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Alexander G. Ruthven,
Director of the Museum of Zoology,
University of Michigan.
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NOTES ON THE MAMMALS OF ALGER COUNTY, MICHIGAN.

By Norman A. Wood.

In the summer of 1916 the University of Michigan sent an expedition to Alger County in northern Michigan for the purpose of adding to the data on the distribution of the animals of the state which is being accumulated by the Museum of Zoology. The University is indebted to Mr. George Shiras 3rd, for the opportunity to send out this expedition, and the field party is indebted to him for the use of his camp, for many helpful suggestions in the field, and for field notes on the animals of the region. A general account of the personnel and work of the expedition will be given in the report of the director of the Museum for 1916-1917, and it is sufficient to say here that the writer was in charge of the field work and devoted his time largely to the study of the birds and mammals.

The region selected for study is in the northwestern part
of Alger County in the Northern Peninsula (see map). It lies mostly to the south of Onota and Deerton, and is bounded roughly by Silver Lake, Howes Lake, Deerton and Deer Lake. Headquarters were established at Peter White Camp, Section 34, T. 47 N., R. 22, W., and most of the work was done in this and adjoining sections with occasional trips to different parts of the general region.

The surface is without notable relief and the soil is described as mostly "swampy" and "sandy till", a small amount as "sandy". The rock is near the surface but only outcrops along the rivers and lakes. The region is drained by the Whitefish River and Rock River into Lake Superior. The lakes, except Cranberry Pond, are shown on the map. Cranberry Pond is on Section 26, T. 47 N., R. 22 W.

The predominating trees are hardwoods, and the forest is principally composed of hard maple, yellow birch, beech, and hemlock (in certain areas). White pine is scattered throughout the forest, nowhere forming a pure stand, and the basswood and ironwood are present in small numbers. Spruce, balsam and arbor-vitae predominate in some of the low places forming arbor-vitae or "cedar" swamps, and these species are occasionally found in the hardwood forest on higher ground. On the forested river flats the elm and black ash predominate, and very large elms are of occasional occurrence in the hardwood forest. There is a large tamarack swamp at the west end of Howes Lake, and a small one at Cranberry Pond.

There are artificial clearings and a few farms along the railroad, and an extensive clearing extends from Onota southwestward nearly to Whitefish Lake. About a mile south of Deerton a meadow, about a mile long and probably the result

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of the work of beaver, occupies the lowland along the Whitefish River.

In addition to the species given in the following list, the fisher, marten, small brown weasel (*Mustela cicognani*), New York weasel (*Mustela noveboracensis*) and at least two bats almost certainly occur in the region. The fisher and marten have been so diminished in numbers by trapping, and, with the weasels, are so shy in summer that they are seldom seen. The residents distinguish two weasels, a large one and a small one, which makes it probable that both of the forms above mentioned are present. The writer observed two species of bats, but as specimens could not be secured their identity could not be established.

**List of Species.**

*Rangifer caribou* (Gmelin). Woodland Caribou.—Mr. Shiras has the following record of the occurrence of the caribou near the region studied. Jack Le Pete, a former guide of Mr. Shiras, reported to him that in 1865 he shot 6 caribou near Sand River, 6 miles west of Peter White Camp, in Marquette County.

*Alces americanus* (Jardine). Eastern Moose.—Mr. Shiras informed the writer that in August, 1878, he saw a cow moose at Little Lake, several miles south of Peter White Camp and outside of the region covered. The writer obtained a small set of moose antlers at N. M. Kauffman's camp on Silver Lake which were taken from an entire skeleton found on the edge of the lake about 1892.

*Odocoileus americanus borealis* (Miller). Northern Virginia Deer.—The deer are protected about Peter White Camp and are very tame, coming to the grounds about the camp in numbers. The writer saw more than twenty deer in this region during the field work. They are attracted by the natural salt
licks that occur at several places about Whitefish Lake, and it is in this region that the remarkable flash-light photographs of the species have been taken by Mr. Shiras.

*Sciurus carolinensis leucotis* (Gapper). Northeastern Gray Squirrel.—The writer did not find this species in the region but was told by residents that a few were taken by deer hunters who camped about two miles west of Peter White Camp in 1915. The species is probably nowhere common in the region as the supply of food (which is principally beech nuts) is very uncertain.

*Sciurus hudsonicus loquax* (Bangs). Southeastern Red Squirrel.—The red squirrel is common and was generally found in the cone bearing trees.

*Eutamias quadricittatus neglectus* (Allen). Lake Superior Chipmunk.—This chipmunk is not as common as the large one and is found in the clearings throughout the area. Young were observed on July 25 and 27. (Plate III, fig. 1.)

*Tamias striatus griseus* (Mearns). Northeastern Chipmunk.—This large species is quite common in the forest and is found in clearings at Peter White Camp.

*Marmota monax canadensis* (Erxleben). Canada Woodchuck.—The woodchuck is not rare in the region and occurs in the heavy forest, pasture lands and clearings.

*Sciuropterus sabrinus macrotis* (Mearns). Canada Flying Squirrel.—The writer did not find the flying squirrel but was told by the residents that they are occasionally observed in the forest. It is referred to this sub-species as the specimens from northern Michigan in the Museum collections have been so identified by the U. S. Biological Survey.

*Castor canadensis michiganensis* (Bailey). Woods Beaver.—While formerly quite common the beaver is now scarce in the region. A few were found about Whitefish Lake and
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along the Whitefish River as far as Peter White Camp. A small dam was built across the river during June and July, but it was an ineffective one. Fresh cuttings were found all along the edge of Whitefish Lake and adjacent stretches of the river. The trees cut were small ash. (Plate I, fig. 2.)

*Mus musculus* (Linnaeus). House Mouse.—The house mouse occurred about the buildings at Peter White Camp but not in as large numbers as did the Michigan mouse.

*Peromyscus maniculatus gracilis* (Le Conte). Michigan Mouse.—This mouse was found to be the most abundant mammal of the region. It occurred in large numbers about camp and was taken in all of the habitats in which trapping was done. It was so abundant as to interfere with the trapping of other small rodents.

*Ecvotomys gapperi* (Vigors). Red-backed Mouse.—The red-backed mouse is apparently rare in the region and only one specimen was taken. This specimen was found in a root cellar built partly underground near Peter White Camp.

*Microtus pennsylvanicus* (Ord). Meadow Vole.—The vole was not common, but a few were observed in the meadows and two were taken in dead grass at the edge of the river near Peter White Camp.

*Ondatra zibethica* (Linnaeus). Northern Muskrat.—This muskrat is quite common about the lakes and streams in the area studied. It was often seen and heaps of opened clam shells were frequently found.

*Zapus hudsonius* (Zimm.). Northern Jumping Mouse.—This species was not found by the writer but was reported by residents as occasionally seen.

*Ercthizon dorsatum* (Linnaeus). Canada Porcupine.—The porcupine is still a common species in the region and it was often seen, especially about the salt licks. Two were caught
in steel traps set for skunks and baited with fish and meat. Many individuals were observed along the edge of Whitefish Lake, where they feed on water plants, and it was at the edge of this lake that the albino lived for several years of which Mr. Shiras secured a successful flashlight photograph. (Nat. Geog. Mag., xxii, pp. 574-582.) (Plate III, fig. 2.)

*Lepus americanus phaeotus* (Allen). Minnesota Varying Hare.—The writer saw but two hares, one of which was caught in a steel trap baited with meat for skunks. Residents reported this species as common in the cedar swamps in winter.

*Lynx canadensis* (Kerr). Canada Lynx.—According to Mr. Shiras there are still a few Canada lynx in the region.

*Lynx rufus* (Gueldenstaedt). Bay Lynx.—This lynx also persists in small numbers, according to residents.

*Canis occidentalis* (Richardson). Timber Wolf.—The timber wolf still exists in numbers notwithstanding the bounty. According to Mr. Shiras they kill hundreds of deer each year in Alger County alone. A number have been trapped near Peter White Camp, and one of these—a ninety pound specimen—taken on July 29, 1907, was photographed by Mr. Shiras. (Plate II, fig 2, and Nat. Geog. Mag., Vol. XIX, p. 423.) The bounty on this species should be increased.

*Canis latrans* (Say). Coyote.—This species has, according to Mr. Shiras, come into the region within a few years. They are heard more often than seen. The writer saw tracks at the head of Whitefish Lake on July 8 and heard one there on the evening of July 23.

*Vulpes fulva* (Desmarest). Red Fox.—The fox is apparently not common. A few have been seen and taken by the residents.

*Ursus americanus* (Pallas). Northern Black Bear.—Although the writer saw signs of bear at various places the
species is apparently not common and was so reported by residents.

*Procyon lotor* (Linnaeus). Raccoon.—No raccoons were observed by the writer, and the tracks were seen but once. Mr. Shiras reported that the species is becoming more common, and he has secured flash-light pictures of several which came to the growing corn in the clearing at Camp White at different times. (Plate II, Fig. 1, and Nat. Geog. Mag., XXII, pp. 584-595.)

*Mephitis hudsonia* (Richardson). Northern Plains Skunk.—This species is a common one in the area. The writer caught two in steel traps baited with fish and meat. Of these two the male (Plate IV, middle figure) has the normal coloration, and the female (Plate IV, right figure) differs from it in having shortened dorsal stripes and a white-tipped tail—variations not infrequently found in specimens from northern Michigan.

*Mustela vison* (Schreber). Northern Mink.—This species is rather common and many are trapped each season. The writer saw one individual at the edge of Whitefish Lake on June 11. (Plate I, Fig. 1.)

*Lutra canadensis* (Schreber). Canada Otter.—The otter is not rare in the region and several are taken each year by trappers. The writer found tracks in the mud at the edge of the river a mile below camp on July 1.

*Sorex personatus* (Geoffrey St. Hilaire). Masked Shrew.—Two specimens of this shrew were found by the writer. One was trapped in a root cellar at Camp White, on July 16, the other was caught by a house cat near Deerton on July 19.

*Blarina brevicauda* (Say). Short-tailed Shrew.—This species was not common in the region and only a half dozen were taken in traps set through June and July. One was cap-
tured in the root cellar at Peter White Camp, the others in the hardwood forest.

*Condylura cristata* (Linnaeus). Star-nosed Mole.—Apparently a rather rare species in the region; found in black soil along the edge of streams and lakes. The writer saw fresh mounds at Silver Lake on July 29, and Mr. Shiras found one dead at Peter White Camp in 1915. The only specimen obtained by the writer was taken near a house at Deerton.
PLATE I.

Figure 1. Mink on the shore of Shiras Lake. Flash-light photograph by George Shiras 3rd.

Figure 2. Beaver repairing dam, Marquette County. Flashlight photograph by George Shiras 3rd.
PLATE II.

Figure 1. Raccoons at Whitefish Lake. Flash-light photograph by George Shiras 3rd.

Figure 2. Timber wolf trapped near Whitefish Lake: an adult male weighing 90 pounds. Photograph by George Shiras 3rd.
PLATE III.

Figure 1. Lake Superior Chipmunk, western Ontario. Photograph by George Shiras 3rd.

Figure 2. Stumps used as artificial deer-licks and gnawed by porcupines. Photograph by Wilbur MacAlpine.
Northern plains skunks from northern Michigan. The middle of the three specimens shown has the normal coloration, the outer two differ in the length of the dorsal stripes and in having more or less of the tip of the tail white.
A MINNOW NEW TO THE MICHIGAN FAUNA.

By T. L. Hankinson.

Over two hundred specimens of *Leuciscus carletoni* Kendall, a minnow not hitherto recorded from the state, were taken in different parts of Michigan in 1916. The species was described from specimens taken in Maine (Bull. U. S. Fish. Comm., XXII, 357-359), and the writer can find no other records of its occurrence, although Kendall states that it is doubtless widely distributed.

