm.; black, face and occiput green; prothorax with anterior margin and three spots, green or yellow; thorax green with spaces at base of wings, lateral suture and six bands before, black; the two middle bands are abbreviated anteriorly and separated by

the mid-dorsal carina, which is very feebly green. Abdomen black, a dorsal band and sides of first two or three segments yellowish; a yellow spot at base of each of segments, four to seven; and sides of 8 and 9, usually yellowish. \* \* \* This is *Gomphus* sp. Williamson, *Dragonflies of Indiana*, p. 294." This species is most closely related to *abbreviatus*, which species, however, is not known west of the mountains. From *brevis*, another close relative, which has been taken in western Pennsylvania, it may be separated at sight by the green face, the face in *brevis* being sharply marked with black.

12. *Gomphus descriptus* Banks should be dropped from the Indiana hypothetical list. It was recorded from Illinois on an erroneous determination. The species has not been recorded west of the mountains.

13. Mr. Tough, in a recent letter kindly calls my attention to an error in the description of *Gomphus dilatatus*, p. 286, *Dragonflies of Indiana*. Second line from bottom, for *apical* read *basal*. Mr. Tough reports taking two males of this species in Illinois, and one of these has a small but distinct yellow basal spot on the eighth abdominal segment. The few specimens I have seen of *dilatatus* have had eight immaculate above.

14. *Gomphus segregans* Needham is a synonym of *Gomphus spiniceps* Walsh.

15. On June 17, 1901, at a ripple near the Clover Leaf railroad bridge over the Wabash River at Bluffton, I took *Gomphus fraternus*, *G. crassus*, and *Progomphus obscurus*. *P. obscurus* was the most abundant and *G. crassus* the rarest. The next day at the same ripple, at the same time of day, under conditions which to me seemed the same as the day before, I took *G. grasilinellus*, *G. crassus* and *P. obscurus*. But *G. fraternus* was not seen, and *G. grasilinellus*, not seen on the 17th, was the commonest species of the three on the 18th. Specimens of the four species were all bright and clean, not at all worn. The why, whence and whither of imago *Gomphi* is a puzzle. On both these dates in the crowded willow herbs at the ripple *Argia putrida*, *apicalis*, *tibialis*, *sedula* and *violacea*—the five *Argias* known for the State—were pairing.

16. During the season of 1901 *Progomphus obscurus* was observed at Bluffton, June 17 and 18; Tippecanoe River, near Warsaw, June 23 and 30; Chapman Lake, June 30, where half a dozen exuviae were gathered on the sand beaches near the water's edge; old canal feeder and St. Joseph River near Ft. Wayne, July 19.

17. An exuvia of *Hagenius brevistylus* was collected from a pile in Tippecanoe River, June 23, 1901. On June 30 Mr. Kennedy took an imago along the river, and on the same date several were seen in a second growth brush lot, flying leisurely about—if no insect collector was in striking distance—and frequently alighting on twigs, stumps or an old rail fence.

18 During the summer of 1901 *Boyeria vinosa* was not rare in the low woods about the Biological Station at Winona Lake. Students collected a large number of nymphs of all sizes at Turkey Lake, July 19, 1901.

19. A single exuvia of *Basiaeschna janata* was found along the Tippecanoe River near Warsaw, June 23, 1901, identified by Professor Needham.

20. On August 24 and 25, 1901, Mr. Kennedy and myself collected several males of *Aeschna clepsydra* at Shriner Lake, Whitley County. This makes the Shriner-Round Lake list number 47 species. As observed on these two days, *clepsydra*, as his brighter color pattern would indicate, is a more dashing fellow than his common congener *constricta*.

21. *Macromia illinoensis* Walsh. Wabash River, Bluffton, June 20, 1901; Tippecanoe River, near Warsaw, June 23, 1901; old canal feeder and St. Joseph River, near Ft. Wayne, July 19 and August 11, 1901. *Macromia taeniolata* Rambur. Old canal feeder and St. Joseph River, near Ft. Wayne, July 19 and August 11, 1901; associated with *illinoensis*, *taeniolata* being the most numerous. This large dragonfly, floating idly or cutting through the air without apparent effort, always flashing the sunlight like darts from glimmering wings and metallic body, can not fail to draw the interest and admiration of any idle observer who may wander along its haunts. Its alertness usually brings dismay to the collector who has waited patiently in waist-deep mud and water for its coming, and whose deep and fervent reproaches follow the beautiful form as it sails away, first tree-top high, then skimming the water with its strong front wings, in pure derision of the impotent wretch who plotted so clumsily against its life.