The minnow was found in 1916 in four stream systems, the Au Sable, Manistee, Molasses and White River, and a re-examination of the fish recorded from Houghton County by the writer in 1905 as *Conesius plumbeus* on the authority of Dr. S. E. Meek (Mich. Geol. and Biol. Surv., Pub. 20, Biol. Ser. 4) shows that they are also to be referred to *L. carletoni*.

*Leuciscus carletoni* and *Conesius plumbeus* resemble each other so closely as to be easily confused, particularly in the
absence of large series. The former differs from the latter chiefly in having the pharyngeal teeth usually 2, 4-5, 2 instead of 2, 4-4 2 and in having the barbel very small and frequently absent—sometimes present on one side and not on the other. Specimens of *Leuciscus carletoni* also resemble closely the horned dace, *Semotilus atromaculatus*, and this is probably one reason why it has been overlooked by students of Michigan fish. From *Semotilus* it may be readily distinguished by its more slender form, smaller mouth, finer scales on the anterior part of the body, and more posterior location of the dorsal fin. There is little chance of its being confused with the other Leuciscus common in Michigan (*L. neogaeus*) for it is less robust in form and tends to grow larger and has a better developed lateral line, at least in those already collected, and in having, in many cases, the maxillary barbel. In the last character it differs from other members of the genus *Leuciscus*, a fact that led the writer and Dr. Meek to wrongly assign it to the genus *Cuneius*.

The writer is indebted to Dr. Henry W. Fowler, of the Academy of Natural Sciences of Philadelphia, for the identification of the specimens.
THE TYPE OF PLEUROCERA RAFINESQUE.

By Bryant Walker.

The unfortunate legacy that Rafinesque left to American conchology has been, from the beginning, a source of perplexity, to say nothing of contention and bitterness, not only to his contemporaries, but to many of his successors. The recent paper by Dr. H. A. Pilsbry (Naut. XXX, 1917, p. 109), is an admirable attempt to settle the standing of Rafinesque's dubious genera of fresh-water univalve mollusca and, in the main, is a most satisfactory solution of the many questions involved.

It is unfortunate that Dr. Pilsbry did not see his way clear to retain Campeloma Raf. and Anculosa Say. Both of these names have now had general recognition for many years and should be retained, if it is a possible thing to do so. To replace them by Ambloxis Raf. and Leptoxis Raf., both at the best very doubtful, must be regarded almost as a miscarriage
of justice. It is possible that future students may find sufficient grounds for the reinstatement of both of these names. The questions involved in both cases are purely zoological. They do not involve any construction of the International Code and are wholly matters of individual opinion as to the proper construction of Rafinesque's published writings and the elimination of opinions based on references to his unpublished "Conchologia Ohioensis," which are, of course, absolutely inadmissible. But most writers on the subject have been as unsuccessful in their attempts in the latter particular as Mr. Dick was in keeping King Charles the First out of the Memorial. The futility of discussion on questions of this kind is so obvious that their settlement must, in the end, be left to those who have not participated in the promulgation of the opinions at issue. For this reason, I, personally, bow to the great weight of Dr. Pilsbry's judgment, and leave to others the discussion of the merits of the questions involved and the possible reversal of his decision.

But as to Pleurocera the situation is quite different. Not only does the position taken by Dr. Pilsbry involve the standing of two generic names which for over fifty years have had universal recognition, but it is based, as it seems to me, upon a radically incorrect construction of the Code and of several of the decisions of the International Committee, and for that reason should not pass unchallenged.

Statement of Facts.

1. Pleurocera was first described by Rafinesque in 1818 (Am. Monthly Magazine, etc., III, p. 355) as follows:

G. Pleurocera. Univalve. Shell variable oboval or conical, mouth diagonal crooked, rhomboidal, obtuse and nearly reflexed at the base, acute above the connection. lip
and columella flexuose entire. Animal, with an operculum membranaceous, head separated from the mantle inserted above it, elongated, one tentaculum on each side at its base, subulate acute, eyes lateral exterior at the base of the tentacula.

Six species are named but none described.

2. In 1819, in his “Prodome” published in the Journal de Physique, etc., of Brussels, I.XXXVII, p. 423, Rafinesque re-defined Pleurocera. Binney’s translation (L. & F. W. Sh., Pt. III, p. 62), with one or two exceptions, is excellent and is as follows:

Shell spiral, oval or pyramidal, many whorls “en aplomb” (Binney says “rounded,” rather flat or straight, literally perpendicular); aperture oblong, oblique, base prolonged, twisted, narrowed above; outer lip thin, interior lip appressed to the columella, which is smooth and twisted, without umbilicus. Animal with a membranaceous operculum, proboscis-like head, inserted in the back; tentacles two, lateral, subulate, sharp, eyes at their exterior base. Family Neritacca (Binney says “Turbinacea”). Species numerous, of which I have already twelve, all fluviatile, from rivers and creeks.

3. In 1820 (Ann. of Nat., p. 11), Rafinesque described his Pleurocera verrucosa. This is the first recognizable species described as, or referred to, Pleurocera and is unquestionably the species commonly known as Angitrema verrucosa.

4. In his “Enumeration and Account,” etc., 1831, p. 2, Rafinesque remarks:

My G. Pleurocera, 1819, is, perhaps, a S. G. of Melania, but the animal is different, with lateral feelers; the shell is always conical oblong with the opening oblong, oblique, acute at both ends, columella flexuose twisted.

In the same paper (p. 3), he described Pleurocera acuta from Lake Erie. This species is undoubtedly the same as Lea’s Melania subularis from the Niagara River as hereinafter demonstrated.
5. In 1864, (Pr. A. N. S. P., p. 24), Tryon in his “Synopsis of the Streptomatidæ” revived the use of Pleurocera. His reasons for so doing were given at length in the Am. Jour. of Con., I, 1865, p. 97 et seq. This article was reprinted as the introduction to his “Streptomatide,” Part IV, L. & F. W. Shells, published by the Smithsonian Institution in 1873.

6. In 1865, Binney (L. & F. W. Sh., Pt. III, p. 62, fig. 126) published a fac-simile of a figure of Pleurocera taken from Rafinesque’s unpublished ‘Conchologia Ohioensis,” which is consequently available for nomenclatorial purposes from that time.


8. In 1917, Pilsbry (l. c., p. 110) accepted and adopted Hannibal’s designation.

**Argument.**

I.

It is to be noted that Rafinesque’s original description of Pleurocera in 1818, with six named, but undescribed, species, and his revised diagnosis in 1819, with no species mentioned, were both published before he described his *Pleurocera verrucosa* in 1820. Pleurocera was, therefore, a genus without a type and the question at issue is:—what species under the facts and a proper construction of the Code must be held to be the genotype.

Both of Rafinesque’s generic descriptions taken by themselves, are adequate, “clearly giving generic characters,” and there can be no doubt but that Pleurocera was intended to include the group of species, which for over fifty years has been universally designated by that name. This is confirmed by his figure, published by Binney in 1865 and since that time
admissible evidence. It may, therefore, be considered as settled beyond dispute that Pleurocera since 1819 has been an adequately described genus, representing a common and well known group of species and as such it has been universally recognized for more than fifty years.

It is equally clear that *Pleurocera verrucosa* Raf. does not fall within the original generic diagnosis nor agree with Rafinesque's figure, but, on the contrary, by the unanimous concensus of opinion of all conchologists for over half a century, belongs to an entirely different genus.

Pleurocera belongs to category 5 of Opinion 46 of the International Commission.

Three rules are laid down in that opinion:

1st. "In genera published without mention, by name, of any species, no species is available as a genotype unless it can be recognized from the original generic publication."

That is, no species that does not comply in its characters with the original generic diagnosis, is available as the genotype.

2nd. "If it is not evident from the original publication of the genus how many or what species are involved, the genus contains all the species in the world, which would come under the generic description as originally published."

3rd. "The first species published in connection with the genus becomes *ipso facto* the type."

My contention is, that these rules of procedure must be construed together and harmoniously. Any construction that would so interpret any one of these rules as to negative either of the others must necessarily be erroneous. In short, if the "first species published in connection with the genus" does not comply with the generic diagnosis and therefore cannot "be recognized from the original generic publication," it is not available as a genotype.
It also seems to me that the argument advanced by the Commission in Opinion 19 is applicable to this case.

If, for any reason, it should be contended that the first rule laid down in Opinion 46 as above quoted was not intended to apply to a case like this, then I would further urge that it is a cardinal principle in the legal construction of precedents that the determination of a court of final resort is a precedent only for subsequent cases involving the same essential facts.

If any of the essential facts in a subsequent case is different, the prior case is not a precedent that is binding on the court, but may be construed or modified as the court may deem necessary in dealing with the facts of the subsequent case.

While the language on page 107, Op. 46, "that the first species published as a member or members of the genus are the only species available as the type" would, if taken by itself and construed literally, seem to cover the case of verrucosa, the language used must necessarily be construed to mean that such subsequently described species agrees with the original generic diagnosis.

The fact that such subsequent species might not fall within the generic specification was, evidently, not called to the attention of the International Commission. Such a possibility is not mentioned in their opinion and was not passed upon by them. This being so, the essential differential fact in this case that the subsequent species does not fall within the generic diagnosis raises an entirely new and different question for which the decision given is not necessarily a precedent and which is still open for discussion and decision upon its merits.

But it seems to me that the question is really covered by the statement in the opinion that "each new genus, therefore, contains all the species of the world, which come in that cate-
gory in the tables." And it necessarily follows that it does not include any species that does not "come within that category in the tables." And consequently, the erroneous reference of a subsequently described species, either by the original author or a subsequent writer, cannot make that species the type of a genus to which, zoologically considered, it does not belong.

In other words, the opinion, taken as a whole, should be construed as though it read,—Each new genus contains all the species in the world, which come within that category in the tables (i. e., the original generic diagnosis) and the first species published as a member of the genus that falls within the original generic diagnosis is the only species available as the type.

This, it seems to me, is not only common sense, but is the proper legal construction of the language of the opinion and it is exactly what I claim.

I submit, therefore, that under a proper construction of Opinion 46, the verrucosa Raf., although it was described as a Pleurocera, is not available as a genotype on the ground that it does not comply with and cannot "be recognized from the original generic publication."

II.

Hannibal's designation of verrucosa as the type of Pleurocera, in 1912, is entirely immaterial, as it was either invalid or unnecessary.

If I am right in the foregoing contention, his attempted designation was absolutely void. The International Commission has held (Op. 15) that the author of a published name has no greater rights over it than any other writer. The same rule is applicable to the description of a new genus. The original publication must govern and a subsequently designated genotype must accord with the generic specification. Rafinesque
himself did not attempt to designate verrucosa as the type of Pleurocera. If he had, the designation would have been invalid. Hannibal had no more right to designate as the type a species that does not agree with the original generic specifications than Rafinesque had by erroneously including it in his genus. In other words, he cannot, by such designation, validate the erroneous action of Rafinesque in describing verrucosa as a Pleurocera.

If, on the other hand, my contention is erroneous, and the third rule laid down in Opinion 46 is to be construed literally, without reference to the remainder of the opinion and without any qualification, then verrucosa became automatically the type of Pleurocera and Hannibal's designation was only the statement of a fact already determined.

III.

If the preceding argument is correct, and verrucosa Raf. is not available as the type of Pleurocera, its genotype still remains to be determined. No other designation of a type for the genus has ever been made, and, unless the question has already been determined under the rules laid down in Opinion 46, the designation of a proper type is still open.

But it seems to me that the question is already settled.

In 1831, Rafinesque described three additional species of Pleurocera. Two of them from Kentucky are unidentifiable. But the third, *P. acuta*, from Lake Erie, is undoubtedly, as it appears to me, the species from the Niagara River described by Lea as *Melania subularis*.

Rafinesque's species has been referred to *Goniobasis virginica* Gmel. by Hannibal, but, as virginica is not known from the Lake Erie Basin and does not agree with the description of acuta, the approximation is evidently erroneous.
The description of *P. acuta*, though short, does not apply to any other Pleurocerid belonging to the Lake Erie fauna, but does, as it seems to me, unmistakably cover the species so well known as subulare Lea.

That *acuta* Raf. and *subularis* Lea are the same species is shown conclusively by the following comparison of the original descriptions, in which every word of both, and nothing else, is included.

*Pleurocera acuta* Raf.  
Elongate, very acute.  
Flat, nine spires, the first angular in front.

*Melania subularis* Lea.  
Elevated and acutely turreted, apex acute, horn color.  
Whorls about twelve, flat, carinate on the middle of the body-whorl, base angulated.  
Aperture white and one-fourth the length of the shell.  
Length 1.3; diam. .4 in.  
Lake Erie.

Dr. Lea could almost be convicted of plagiarism on this showing. If this identification is correct, then under the ruling of Opinion No. 46, *Pleurocera acuta* Raf., being the first identifiable species described as Pleurocera and complying with the original generic diagnosis, automatically becomes the genotype as being the "only species available as a type."

While I think that under the showing made, it is unnecessary, nevertheless, to put the question beyond any peradventure of a doubt, I hereby identify *Pleurocera acuta* Raf. as the species subsequently described by Lea as *Melania subularis* and do further designate it as the type of the genus Pleurocera Raf.
In conclusion, I desire to insist most strenuously:

1. That the original diagnosis of Pleurocera is an adequate and unmistakable description of a group that has had universal generic recognition for over fifty years.

2. That the figure copied by Binney from the "Conchologia Ohioensis," and now admissible in evidence, confirms very exactly the present existing conception of the genus.

3. That verrucosa Raf. does not fall within the original generic diagnosis nor agree with Rafinesque's figure, but, on the contrary, by the unanimous consensus of opinion of all conchologists for over half a century, belongs to an entirely different genus.

4. That the establishment of verrucosa as the genotype of Pleurocera would result in transferring the generic name to a group that does not comply with the original generic specifications.

5. That such a result, in plain violation of the clear intent of the original author, would be most unfortunate and should not be done, if in any way it can be avoided.

6. That Pleurocera acuta Raf. is clearly identifiable.

7. That under a proper construction of the Code as interpreted by Opinion No. 46, it becomes necessarily the genotype.

8. If not, that it has now become the type by designation, as being the first species complying with the original generic diagnosis that has been so designated.
TWO NEW SPECIES OF ELEUTHERODACTYLUS
FROM COLOMBIA.

BY ALEXANDER G. RUTHVEN.

The collections made in the Santa Marta Mountains, Colombia, for the Museum of Zoology, by the Bryant Walker Expedition (1913) and by M. A. Carriker (1914), contain a number of new species of Eleutherodactylus, two of which are described in this paper.

Eleutherodactylus sanctae-martae, new species.

Diagnosis: Size moderate; head broad, as broad as long; nostril much nearer tip of snout than eye; eye large, the diameter of the orbit a little greater than the distance between orbit and nostril; snout rounded with distinct canthus rostralis, the length a little less than half the length of the head. Tongue heart-shaped, emarginate behind; vomerine teeth in two groups well behind the choanae. Tympanum distinct, rather small,
its greatest diameter contained in the length of the snout about 3.5 times. Toes free, well developed; the hind limb being carried forward along the body the tibio-tarsal articulation reaches the anterior margin of the orbit; disks well developed, the disk of the third finger larger than the ear, about three sevenths of diameter of eye. Skin of dorsal surface finely granular with a few enlarged tubercles and a distinct glandular fold above each ear; belly coarsely granular; a strong fold across chest.

*Habitat*: Santa Marta Mountains, Colombia.

*Type Specimen*: Cat. No. 48605, Museum of Zoology, University of Michigan; San Lorenzo (5,000 ft.), Santa Marta Mountains, Colombia; July 16, 1913; Alexander G. Ruthven, collector.

*Description of Type Specimen*: Head broad, as broad as long, its length contained in the total length 2.9 times; snout rounded, its length a little less than one half the length of the head; canthus rostralis distinct; eye large, its diameter a little greater than the distance between the eye and nostril and 3.2 times the diameter of ear. Tympanum distinct, small, the diameter contained in the length of the snout 3.6 times. Tongue heart-shaped, emarginate behind; vomerine teeth in two groups well behind the choanae. Fingers and toes well developed, with large digital expansions, the disk of the third finger nearly 1.3 times greatest diameter of the ear, its width contained in the diameter of the eye about 2.44 times. First finger conspicuously shorter than second; the hind limb being carried forward along the body the tibio-tarsal articulation reaches the front of the orbit; a large oval inner and a small conical outer metatarsal tubercle. Skin of dorsal surface finely granular, with a few tubercles, indications of narrow glandular folds on the sides, and a strong fold above each ear:
Occasional Papers of the Museum of Zoology 3

belly coarsely granular; a strong fold across the chest. Above brown with a dark interocular line, a small black spot on each shoulder, and a faint dark rhomboidal marking with anterior extensions on the sacral region; limbs cross-barred; posterior side of the thigh brown spotted with white; belly white with brown spots; chin and throat white very densely powdered with brown.

Total length, 36.75 mm.; length and width of head, 14 mm.; length of snout, 6.5 mm.; diameter of ear, 1.75 mm.; hind limb to tip of longest toe, 57 mm.; hind foot, 26.5 mm.; front leg to tip of longest finger, 25 mm.

Remarks: The species is represented by two specimens, one of which has been deposited in the British Museum (Natural History). The latter was taken at an altitude of 6,500 feet on San Lorenzo.

Eleutherodactylus megalops, new species.

Diagnosis: Size small; head broad, nearly as broad, or a little broader than the body; the width equal to or a little less than the length to the posterior margin of the ear; nostril much nearer to tip of snout than eye; eye large, the diameter of orbit equal to or a little greater than its distance from nostril; snout rounded, with weak or moderately distinct canthus rostralis; its length contained in the width of the head 1.5 to 2.3 times. Tongue oval, entire; vomerine teeth in two groups behind the choanae. Tympanum distinct, its greatest diameter contained in the length of the snout 2.2 to 3.5 times. Toes free: the hind limb being carried forward along the body the tibio-tarsal articulation reaches the anterior border of the orbit, the nostril or some point between; digital expansions moderate, occasionally as large but generally smaller than tympanum. Skin above rough with many small
tubercles and more or less numerous large ones, the latter sometimes without definite arrangement, but most frequently some of the dorsal ones fused to form short irregular glandular ridges, the most constant of which are two curved ones over the shoulders and one over the ear; the dorsal ridges sometimes connected to form two linear ridges from eye to lumbar region; belly inconspicuously granular, sometimes almost smooth.

_Habitat:_ Santa Marta Mountains, Colombia.

_Type Specimen:_ Cat. No. 48444. Museum of Zoology, University of Michigan; San Lorenzo (5,000 feet), Santa Marta Mountains, Colombia; July 16, 1913; Alexander G. Ruthven, collector.

_Description of Type Specimen:_ Head broad, its width equal to the length of the head to the posterior border of the ear; length of head contained in total length 2.3 times; snout rounded, its length a little less than half the length of the head; canthus rostralis weak; eye large, its diameter greater than its distance from the nostril, and 2.5 times the diameter of the ear; tympanum distinct. Tongue oval, entire behind; vomerine teeth in two groups behind the choanae. Fingers and toes slender, the first finger a little shorter than second; a large oval inner and a small round outer metatarsal tubercle; the hind limb being carried forward, the tibio-tarsal articulation reaches midway between the orbit and nostril; disks moderate in size, the expansion of the third finger two-thirds of diameter of ear. Dorsal surface rough with many small tubercles and scattered large ones, some of the latter fused to form two short glandular ridges above the shoulders and a ridge above each ear; belly granular. Above brown with a few black spots; a black band from the eye above the ear, and
three from eye to lip; chin and throat brown with white spots; belly white with brown reticulations.

Total length, 24 mm.; length of head, 10.25 mm.; width of head, 10.25 mm.; length of snout, 5 mm.; diameter of ear, 1.5 mm.; hind leg to tip of longest toe, 43 mm.; hind foot, 19 mm.; fore leg, 15 mm.

Notes on Paratypes: The variations in structure in the series of 22 specimens selected as paratypes have been adequately given in the diagnosis. The coloration is rather constant, most of the specimens having a color pattern similar to that of the type. A few specimens have a single dark interocular band, and two have two dark bands separated by a lighter one. A number of specimens have a pale spot between the shoulders, and three have a wide yellow vertebral stripe.

Remarks: Besides the specimens described above there are in the Santa Marta collections a considerable number of specimens which differ from the type and paratypes, but which the writer has been compelled to refer to this species. The variations are in color and in the prominence of the dorsal tubercles and glandular folds. In some specimens the tubercles are mostly small, and the glandular ridges are absent or only present over the ear. In a few the glandular ridges are limited to a very open chevron behind the eyes. In others there are two irregular linear glandular ridges on either side of the vertebral region, and in one specimen there are two straight linear ridges on either side of the back from the orbits. Many specimens are colored like the type, but some are pale (red or green in life) except for a dark patch on the head and shoulders, the patch varying from a uniform to a yellow with dark reddish brown markings. There are specimens apparently intermediate between those described above and the types, but it is possible that another species is represented, so that the.
diagnosis has been drawn from those specimens which correspond closely with the type.

The species is not uncommon on San Lorenzo between altitudes of 4,500 and 6,500 feet and was taken as high as 7,500 feet. Fourteen specimens in the collection are from Don Diego on the coast and were taken by M. A. Carriker in January, 1914.
Figures 1 and 2. *Eleutherodactylus megalops*. The drawings are twice the natural size.

Figures 3 and 4. *Eleutherodactylus sanctae-martae*. The drawings are twice the natural size.
Eleutherodactylus megalops
Eleutherodactylus sanctae-martae

Plate I

1

2

3

4

COCKAYNE, BOSTON
DESCRIPTION OF A NEW SALAMANDER FROM WASHINGTON.

BY HELEN THOMPSON GAIGE.

Among a collection of amphibians which has recently been received at the Museum of Zoology from Lake Cushman, Washington, are a number of small salamanders which undoubtedly represent a new species of the genus Ranodon. The discovery of this form in North America is particularly noteworthy as the genus has hitherto been composed of a single species, Ranodon sibiricus, which has been recorded only from eastern Siberia and northeastern China.

The writer is indebted to Dr. Leonhard Stejneger for his assistance in diagnosing the form and to Dr. George A. Boulenger for its comparison with the specimens of Ranodon sibiricus in the British Museum (Natural History).
Ranodon olympicus

Plate I
NOTES ON A COLLECTION OF ODONATA FROM SCHOOLCRAFT COUNTY, MICHIGAN.

By A. F. Combs.

During the month of July, 1915, the writer was a member of the Bryant Walker Expedition to Schoolcraft County in the upper peninsula of Michigan. The following paper embodies the results of his observations during that time, and is the first of a series of papers on the Odonata of the state. Eventually it is hoped that a comprehensive account of the state fauna may be published.

The vicinity of the Manistique River offers particularly favorable breeding grounds for aquatic insects, as the whole country is cut up by small streams, ponds, small lakes, and oxbow lakes formed by the river, while the river itself, tho it carries a quantity of silt and is stained by the drainage from the extensive swamps, supports such forms as require running water. From these conditions it might be expected that the odonate
fauna would be large, a supposition corroborated both as regards species and individuals.

The odonate habitats may be divided into three groups, the Manistique River, the small streams flowing into it, and the small lakes and ponds. Two habitats common in northern Michigan were lacking, viz., clear, rapid streams, and rocky lake shores, factors which undoubtedly excluded many species from the region.