22. During the whole of July, 1901, and possibly later, *Epicordulia princeps* was on the wing along the reed-grown shores of Winona Lake. This species spends more hours per day on the wing than any other species in Indiana. In the gray twilight, before sunrise, while the black bass were noisily gathering their breakfasts in the shallow water, as we sat in the boat casting to right and left with an indigestible, hook-enshrouded minnow, *princeps*, misty and indistinct, floated by. After sunset, when we went to the shore with the shotgun to snapshot at bats, there he was again, out over the water, hurrying along in the gathering dusk as though his day were not yet completed.

23. On September 3, 1901, at an old gravel pit near Bluffton, I observed *Sympetrum vicinum* ovipositing. The male held the female by the head as they hovered a minute in front of a curtain of algae, formed by a mass of the plant clinging to the edge of an old plank as the water had become lower in the pit. This curtain was about nine inches high, the lower edge of it trailing in the water. The dragonflies moved swiftly forward and the abdomen of the female

was tapped quickly against the curtain. At once they moved backward and downward, and the female struck the water with her abdomen. Then they rose again, hovered a moment a few inches in front of the curtain, and repeated the performance. After some time they separated and alighted among some cat-tails growing near. Oviposition was not interrupted by copulation. Part of this curtain of algae was collected. Portions of it were literally piled up with the dragonflies' eggs. Doubtless some of the eggs were washed from the abdomen into the water, but the majority were placed on the algae. Eggs had been placed at the top of the curtain, but this had become thoroughly dry. Females, which I saw ovipositing were placing the eggs two or three inches above the water where the curtain was very damp. The hatching of the egg, and possibly the first moult of the nymph, takes place on this curtain.

24. Though the subject of Odonate copulation has been considered by many authors with "presque toujours une description détaillée et souvent poétique," I have been unable to find any statement concerning the filling of the seminal vesicle of the male dragonfly, other than that this takes place before copulation. In the case of *Calopteryx*, *Argia* and *Enallagma*, where I have been able to make positive observations, the male fills the seminal vesicle at once after he has captured the female. It seems probable that during the wild flight of mating *Aeschnas* and some of the gomphines (I have noticed especially *Dromogomphus spoliatus*) the seminal vesicle is being filled, and, this accomplished, the pair come to rest in tree-top, on the ground, or where not, and copulation takes place. The Anisoptera, which I have observed, do not copulate while flying, if they are undisturbed.

## EXPLANATION OF PLATE.

1. *Argia translata* Hagen. Ohio Pyle, Pa., September 8, 1901, J. L. Graf.  
Lateral view of ♂ abdominal appendages.
2. *Herpetogomphus designatus* Hagen. Portion of right wing; *t*, triangle; *i*, internal triangle; *a*, anal vein (or postcosta); *b*, first branch of anal vein; *c*, second branch of anal vein; *p*, post-anal cells (middle post costal space).
3. *Ophiogomphus rupinsulensis* Walsh. Portion of right wing. Lettering same as for fig. 2.
4. *Gomphus spicatus* Hagen. Portion of right wing. Lettering same as for fig. 2.
5. *Gomphus villosipes* Selys. Portion of right wing. Lettering same as for fig. 2.
6. *Gomphus scudderi* Selys. Portion of right wing. Lettering same as for fig. 2.
7. *Lanthus albistylus* Selys. Portion of right wing. Lettering same as for fig. 2.
- 8 and 9. *Enallagma doubledayi* Selys. Provincetown, Mass., August 4, 1899, J. E. Benedict. Lateral and dorsal views of ♂ abdominal appendages.
- 10 and 11. *Enallagma aspersum* Hagen. Conneaut Lake, Pa., August 18, 1899, D. A. Atkinson. Lateral and dorsal views of ♂ abdominal appendages.
- 12 and 13. *Enallagma calverti* Morse. Sheep Creek, Wyoming, August 6, 1899, E. B. Williamson. Lateral and dorsal views of ♂ abdominal appendages.
- 14 and 15. *Enallagma cyathigerum* Charpentier. Sheep Creek, Wyoming, August 6, 1899, E. B. Williamson. Lateral and dorsal views of ♂ abdominal appendages.
16. *Gomphus viridifrons* Hine. Ohio Pyle, Pa., June 25, 1900, E. B. Williamson. Lateral view of ♂ abdominal appendages.
17. *Gomphus viridifrons* Hine. Ohio Pyle, Pa., June, 1900, E. B. Williamson. Vulvar lamina.
18. *Gomphus brevis* Selys. Ohio Pyle, Pa., June 24, 1900, E. B. Williamson. Lateral view of ♂ abdominal appendages.
19. *Gomphus brevis* Selys. Ohio Pyle, Pa., June 28, 1900, E. B. Williamson. Vulvar lamina.



## PLATE I.