The imagoes were found widely distributed, tho many species, exhibited marked preferences for certain sets of conditions. *Calopteryx acquabilis* was found only along the river, usually flying over the water, *Calopteryx maculata* in smaller numbers was frequently associated with it, but was more often found in shady, rather open woods in company with species of Lestes. *Libellula quadrimaculata* preferred high, dry, open country, while *Libellula pulchella* was only seen flying over the waters of an oxbow lake. The various species of Enallagma were found among the reeds and grasses on the shores of small lakes and ponds. The species of Aeschninae were most often seen in open woods, as was true of the single species of Cordulegaster. The species of *Sympetrum* were widely distributed in open woods, meadows, ponds, small streams—anywhere that there was an abundance of sunlight. All of the species of *Leucorrhinia* save *L. intacta* were taken at lakes and ponds, while it frequented the edges of woods in sunny openings. The various species of *Somatochlora* were all found along old logging roads cut thru heavy woods.

In all, specimens of fifty-one species were secured, of which thirty-three belong to the suborder Anisoptera and eighteen to the suborder Zygoptera. One new species was taken, and described by Mr. Kennedy as *Somatochlora walkerii*. All the specimens are in the Museum of Zoology at Ann Arbor.
I wish to acknowledge my indebtedness to Dr. E. H. Walker and to Mr. C. H. Kennedy for the determination of the Somatochloras, and to Mr. E. B. Williamson for assistance with several other forms.

LIST OF SPECIES.

Suborder Zygoptera.

Family Calopterygidae.

*Calopteryx maculata* Beauvois.—The species was abundant and was widely distributed. It was seen throughout the month, most commonly along paths and roads in the woods, rarely in the open and never in abundantly lighted places. The flight is noticeably weak and irregular. Copulating pairs were taken on July 10. The females outnumbered the males throughout the month.

*Calopteryx aequabilis* Say.—This species was somewhat less numerous than the preceding. It was closely associated with the river, and most often noted in groups of four or five to twenty. Individuals gathered in the sunlight at the foot of steep banks along the river, and seemed on the whole rather inactive. The species seemed to increase in abundance throughout the month.

Family Agrionidae.

*Lestes uncatus* Kirby.—This species was found with the two following forms, and was rather rarer than either.

*Lestes rectangularis* Say.—A quite common species which preferred the thick, dark woods. It was never seen in the open nor about water. The first specimen secured was an immature male taken July 15. The males outnumbered the females.

*Lestes disjunctus* Selys.—Like the preceding forms of the genus, this species frequented the thick woods and was rarely seen in the open.
Nehalennia irene Hagen.—This delicate metallic green species was taken first on July 6. Its color and small size make it very inconspicuous among the long grasses at pond edges where it seems to live exclusively.

Nehalennia posita Hagen.—The species seems identical with the preceding in habits.

Nehalennia gracilis Morse.—A single male taken on July 13, in company with the last species, is the only record.

Enallagma calceriti Morse.—This species was common during the month, and was probably the most abundant representative of the genus. In common with all the species of the genus it frequented the grassy and reedy edges of still water to the exclusion of all other habitats.

Enallagma hageni Walsh.—This species is very similar in habits to the above.

Enallagma carnuculatum Morse.—The above data applies to this species.

Enallagma ebrium Hagen.—This species was found associated with other members of the genus but did not appear till July 23.

Enallagma civile Hagen.—This form was common throughout the month.

Enallagma doubledayi Say.—This exceedingly quiet and retiring species was recorded throughout the month, and was rarely noted on the wing.

Enallagma piscinarium Williamson.—A single male taken July 23 in the rank grass about a small pond was the only record for the species.

Ischnura verticalis Say.—This single representative of the genus was common throughout the month and was usually associated with the preceding genus.
Occasional Papers of the Museum of Zoology

Agrion resolutum Williamson.—This species was found in company with the species of the two preceding genera.

Chromagrion conditum Hagen.—The single representative of this genus was common throughout the last half of July. It is decidedly secretive in habits.

Suborder Anisoptera.

Family Aeschnidae.

Cordulegaster maculatus Selys.—This species was rather rare, but seemed to be on the increase toward the latter part of July. It was found only patrolling roadways thru the forest.

Gomphus grasilinellus Walsh.—Two females taken in thick woods on July 14 were the only records for this species.

Gomphus annicola Walsh.—The first specimen of this species was taken on July 17 in the thick woods. Further specimens were taken July 19 and 27 in similar habitats. On July 26 several nymphs about to transform were found on the river bank, one of which proved to be a female, the only one of the sex taken.

Gomphus cornutus Tough.—A much worn specimen of the species was collected on July 6, and from then until the end of the month the form was frequently noted. It was observed along the river, in meadows, in open woods and about small lakes and ponds, differing in this respect from most of the genus. It is interesting to note that the but recently described female was taken on several occasions.

Gomphus brevis Hagen.—This rather rare species was found only along an old logging road thru the forest. It was seen throughout the month.

Gomphus scudderi Selys.—The only specimen of this species secured were those from nymphs which transformed under observation. From July 18 to the 30th the nymphs were fre-
quently found crawling up the low sandy river banks during the early morning hours.

_Aeschna verticalis_ Hagen.—This species occurred only in open woods not far from the river. In the afternoon, individuals were often noted resting on the sunny side of tree trunks, but became more active toward sundown.

_Aeschna canadensis_ Walker.—The species was much associated with the preceding, and had very similar habits.

_Aeschna constricta_ Say.—This species was rather rarer than the two preceding, and of very similar habits.

_Aeschna cremita_ Walker.—A single specimen taken on July 29 in open, sunny woods was the only record for the species.

_Aeschna interrupta_ Walker.—This species was found under very similar conditions to the others of the genus.

_Tetragoneuria spinigera_ Selys.—The few specimens obtained of this locally rare species were all secured about a meadow near the river. They were very active and wary, and when alighting usually took a very inaccessible position.

_Somatochlora williamsoni_ Walker.—This species was rather rare, and was usually seen in the woods and along small streams. A female was observed ovipositing in a little brook on July 24.

_Somatochlora walshii_ Scudder.—The two specimens of this species that were collected were both taken on an old logging road in dense woods on July 24.

_Somatochlora minor_ Calvert.—This species was usually found in the dense woods, especially along old roadways, but was occasionally noted in the open. It was observed at intervals throughout the month.

_Somatochlora forcipata_ Scudder.—This species was found only on July 26, when several specimens were taken in the deep woods.
Somatochlora walkeri Kennedy.—This species, described by Kennedy from the material collected, was taken in a roadway thru partly cleared woodland. It seemed to prefer the low, wet spots in the road.

Dorocordulia libera Selys.—Asingle specimen taken in the deep woods on July 17 was the only record for the species.

Cordulia shurtleffi Scudder.—This species was taken only on July 6 near a small lake. But a single specimen was taken.

Leucorhinia hudsonica Selys.—A single specimen, a female, taken on high, open ground on July 17 was the only representative of the species found.

Leucorhinia proxima Hagen.—This species was found flying over lakes and ponds during the month.

Leucorhinia frigida Hagen.—This species was very similar in habits to the preceding.

Leucorhinia intacta Hagen.—This form was closely associated with the preceding one.

Leucorhinia glacialis Hagen.—This species was common thruout the month. It frequented small ponds, and mating pairs were seen commonly during the entire time.

Synpetrum vicinum Hagen.—A much worn female was found in a clearing on July 8, and was the first record of the species. Later it became common about wet clearings that were well lighted, but seemed to avoid the river.

Synpetrum obtrusum Hagen.—This species was quite common after July 15, but up to that date but a single specimen was taken. It frequented wet, sunny clearings.

Synpetrum rubicundulum Say.—Like the preceding species, this form was not frequently noted till after July 15. It seemed to prefer high, rather dry, open spaces.

Synpetrum scoticum Donovan.—A single specimen of this species was taken in a wet marsh, July 29.
Libellula pulchella Drury.—This dragonfly was rarely noted about one end of an ox-box lake along the river. It was noted from July 9 to 19. The species was very restless and shy.

Libellula quadrimaculata Linne.—Nearly all of the specimens of this species taken were old and worn. They were usually observed in dry, open meadows, and disappeared after the twenty-fifth of the month.

Libellula exusta Say.—Altho this species was noted throughout the month, it was rare. Like the preceding form, the specimens were old and worn. They were mostly taken about ponds and damp clearings. A female was observed ovipositing on July 19.
AN ANNOTATED LIST OF SHELLS FROM NORTHERN MICHIGAN.

By Mina L. Winslow.

The shells listed below were collected by members of four expeditions from the Museum of Zoology and the Michigan Geological and Biological Survey. In 1912 Mr. N. A. Wood made a small collection at Whitefish Point, Chippewa County, while engaged primarily in work on birds and mammals, also a larger collection in the same region in 1914; a third incidental collection was made by him in Alger County during the summer of 1916. In 1915 a more extensive collection was made near Floodwood in Schoolcraft County by persons able to devote more time to the work, with the result that 41 of the 65 species and varieties listed were secured in that region.

The species discovered are those that might have been expected in the region, judging by the results of other collectors to which reference is made in the short bibliography at the end of this paper (Walker, 1894, 1906, 1908, 1915).
The writer is indebted for generous assistance in the determination of species, exclusive of the Sphæriidæ, to Dr. Bryant Walker, of Detroit, and in the determination of the Sphæriidæ to Dr. Victor Sterki, of New Philadelphia, Ohio.

By way of a systematic summary it may be noted that the species fall into the following groups:

**Terrestrial, 19 species and varieties:**

<table>
<thead>
<tr>
<th>Family</th>
<th>Genus.</th>
<th>Species</th>
<th>Family</th>
<th>Genus.</th>
<th>Species</th>
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<tr>
<td>Helicidae</td>
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<td>Lymnaeidae</td>
<td>3</td>
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<tr>
<td>Zonitidae</td>
<td>3</td>
<td>6</td>
<td>Physiidae</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Limacidae</td>
<td>2</td>
<td>2</td>
<td>Planorbidae</td>
<td>1</td>
<td>10</td>
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<td>Philomycidæ</td>
<td>1</td>
<td>1</td>
<td>Ancyliidae</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Endodontidæ</td>
<td>2</td>
<td>4</td>
<td>Viviparidae</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Succineidæ</td>
<td>1</td>
<td>2</td>
<td>Unniicolidae</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pupillidæ</td>
<td>1</td>
<td>1</td>
<td>Unionidæ</td>
<td>4</td>
<td>6</td>
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<tr>
<td>Cochlicopidæ</td>
<td>1</td>
<td>1</td>
<td>Sphæriidæ</td>
<td>3</td>
<td>12</td>
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</table>

**Fluvial, 46 species and varieties:**

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<th>Genus.</th>
<th>Species</th>
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<td>12</td>
<td>19</td>
<td>15</td>
<td>46</td>
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</tbody>
</table>

**List of Species.**

1. *Polygyra albolabris* (Say).—Schoolcraft: Several specimens were found on rotten wood and leaves along the Manistique River and in the hardwood forest. They are rather frail shells, with the exception of No. 33 which is quite solid and of a pale yellow color. Alger: From the hardwood forest. Of the eleven specimens three are immature. Chippewa: Found in the road after a rain. Others from hardwood forest and spruce-cedar swamp near Vermilion. Eggs and young shells were collected near Vermilion. The smallest measure alt. 2, diam. 3.25 mm.; the largest, thirty-two days old,

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1 Two species not represented in these collections (*Physa heterostropha* Say and *Sphaerium simile* Say) have been listed from Chippewa County (Hankinson, pp. 118, 132, 133, 134, 135).

2 In the list of species the localities referred to are counties unless otherwise stated.
measure $2.75 \times 5$ mm. This would seem to show the rate of growth.

The series of this species (Chippewa County, 11; Alger County, 8; Schoolcraft County, 2) is too small to give much idea as to what is really the prevailing type of this region, especially as the series is extremely variable. Thus the two specimens from Schoolcraft County measure:

$$\text{Alt. } 16.75 \text{ mm}; \text{ Diam. } 25.75 \text{ mm}; \text{ Axial Index } 63.$$  

The first is a good representative of the flat northern form, while the latter is quite typical of the southern race.

The eight specimens from Alger County vary from 25.5 mm. to 29.75 mm. in diameter, six of them being between 27 mm. and 27.75 mm. in diameter; the altitude varies from 17 mm. to 18.75 mm. and the axial index from 64 to 69.

The eleven specimens from Chippewa County vary from 25.5 mm. to 29.5 mm. in diameter, and from 16 mm. to 19.5 mm. in altitude, and the axial index from 63 to 70 mm., and they exhibit the same tendency toward the northern form on the one hand and the southern form on the other.

The average dimensions of the three sets are as follows:

<table>
<thead>
<tr>
<th>County</th>
<th>Alt. (mm)</th>
<th>Diam. (mm)</th>
<th>Axial Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alger Co.</td>
<td>17.88</td>
<td>27.34</td>
<td>67</td>
</tr>
<tr>
<td>Chippewa Co.</td>
<td>18.36</td>
<td>27.02</td>
<td>68</td>
</tr>
<tr>
<td>Schoolcraft Co.</td>
<td>18.88</td>
<td>27.13</td>
<td>66</td>
</tr>
</tbody>
</table>

A comparison of the average shell of the whole series with the average shell from the Upper and Lower Peninsula (Walker, 1900, p. 36) and from the Charity Islands (Walker, 1915, p. 2) may be made as follows:

<table>
<thead>
<tr>
<th>Region</th>
<th>Alt. (mm)</th>
<th>Diam. (mm)</th>
<th>Axial Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up. Pen.</td>
<td>17.02</td>
<td>25.81</td>
<td>65</td>
</tr>
<tr>
<td>Chippewa, Alger, Schoolcraft Co.</td>
<td>18.03</td>
<td>27.16</td>
<td>67</td>
</tr>
<tr>
<td>Charity Ids.</td>
<td>18.51</td>
<td>26.33</td>
<td>70</td>
</tr>
<tr>
<td>Lower Pen.</td>
<td>18.10</td>
<td>27.10</td>
<td>68</td>
</tr>
</tbody>
</table>
So far as this shows anything, it would seem that the average shell in this series is both larger and higher than the average Upper Peninsula specimen; that it is wider and more depressed than the average Charity Island shell, and also a trifle wider and more depressed than the average Lower Peninsula specimen. It must be said that the chief impression made by an inspection of the whole series was that of its extreme variability, giving the appearance of coming from a transition region. This, however, may be the result of variation in local conditions of environment rather than of geographical situation.


All the specimens are umbilicate, and the occurrence of this species with the preceding one again bears out the conclusions of Dr. Walker in regard to their coincident distribution (Walker, 1905, pp. 92-93, Pl. I).

3. Vitrca hauimomins (Strom).—Schoolcraft: Found under logs, on dead leaves in a pond, and under log on a wooded sand ridge.

4. Vitrca binneyana (Msc.).—Schoolcraft: One lot of this species from rotten wood and leaves in the hardwood forest. It has been listed as a boreal species (Walker, 1908, p. 282).

5. Vitrca ferrea (Msc.).—Schoolcraft: Three specimens were collected in the hardwood forest among leaves and decaying wood.


7. Zonitoides aborrea (Say).—Schoolcraft: Eight lots of this common species were collected on logs, on sand ridges, in
hardwood forest, and from sand in Bear Creek. Alger: Found on old logs of maple, birch, and hemlock, and on an old mushroom. Chippewa: Found under logs and in a cedar-spruce swamp near Vermilion.

8. Zonitoides exigua (Stimp.).—Schoolcraft: A single specimen from leaves at the bottom of a wooded pond. This is one of the "purely boreal species, which are characteristic of the northern region and whose range to the south is as a rule quite restricted." (Walker, 1908, p. 282.)

9. Agriolimax agrestis (L.).—Chippewa: A single slug of this species was found under a wet log.

10. Agriolimax campestris (Say).—Schoolcraft: Under rotten wood and leaves in the hardwood forest on both high and low ground.

11. Pallifera dorsalis (Binn.).—Schoolcraft: Found with A. campestris. Chippewa: From the same location as A. agrestis.

12. Pyramidula alternata (Say).—Schoolcraft: Specimens from six habitats were collected in decaying logs and leaves. The largest is sub-scalariform. Alger: Five lots, mostly immature shells, were obtained in the hardwood forest, and in the Whitefish River. One shell has the following dimensions: alt. 17 mm., diam. 20.5 mm., axial index 82.10. Chippewa: Specimens from an old log pile were juveniles; one from a spruce-cedar swamp near Vermilion is rather high, measuring 12.5 mm. x 18 mm.; others were collected in the hardwood forest, Vermilion.

13. Pyramidula cronkhitei anthonyi (Pils.).—Chippewa: From a spruce-cedar swamp near Vermilion.

14. Pyramidula cronkhitei catskillensis Pils.—Schoolcraft: From high and low ground, under logs, decayed wood,
and leaves. Chippewa: From old logs and from a dry pond in spruce and birch woods. The largest shell is very close to *anthonyi* and ought perhaps to be called that.

The predominance of this form over the preceding one accords with the observations of Walker (Walker, 1908, p. 287) who states that *anthonyi* is "apparently replaced throughout the Upper Peninsula by the var. *catskillensis* Pils."

15. *Helicodiscus parallelus* (Say).—Schoolcraft: This common form was found in decaying wood and leaves in the hardwood forest. Alger: Found in old dead logs.

16. *Succinca retusa* Lea.—Alger: Three lots of immature shells from Whitefish River have been referred to this species. The largest measures 19 mm. in altitude and 6.75 mm. in aperture length.


18. *Strobilops virgo* (Pils.).—Schoolcraft: From leaves in a pond. "A characteristic boreal species * * * apparently rarely found south of the Saginaw-Grand valley." (Walker, 1908, p. 282.)

19. *Cochlicopa lubrica* (Müll.).—Schoolcraft: Three individuals were found on logs on both high and low ground.

20. *Lymnaea humilis modicella* (Say).—Schoolcraft: One small shell, not fully mature, was found in a wooded swamp.

21. *Lymnaea obtusa peninsula* Walker.—Schoolcraft: One lot of twenty specimens was taken from submerged logs and sand in Buschwahr Creek. All the specimens are immature, several are somewhat malleated, and almost all have their apices eroded.

23. *Lymnaea clodes* Say.—Chippewa: A young shell, but apparently this species, of 2.5 whorls, 2.75 mm. x 1.15 mm. The lip is thickened and the columella is heavily calloused.

24. *Lymnaea lanceata* Gld.—Schoolcraft: From a slough, in leaves and weeds. These are typical in form and size, and are eroded on the apices.


26. *Physa gyrina* Say.—Schoolcraft: From submerged leaves and grass in a wooded pool with sand bottom, in a backwater from the river, from Buschwahr Creek, and from Bear Creek. Almost all of the lots are immature shells. Alger: One lot, from rushes in White Lake. Chippewa: From black ash swamp, Vermilion; from pond on the beach at Vermilion; and a variety with longitudinal stripes from Beaver Pond, Vermilion.

27. *Physa elliptica* Lea.—Chippewa: A very large series of several hundred specimens was obtained from a small spring brook. Almost all are striped with white.

28. *Physa ancillaria crassa* Walker.—Several specimens were collected with *Lymnaea emarginata* Say from rocks at the edge of the water, Mackinac Island.


This is the common form of *Physa* represented in the collection. It has been difficult to refer these shells to any species through the lack of any very distinctive characters. Very few fully mature specimens are in the collection.
30. Physa integra Hald. var.—Schoolcraft: Most of the specimens from this county are distinguished from the typical form by the presence within the aperture of a heavy reddish varix, and by the more shouldered and less expanded character of the whorls. They were found on sand and grass in Bear Creek and on sticks in the Manistique River.

31. Physa aplectoides Sterki.—Schoolcraft: Several specimens were collected on rotten leaves in a wooded swamp. The first record for this species was made in Ohio by Dr. Sterki; the second (first for Michigan) on Isle Royale by Dr. Walker. This is the second Michigan record and adds a connecting link for the two localities.

32. Physa sp.—Schoolcraft, Chippewa. In this division are placed all the shells too young for specific identification.

33. Aplexa hypnorum (L.).—Schoolcraft: In a wooded pond, the bed of a brook, and a slough, several specimens were taken.

34. Planorbis trivolvis Say.—Schoolcraft: From dead leaves in a pond, and from submerged brush in a glacial lake surrounded by a cranberry marsh. Alger: A good series of specimens was obtained in Whitefish Lake and in Silver Lake. The typical form grades into the following variety.

35. Planorbis trivolvis binneyi Tryon.—Alger: From Whitefish Lake. The intergradation of this form with the typical trivolvis seems again to bear out the opinion of Dr. Walker that binneyi is a variety, and not a distinct species (Baker, p. 277). One specimen agrees in surface malleation with the shell figured by W. G. Binney (p. 115, fig. 193) as P. corpulentus and noted as "a curiously indented form from the west coast." The same specimen, which is the largest of the lot, measures as follows: greatest diameter 27.25 mm., lesser
19 mm., altitude of the aperture 15.00 mm., at the aperture 10 mm.

36. Planorbis antrosus (Con.).—Schoolcraft: From logs and sand in Buschwahr Creek.

37. Planorbis antrosus striatus (Baker).—Schoolcraft: From weeds in Beaver Pond. Chippewa: From pond lily leaves in Beaver Pond, a pond on the beach at Vermilion, and leaves in Vermilion Lake. All of this form in the collection tend to have the rounded whorls of var. aroostookensis.

38. Planorbis hirsutus Gld.—Chippewa: Four specimens from Beaver Pond, and several from Vermilion Lake at Vermilion.


40. Planorbis parvus Say.—Chippewa: A good series of this small shell was collected from pond lily leaves in Beaver Pond. Some of the immature specimens are apparently more deeply umbilicated than others and may represent another form; but all the mature shells are parvus and these are probably also a variation of that species.


42. Segmentina armigera (Say).—Schoolcraft: One lot is typical armigera, and was collected from rotten leaves in a wooded swamp.

43. Segmentina armigera (Say) var.—Schoolcraft: From leaves and sand bottom in wooded pool and from rotten leaves in a wooded swamp. One lot is nearest to S. crassilabris Walker in shape, but the lamellae and aperture approach those of armigera. None are typical armigera in all points.
44. *Ancylius parallelos* C. B. Ads.—Schoolcraft: One small specimen was found in the debris of the hardwood forest, and another lot (of eleven) was collected from sand and grass in Bear Creek. Alger: A single specimen from pond lily leaves. Chippewa: From pond lily leaves in Beaver Pond.

45. *Campeloma decisa* (Say).—Schoolcraft: Four lots were collected from the Manistique River, and two from Bear Creek. The latter are eroded, not only on the apex but on the body whorl as well, to such an extent that holes have been worn through the shell. The shells from the river are not so much eroded, and are coated with a dark reddish deposit. Chippewa: From a pond near the edge of the road.


47. *Amnicola limosa* (Say).—Schoolcraft: From sand and grass in Bear Creek. Alger: A good series of this small operculate was collected from lily pads.

48. *Lampsilis lutecola* (Lam.).—Schoolcraft: From shallow water in a river cut-off, and from sand at the edge of the Manistique River.

49. *Anodonta marginata* Say.—Schoolcraft: From shallow water in a river cut-off, and from sand and muck bottom in Meecic Lake. The latter are pale yellow tinged with green, and the former are very large and of a darker color. The largest measures 133 mm. x 61 mm. x 50 mm. Chippewa: From a pond and from Beaver Pond at Vermilion. These are deeply colored with green and brown, and show the beak sculpture and the rays of the epidermis. Others were taken in Vermilion Lake, and Shelldrake River, near Vermilion. Alger: Three left valves from Howe’s Lake, with the note (by Wood): “Found at edge of lake. Opened by muskrats?”


52. *Anodontoides ferussacianus buchanensis* (Lea).—Schoolcraft: One specimen from the same habitat as that of the last named species. Alger: From Whitefish River.

53. *Unio complanatus* "Sol." (Dill.).—Chippewa: Shelldrake River near Vermilion. Alger: Nine specimens from Whitefish River below Camp White, and one valve with the *A. g. footiana* with note as under that species.

54. *Sphærium sulcatum* (Lam.).—Chippewa: From a Beaver Pond near Vermilion. "Form—peculiar; if found at other places, at least a subspecies, proved also by No. 10, evidently a juvenile of the same." Sterki.

55. *Sphærium sulcatum planatum* Sterki.—Chippewa: From Shelldrake River, Vermilion. "Somewhat intermediate: near those from Mountain Lake, Marquette Co., but the latter are much smaller and evidently immature." Sterki.

56. *Sphærium lincatum* Sterki.—Chippewa: From the bed of Vermilion Lake in water three feet deep. "Large fine specimens, much larger than those from Mountain Lake and less angular behind." Sterki.


According to Sterki (Sterki, p. 435) the habitat of this species is "Lakes Champlain and Nephremagog, Vermont."
Specimens which may belong to *S. vermontanum* have been seen from Maine, Quebec, and Ontario."

59. *Sphaerium rhomboideum* (Say).—Chippewa: One specimen, from a Beaver Pond near Vermilion.

60. *Sphaerium occidentale* Prime.—Schoolcraft: Several specimens from a wooded pond, and from leaves in a swamp. Chippewa: Black ash swamp, Vermilion.

61. *Musculium truncatum* (Lins.).—Schoolcraft: Abundant on the sand bottom and on leaves and grass in a wooded pool.

62. *Pisidium variabile* Prime.—Schoolcraft: A few valves from logs and sand in Buschwahr Creek.

63. *Pisidium neglectum* Sterki.—Schoolcraft: From sand and grass in Bear Creek.—"*P. neglectum* St., or near (immature)." Sterki.

64. *Pisidium subrotundum pumilum* Sterki.—Schoolcraft: From the bed of a brook.

65. *Pisidium* sp.—Chippewa: Black ash swamp at Vermilion. Not sent to Dr. Sterki.
Summary of the Distribution of the Species Listed, Including Isle Royale Records.


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<th>Species</th>
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<td>1. Polygyra albolabris (Say)</td>
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<td>2. Polygyra fraterna (Say)</td>
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<td>3. Vitrea hammonis (Ström)</td>
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<td>4. Vitrea binneyana (Mse.)</td>
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<td>5. Vitrea ferra (Mse.)</td>
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<td>6. Eucosmilla chersonis polygyratus Pilsl.</td>
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<td>7. Zonitoides arborca (Say)</td>
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<td>8. Zonitoides exigua (Stimp.)</td>
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<td>9. Agriolimax agrestis (L.)</td>
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<td>10. Agriolimax campestris (Binn.)</td>
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<td>11. Palliterna dorsalis (Binn.)</td>
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<td>12. Pyramidula alternata (Say)</td>
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<td>13. Pyramidula cronkhitica anthonyi Pilsl.</td>
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<td>14. Pyramidula cronkhitica-catskillensis (Pils.)</td>
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<td>15. Helicodiscus parallclus (Say)</td>
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<td>16. Succinea retusa Lea.</td>
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<td>17. Succinea ovalis, Say?</td>
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<td>18. Strobilops virgo (Pils.)</td>
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<td>19. Cochlicopa lubrica (Müll.)</td>
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<td>20. Lynnea humilis modicella (Say)</td>
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<td>21. Lynnea obrussa peninsula Walker.</td>
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<td>22. Lynnea obrussa exigua Lea.</td>
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<td>23. Lynnea elodes Say.</td>
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<td>24. Lynnea lanceata Gld.</td>
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<td>25. Lynnea emarginata Say.</td>
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<td>26. Physa gyrina Say.</td>
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<td>27. Physa elliptica Lea.</td>
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<td>28. Physa ancillaria crassa Walker.</td>
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<td>29. Physa sayi warreniana Lea?</td>
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<td>30. Physa integra Hald. var.</td>
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<td>31. Physa aplectoides Sterki</td>
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<td>33. Aplexa hypnorum (L.)</td>
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<td>34. Planorbis trivolvis Say.</td>
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<td>35. Planorbis trivolvis binocyi Tryon</td>
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<td>36. Planorbis antrosus (Con.)</td>
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<td>37. Planorbis antrosus striatus (Baker)</td>
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<td>38. Planorbis hirsutus Gld.</td>
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<td>39. Planorbis deflectus Say</td>
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<td>40. Planorbis parvus Say</td>
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<td>41. Planorbis umbilicatellus Ckll.?</td>
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<td>42. Segmentina armigera (Say)</td>
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<td>43. Scymnentina armigera (Say) var</td>
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<td>45. Campeloma decisa (Say)</td>
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<td>50. Anodonta grandis gigantea Lea</td>
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<td>51. Anodonta grandis footiana Lea</td>
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<td>52. Anodontoides ferussacianus buchanensis (Lea)</td>
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<td>53. Unio complanatus &quot;Sol.&quot; (Dill.)</td>
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<td>55. Sphærium sulcatum planatum Sterki</td>
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<td>56. Sphærium lineatum Sterki</td>
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<td>57. Sphærium stamineum (Con.)</td>
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<td>58. Sphærium vermontanum Prime</td>
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<td>60. Sphærium occidentale Prime</td>
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<td>61. Musculium truncaturn (Lins)</td>
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<td>62. Pisidium variabile Prime</td>
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<td>64. Pisidium subrotundum pumilum Sterki</td>
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<td>65. Pisidium sp</td>
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Total for each locality 41 18 33 28
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1915. The Results of the Mershon Expedition to the Charity 
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Wood, N. A. Notes on the Mammals of Alger County, Michi-
A NEW AMPHIBIAN OF THE GENUS ELEUTHERODACTYLUS FROM THE SANTA MARTA MOUNTAINS, COLOMBIA.

By Alexander G. Ruthven.

The species described in this paper was found in the Santa Marta Mountains, Colombia, by the Bryant Walker Expedition of the University of Michigan in 1913. The specimens are in the Museum of Zoology and the British Museum (Natural History).

Eleutherodactylus delicatus, new species.

Diagnosis: Size very small; head more than one third the total length, as broad as long; nostril much nearer to end of snout than eye; snout acuminate, a little less than half the length of the head; diameter of eye about three-fourths of the length of the snout. Vomerine teeth in two groups behind the choanae; tongue sub-circular, entire behind. Tympanum concealed or indistinct. Digits well developed and provided with disks, disks of toes small, those of the fingers well developed; toes free; first finger shorter than second; the tibio-tarsal ar-
articulation reaching the middle of the orbit when the leg is extended along the side. Skin finely granular above, coarsely granular below; a few low warts on the upper eyelids; no fold across chest. Pale brown above with a blackish brown stripe from the end of the snout to the lateral region of the breast and a dark brown anal patch; ground color of the belly dull white, the chin, throat, pectoral region and under surface of hind limbs densely speckled with brown.

Habitat: Santa Marta Mountains, Colombia.

Type Specimen: Cat. No. 50159, Museum of Zoology, University of Michigan; San Lorenzo (5,000 ft.), Santa Marta Mountains, Colombia; July 21, 1913; Alexander G. Ruthven, collector.

Description of Type Specimen: Head as broad as long, the length contained in total length 2.4 times; snout acuminate, with distinct canthus rostralis. its length entering the length of the head 2.2 times; diameter of eye \( \frac{7}{8} \) the length of snout. Tongue sub-circular, entire behind; vomerine teeth in two small groups behind the choanae. First finger shorter than second; toes free; disks of toes small, those of fingers well developed, width of disk of third finger a little more than one third the diameter of eye; tibio-tarsal articulation reaching the middle of the orbit when leg is extended along the side. Skin finely granular above with a few low warts on the upper eyelid, no glandular folds; belly coarsely granular, no fold across chest; inner and outer metatarsal tubercles present. Above light brown without distinct markings, lower region of sides dull white, sides of head pale brown, this color forming vertical bands with narrow white interspaces beneath the eyes and in front of the eyes displaced by a few white spots on the edge of the jaw and by a vertical white line on the end of the snout; a broad fuscous band extending from the end of the snout.
along the canthus rostralis, to the lateral regions of the breast, and an anal patch of fuscous black; hind limbs and forearms conspicuously cross-banded. Ground color of lower surfaces dull white, the chin, throat, pectoral region, and under surface of hind limbs densely speckled with brown.

Total length, 11 mm.; length of head, 4.5 mm.; width of head, 4.5 mm.; length of snout, 2 mm.; foreleg to tip of longest finger, 7 mm.; hindleg to tip of longest toe, 17 mm.

Remarks: Three specimens of this species were obtained by the Bryant Walker Expedition, of which one has been deposited in the British Museum and two are in the University of Michigan collection. They were taken at altitudes of 4,500 and 5,000 feet on San Lorenzo. The specimens are all small and may be immature but the bones are apparently well ossified, the vomerine teeth are distinct, and no larval characters are noted.
Eleutherodactylus delicatus

X 8

X 4
A MOST REGRETABLE TANGLE OF NAMES

By T. Barbour.

For the benefit of the zoologists of the future it is only just to attempt to settle the standing of certain names proposed in leaflets, privately printed, which may cause great confusion in future zoological nomenclature. In these leaflets, which appeared within a few days of each other, the same names are used for the same creatures independently described by two authors. Thus is the case badly complicated. For the sake of fixing the status of these names I have assumed that the dates printed upon each of the so-called "Herpetological Notices" is correct. Since most herpetologists have not seen these papers a description of each is in order.

1. Herpetological Notices | No. 1—June 15, 1912 | Prodrome of a Description of a New Genus of Ranidae from | the LooChoo Islands | by | Surgeon J. C. Thompson, U. S. N. | San Francisco | Published by the Author | 1912.

The title page is page 1. Upon page 2 and 3 is given a short diagnosis of Babina, a new genus of Ranidae, having the
University of Michigan

"metacarpal of pollux developed into a sharp and powerful spur." Rana holsti Blgr. is the type species, the only other included being Rana subaspera Barbour. This is the total contents.

2. Herpetological Notices | No. 2—June 28, 1912 | Prodrome of Description of New Species of Reptilia and Batrachia | from the Far East | by | Surgeon J. C. Thompson, U. S. N. | San Francisco | Published by the Author | 1912.

Again the title page is page 1, while upon pages 2, 3 and 4 the following forms are named. Hyla hallowelli from Amamioshima and Kikaigashima in the LooChoo Islands, the type being No. 23808, collection of the California Academy of Sciences. A note follows showing that Tachydrinus formosanus Blgr. is a valid species. Then under the heading Lygosoma indica (Gray) we read that Formosan specimens may be separated by certain definite characters from those upon the mainland, and the remark is added, "Should this variation be set apart from L. indica it is to be known as Lygosoma formosensis. The type will be No. 18627 California Academy of Sciences."


The final paragraph gives the reader a clue to the possible reason why these leaflets have appeared. We read after a few lines showing that the specimens of Eumeces marginatus (Hallowell) from Amamioshima and Kikaigashima are constantly different from those upon Okinawashima and the islands nearby, the following:—"For those who feel the necessity of giving to such a geographical variation a new name, or of promoting it to subspecific rank, the name Eumeces oshi-
mensis is proposed. The type would then be No. 21729, California Academy of Sciences." ** Evidently Doctor Thompson did not believe that this name should be bestowed, and the impression follows that he has some other reason for giving it. This impression later becomes a conviction.

3. Herpetological Notices | No. 3—July 31, 1912 | On Reptiles New to the Island Arcs | of Asia | by | Surgeon J. C. Thompson, U. S. N. | San Francisco | Published by the Author | 1912. In this case the subject matter begins upon page 1 and continues to page 5.

Doctor Thompson first, after having showed that, in Mabuia longicaudata (Hallowell), "Formosan specimens differ slightly from the mainland ones in several respects," proceeds to inform us that "Only upon the ground of the desire to multiply names could one resort to the use of M. rhustrati (Fischer) to designate the Formosan form."

Writing of Lygosoma laterale Say, Thompson quotes Boulenger and Stejneger to the effect that Chinese and American individuals of this species are indistinguishable. "Yet," he adds, "one can safely prophesy that ere long the specimens taken in Formosa and the Loo Choo Islands will appear disguised under a subspecific alias." He then proceeds to name Lygosoma laterale var formosensis, the type being 25026 Cal. Ac. Sci., and Lygosoma laterale var ishikaiensis, the type being 21677 Cal. Ac. Sci.

Setting off the Riu Kiuan race of Achalinus spinalis Peters, we learn that "The Loo Chooan examples differ from the typical Japanese in a decidedly increased number of caudal vertebrae, and in coloration. These differences are not regarded as of specific value (Italics mine). Nevertheless, due provision is made by suggesting the tentative name of Achalinus..."
inus loochooensis for No. 22064 California Academy of Sciences” * * *

Showing similar characters separating the Formosan examples of Callophis maclellandi (Reinhardt) from those upon the mainland, he proceeds to add, after remarking upon the inconsequence of these characters, that “On the other hand, the criterion of a certain school of species-makers is so alien to this standard, that one is forced to suggest a provisional new name, and none would be more appropriate than Callophis formosensis,” the type, 18864 Cal. Ac. Sci.

The leaflet closes with nominal additions to the fauna of a number of Oriental regions and islands.

So much for a reading of, Doctor Thompson’s contributions, which were printed by the Hicks-Judd Co., of San Francisco.

Imagine one’s surprise upon receiving and reading the following pamphlet “Published San Francisco, July 29, 1912.” This antedates by two days Thompson’s third notice. The appearance of this brochure is very similar to those of Thompson, in arrangement and typography. The paper, however, is differently watermarked and no printer’s name is to be found. The title is | Advance Diagnoses of New Reptiles | and Amphibians from the Loo Choo | Islands and Formosa | By John Van Denburgh. | A writer who has long been known most favorably to all herpetologists, the world over, as an accurate, painstaking and skillful scientist.

The contents of this paper include a diagnosis of Babina with Rana holsti as type; a description of Hyla hallowelli from Kikaigoshima the type No. 23806 Cal. Ac. Sci.; a diagnosis of Japalura polygonata ishigakiensis; J. p. miyakensis; Eumeces barbouri; Eumeces marginatus amamiensis; E. m. kikaigensis; E. ishigakiensis; E. chinensis formosensis; Sphenomorphus
Occasional Papers of the Museum of Zoology

indicus formosensis; Sphenomorphus boulengeri; Leirolepisma laterale hoettigeri; Lygosaurus pelleleuris browni; Takydromus stejnegeri Achalinus werneri, and Callophis swinhoei.

Dr. Van Denburgh has published his formal paper “Concerning Certain Species of Reptiles and Amphibians from China, Japan, the Loo Choo Islands, and Formosa (Proc. Cal. Ac. Sci., Ser. 4, Vol. III, p. 187-258, Dec. 16, 1912), and there full data can be obtained regarding all of Dr. Van Denburgh’s species. I noticed at once, however, that no reference was made to Thompson’s descriptions though two of Thompson’s papers antedated Van Denburgh’s preliminary. This fact with the duplication of names which I observed led me to write a letter of inquiry to both Dr. Van Denburgh and Dr. Thompson, as I myself was engaged in working upon material from these areas at that time.*

The following is Dr. Thompson’s answer:

U. S. S. ALBATROSS,
Sausalito, Calif.,
December 27, 1912.

Dear Sir:

Your letter of December 14th is written in a grossly insinuating tone. It is obnoxious to the limit.

The alternative presents of replying in terms that would border on being contraband in the mails, or of calling attention to the absurdity of your attempting to sit in judgment on matters which your distance from the scene of action and ignorance of the facts combine to prevent the forming of an intelligent opinion.

I have been instrumental in bringing to the California Academy since the Fire about 12,000 specimens of reptiles.

* It is extremely unfortunate that I am unable to publish my own letters in this connection, but I carelessly failed to retain copies.
And Dr. Van Den Burgh (sic), a paid employee of the Institution, has essayed the old, old trick of rushing into print with material belonging to another. In this case he used the suggested names, and copied so hastily from my notes that the paper contains over a dozen misspelled words. Thus we "strangely seem to have hit upon the same names for many species."

You refer to publishing leaflets privately as a "reprehensible practice." The most elementary knowledge of bibliography will disclose the fact that this has been done by all grades of workers, from the amateur to the most renowned.

You can make "quite sure of the accuracy of the dates of the three "Herpetological Notices" by inquiring the date of their receipt at the Library of the Zoological Society of London.*

I am publishing privately a "Review of the Recent Contributions to the Synonomy of Amphibia and Reptiles from the Far East," and when you deign to peruse a copy you will find the future workers in the field of Bibliography and Zoological Philology will have no trouble in locating the synonyms. You are being sent an advance sheet.

You really should not be so peeved just because Dr. Van Den Burgh attached your honorable name to a deformed skink,—or because you so completely missed the point in the thumb of Rana subaspera Barbour.

(Signed) Yours, etc.,

J. C. THOMPSON,
Surgeon, U. S. Navy.

* My inquiry regarding dates was because I received all three "Notices" at one time. One would naturally suppose from the method of publication that they would each be distributed immediately they were printed. Obviously the time of their arrival in London has no connection with the exact date of their appearance in San Francisco.
This is Dr. Van Denburgh's answer, somewhat different in character from that of Dr. Thompson's.

Jan. 2, 1913.

Mr. Dear Mr. Barbour:—

Your letter of Dec. 14th has just reached me. It contains the first definite information I have received regarding the actual publication of papers by Dr. Thompson. I had reason to believe that he was probably about to publish, and it was for this reason that I rushed the diagnoses of new forms into print last July. The story is a rather long and unpleasant one. Dr. Thompson, as you perhaps know, is a naval surgeon. After his row with Alexander Agassiz, he came to me and said he had been very badly treated and had resolved to give up fishes and devote himself to a study of snakes, exclusively. He was then on his way to the Philippines, and asked me if I would help him with his work if he collected extensively all groups of reptiles and amphibia for the Academy. This was in the winter of 1905-1906. Later large collections were secured in China, Japan, the Loo Choo Islands and Formosa. I enclose a few extracts from letters from him to me and a copy of a letter which I sent him, May 6th, 1912, which may help you to understand the situation and the extreme difficulty of dealing with this erratic individual. Previous to January, 1911, I had spent much time working up these collections and had in MSS. all the descriptions I have recently published. Thompson then expressed himself as much pleased with this work, but when I let him take the MSS. he went through it and made a list of all my new species and subspecies, by name. He then proposed that I should give him joint authorship in all papers I should ever write (with two exceptions noted in letter) whether or not he had anything to do with their preparation. This I, of course, declined to do,
and he thereupon broke relations with me and stated that he desired to work up his collection himself. This I was quite willing he should do, and I at once stopped working with them, although I had every right to finish as I had begun. I was not, however, willing to throw away the work I had already done, and upon Dr. Thompson's return to this country I wrote him the letter, a copy of which I enclose. He presented no reason for my not publishing other than that he wished to do so himself, so on May 18, 1912, I presented the MSS. to the Academy, for publication. Thompson then threatened the officers of the Academy with injunctions and suits for damages, etc. The whole matter was delayed for months while the Academy made an investigation, found that I was right, and ordered my MSS. printed. In the meantime Dr. T. was busy with the specimens and probably had access to my MSS. When it became evident that he was getting ready to put my species into print I had diagnoses of them printed privately. Your letter, as I have said, is the first I have heard of his 'Herpetological Notices.' I, therefore, cannot tell when they were printed or whether the given dates are actually the dates of publication. This I suppose will have to be determined by the dates when they were received by libraries and museums. As far as I can learn no copies have been distributed here to individuals, or the Academy or either University. I should be very glad to know more about these publications—their alleged dates, species described, type specimen numbers, name of printer if given, etc. If you would be good enough to lend me your copies I should be very glad to examine and return them to you. Or, would you perhaps obtain from Dr. Thompson a duplicate set for me. A letter sent to the California Academy of Sciences would reach him there. Owing to strained relations I am unable to obtain them directly. I will then try to
trace the matter and let you know what I learn. My original paper has just been published by the Academy. I send you a copy under separate cover.

Very sincerely yours,

(Signed) J. Van Denburgh.

It seems hardly worth while to comment upon these writings. I have never had the privilege of meeting Dr. Van Denburgh nor have I ever, so far as I am aware, seen Dr. Thompson. I think I may truthfully say that I received the four publications with my mind absolutely free from personal bias. I have undertaken to put these notes on record at the request of several scientific friends as an aid to the naturalists of the future, who will surely be sadly confused by this curious literature. I take no sides and make no attempt to pass judgment on the reasons for the identity of the names in Dr. Thompson's and Dr. Van Denburgh's brochures. One attitude of mind will, however, be condemned by all and will be considered at least of doubtful ethics, and that is the proposal and publication of scientific names with the assertion attached that the describer himself did not believe in their validity and only named them because, as Thompson says, "one can safely prophesy that ere long the specimens * * * will appear under a subspecific alias" and that "due provision is made" in naming the separated Riu Kiuau *achalinus spinalis*; when we read with the same breath that "These differences are not regarded as of specific value." Further remark is unnecessary.
After I had incautiously and somewhat improvidently, perhaps, accepted the invitation of the chairman to take part in the discussion this afternoon, I began to consider what there was to say upon the subject that had been assigned to me. At the outset it seemed that there was a certain element of uncertainty, what we lawyers call a latent ambiguity, as to what was meant by "method of evolution." Assuming the existence of a primitive, simple, homogeneous type of any class of animal life, which in the course of time has become changed into a series of similar, yet diverse, types of greater complexity of organization, does the "method of evolution" refer simply to the changes in the organism itself from simplicity to complexity, or does it mean those external forces, which, exerted

* Read at a symposium on the method of evolution before the zoological section of the Michigan Academy of Science, March 28, 1917.
upon the original innate tendency toward variation through changes in environmental conditions resulting from migration, isolation, changes in climate, food supply, and chemical constituents in the water, have, first stimulated and then by the pruning off, through natural selection, of improvident variations, guided and directed, as it were, the organism, not only to its present, greater complexity, but to its more perfect adaptation to its present surroundings. Whether the original primitive type, if there had been no changes in environmental conditions, but simply through competition and the struggle for existence, would have evolved along the same lines that it has under the changes of environment to which it has actually been subjected in the past ages, is at the best only a matter of speculation. But there can be no doubt but that the more complex organization of the recent fauna is the combined result of the innate tendency to variation and the influence of changes in the external environmental conditions. The two are coincident.

For this reason, therefore, taking the North American Unionidae as a concrete example, I propose to discuss briefly both aspects of the question.

I. Changes in the Animal.

The Unionidae are a very ancient family. While it is probable their precursors are to be found in the bivalves, which, both in this country and in Europe, have been discovered in the Coal Measures, the connecting links are too few, and the interval of time too great to make that a matter of profitable speculation. The first genuine Unios now known in this country have been found in the Triassic of Texas. They are all simple forms and not unlike many of the simpler forms found in the recent fauna. In the Cretaceous deposits in the western
states, extending from Texas to British America, however, are to be found in very considerable abundance what are evidently the prototypes of our recent species. These fossils show great variation, some of them are exceedingly similar to recent forms, and others are diverse types which have apparently become entirely extinct. Of course, we only know these species from their shells. There is no evidence whatever as to the peculiarities, if any, of the animal that lived inside of the shell. But comparing these fossil species with the recent fauna we find that, with one exception hereafter to be more fully considered, there has been, so far as the shell is concerned, no change of any great extent.

There being no evidence as to what were the peculiarities of the animals of these fossil species, we are forced to judge as to what was the course of evolution in the animal from the various forms of development which we find represented in the recent species. Taking the modern Unionidae as a whole, we find that their organization is comparatively simple and, with one exception, very similar throughout the whole world. The one feature in their anatomy which is a variable one is in the adaptation of the gills as marsupia for carrying the eggs until they are hatched. Assuming that the most primitive form represented in the recent fauna is that of the genus Margaritana, and this assumption is based not only upon the peculiarity of its structure, but upon its range at the present time, which is greater than any other genus and, with the exception of the central part of British North America, extends entirely around the world, we find that all four gills are used as marsupia. The eggs, passing from the ovaries, occupy all four gills of the animal. The gills have neither water-tubes nor septa. The interlaminar connections are patch-like, irregular in shape and position, with indications of a
diagonal arrangement which does not follow the gill filaments and does not form continuous septa.

The next step apparently in the evolution of this feature of the animal was the formation of water-tubes by septa running parallel with the gill filaments, all four gills, however, being still used for carrying the eggs. The next advance was a very radical one, and resulted in the division of the Naiades into two great families; in the one (the Mutelidæ), which is not represented in our northern fauna but is confined to the southern half of the globe, only the inner gill is used for carrying the eggs, while in the Unionidæ proper, which includes the whole of the North American fauna, either all four gills or only the outer gills are used for that purpose. All the North American species of the recent fauna, which belong to the subfamily Unioninæ, which contains the more primitive types, and in which either all four gills or only the entire outer gills are used as marsupia, carry the eggs only a short time and are what are called tachytictic genera.

It would seem that, for some reason which we do not now know, the next step in the evolution of these creatures was for the purpose of enabling the female to carry the eggs in the gills for a longer period, practically through what we now call the winter season. These higher groups are called brachytictic for that reason. The development for this purpose was carried on in two different ways. In one great division, or subfamily, the Anodontinæ, the necessity was met by increasing the complexity of the water-tubes themselves. Whereas in the more primitive forms the water-tubes were filled with the eggs, and the water circulated through them, in this particular subfamily there has been developed in the water-tubes a series of longitudinal partitions which divide each tube into three parts, an inner ovisac in which the eggs
are carried, and two outer (secondary) water-tubes which permit the free circulation of the water around the eggs in their special receptacle. In this way it was possible for the animal to afford the eggs all the aeration that could be obtained. In the other group, or subfamily, the Lampsilinæ, the necessity has been met, either by restricting the marsupia to certain parts of the gill alone, usually in the posterior or central portion, or by developing an increasing number of folds, or pleatings, caused by the swelling of the water-tubes, which thus exposes the eggs to the full benefit of the circulating water. This change in many of the groups has been accompanied, also, by a greater development of the posterior flaps of the mantle, which enable the animal to expose the posterior portion of the gill, when charged with eggs, to the full current of water received from the incumbent siphon. This development of the animal, when carried to its extreme form, represents the highest stage in the present evolution of the family. In the first subfamily, the Anodontinæ, the whole of the outer gill is still used for carrying the eggs, and in these groups, as in the Unioninæ, there is no difference to be noticed between the male and female shells, except, perhaps, that sometimes the female shell is, on the whole, somewhat more inflated. But in the Lampsilinæ, where the marsupium is restricted to a particular portion of the gill, which consequently becomes greatly inflated during the breeding season, the shell of the female is changed in order to afford room for the expansion of the gill, and in these forms there is an inflation of the lower, posterior portion of the shell which is very marked and easily distinguishes the shell of the female from that of the male. Indeed, in the most advanced genus of this subfamily, Truncilla, the difference between the male and female shells is so great that in an early day, before the fact was known
that these differences were sexual, in a number of instances the male and female shells were described as distinct species. This modification of shell in the female is practically the only change, excepting, perhaps, the sculpture of the beaks,* that has taken place, so far as we know, in the structure of the shell itself.

II. ENVIRONMENTAL FACTORS AFFECTING EVOLUTION.

These are primarily migration and isolation, and it is necessary to briefly consider what they have been.

Migration.—The oldest land in eastern North America is what is known as the Laurentian Highlands in eastern Canada. When they first emerged from the sea they were separated from the earliest western land, the Sierra Nevada Mountains, by the sea itself. Later, as the land continued to rise, the southern Appalachians were uplifted and in the first instance, and through Carboniferous times, these, and their western extension, now known as the Cumberland Plateau, extended continuously from the eastern states southwest into Texas. This highland was the original divide between the drainage systems of that time. On the east and south the rivers flowed into the Atlantic and the Gulf of Mexico. North and west of this divide the streams flowed westerly into the Mesozoic Sea, which extended from the Gulf of Mexico to the Arctic Ocean. It was in the swamps, streams and bayous which lay along the eastern shore of this ancient sea that in Cretaceous times were evolved from the primitive forms, coming down at least from Triassic times, the prototypes of the

* There is a very considerable amount of variation in the recent fauna in the sculpture of the beaks. These differences are generally recognized as valid generic distinctions. But we have not as yet accumulated sufficient facts in regard to the development of this feature, either in recent or extinct forms, to formulate any very definite theory as to either the cause, or manner, of its evolution. The whole subject is still in the speculative stage.
present fauna. Through the migration which they were able to make up these ancient rivers, these early primitive forms were enabled to reach and establish themselves in the headwaters in the Laurentian Highlands and in the ancient Appalachian System.*

Isolation.—The first, and perhaps the greatest, factor of isolation which has resulted in the development of our recent fauna, occurred in early Cretaceous times, when by the sinking of a large section of the earth's crust in the Gulf region, what is known as the Mississippi Embayment was formed. This affected a triangular piece of territory extending along the line of the Gulf of Mexico from eastern Texas to the middle of Alabama, and thence northerly to a point above the present junction of the Ohio and Mississippi Rivers. The whole land between these two lines sank at least 5,000 feet, and the sea was admitted as far north as Memphis. This continued entirely through Cretaceous and Tertiary times until by the gradual uplifting of the land and the deposits of sediment brought down by the rivers on either side the depression was filled up and the present systems of drainage were established. So far as the Unionidae are concerned, the important result of this fact was that during all this time the Unios which remained in the rivers west of the embayment were entirely separated from those, which, prior to the great landslides had been able to affect a lodgment in the headwaters of the ancient rivers flowing from the Cumberland Plateau. This created two centers of development and distribution; the one west of the Mississippi, and the other in eastern Tennessee.

* There is a large amount of evidence tending to show that there was considerable migration from the west of the Mississippi, northeastward into the Laurentian region after the Mississippi Embayment, during Tertiary times, but "that is another story" and does not in any way conflict with the general statements herein made.
The first emigrants from the West to the headwaters of the Mesozoic rivers, in the Laurentian and Appalachian Highlands, through orographic changes which caused the transference of streams, were undoubtedly able to penetrate in one way and another into the early streams which flowed easterly and southeasterly into the Atlantic Ocean, but ultimately the continued rise of the Appalachian System resulted in the entire separation of the eastern and western faunas and enabled each of them to develop under local influences, wholly independent of each other.

In the same way changes in the drainage systems of the rivers from the highlands of Tennessee, which originally had flowed southerly into the Gulf of Mexico, by which some of them—those which are now comprised in the Cumberland and Tennessee systems of drainage,—were cut off from their southern connections and established a new system of drainage toward the northwest into Ohio, resulted in the separation of the fauna in the streams south of the Tennessee Highlands from that inhabiting the streams which flowed westerly through what is now the Tennessee and Cumberland Systems, and enabled these, also, to develop under their own peculiar local influences.

Such was the situation at the beginning of the Glacial Epoch. This covered with ice to the depth of several thousand feet practically all the territory in eastern North America north of the Ohio River. The result was, so far as the Unionidæ are concerned, the absolute extermination of the whole race north of the line of glaciation. This wiped out all the connecting links, which might have then existed between the eastern, or Atlantic, fauna, and the western, or Mississippi, fauna, and left them, as represented along the southern borders of the glaciated areas, as distinct faunas, and from
these, upon the retreat of the ice and the establishment of the present systems of drainage, the waters of the glaciated area were re-peopled.

The result of all these changes in the earth's surface is shown in our present fauna by the fact that we have: 1st. East of the Appalachian Mountains a very distinct fauna which extends from Florida to New England, and thence northwesterly toward Hudson Bay. 2nd. Between the Appalachians and the arid regions of the West, occupying the Mississippi Valley and all its tributary streams and drainage systems, the characteristic American fauna, known as the Mississippian. 3rd. In the Alabama River and its tributaries, a very distinct subfauna, evidently derived from the ancient fauna of the Tennessee, but still sufficiently differentiated to be recognized as a distinct faunal element. 4th. West of the Rocky Mountains the Unione fauna is very meagre and is evidently derived from migration from Siberia. It has none of the distinctly American types characteristic of the eastern areas.

In these great faunal areas our modern species have been evolved. Separated from each other, the diverse local influences of climate, food supply and chemical elements contained in the water have all played their part in bringing about the evolution into the numerous species that now exist. This evolution has in some instances gone so far that new genera have been formed, but just when in geologic time these had their beginning, is not known, because the evidence afforded by the fossils of the Tertiary Period is as yet too imperfect to give us the connecting links. We can only imagine when and where they originated. Why they were evolved, like so many similar questions in other branches of the animal kingdom, is almost wholly a matter of speculation.
Such, then, in brief, has been the "method of evolution" of the North American Unionidae, both in the animals themselves, and in the causes which have brought these changes about, and, in conclusion, it may be summarized somewhat as follows:

1. So far as the animals of the Unionidae are concerned, the evolution from the most primitive forms that are known, to the most complex that now exist, has been all centered around the adaptation of the gills of the female for the care of eggs until they are hatched. Whatever changes have been brought about in the shell have been a necessary corollary to the changes in the animal itself.

2. The causes of evolution, aside from the innate tendency to variation that is present in all animal life, must be recognized in the history of the original migration brought about by the opportunities afforded by the earliest drainage system of the country and the subsequent isolation effected by changes in the earth's surface. All these have combined to affect the animal, and to intensify its innate tendency to variation.

The evolution of the species is a minor matter. It is almost wholly the result of local influences and is too complicated and, in many details, as yet too uncertain to justify any attempt to consider it at the present time.
The Museum has recently acquired several collections of Crustacea which are worthy of note.

**Isopoda from British Guiana.**

The Bryant Walker Expedition to British Guiana, in the summer of 1914, obtained a number of isopods, including three new species, in the neighborhood of Dunoon, British Guiana. The specimens were collected by Mr. F. M. Gaige.

*Ethelum americanum* (Dollfus).

This species has previously been reported by Dollfus from St. Vincent, West Indies, where it was found under a log at an altitude of 800 feet. The nineteen specimens collected by Mr. Gaige all came from trees; among bromeliad roots and vines, in hollow stems, on a tree fern. They were taken on
July 18, 25, August 11, 21. The bodies of all these specimens are slightly granular, but in other respects agree with Dollfus' description.

**Cubaris gaigei**, new species.

*Description*: Body capable of being rolled into a ball; dorsal surface spiny; color slaty brown, with an irregular, lighter, median stripe and two light spots at the bases of the uropoda.

![Diagram of Cubaris gaigei](image)

Fig. 1. *Cubaris gaigei*. a, tip of second antenna; b, dorsal view of body; c, ventral view of epimera of first two thoracic segments; p, telson and uropoda.

Head wider than long; front slightly excavate in the middle, the antero-lateral angles produced and rounded; eyes small, oval, with about sixteen facets. Somewhat back from the anterior margin is a row of four small spines, two on either side of the median line; behind these are two slightly larger spines, and along the posterior margin are six longer and stouter spines. First antenna small, 3-segmented; second antenna with a 2-segmented flagellum, the first segment one-third as long as the second.
First segment of thorax with large lateral extensions; dorsal surfaces of lateral parts concave, bearing twenty spines. Coxopodites long and diverging from lateral margins posteriorly. Thoracic segments 2-7, each bearing 13 spines and having long narrow lateral expansions. Second segment with narrow, divergent, truncate coxopodites.

Abdominal segments 1 and 2 unarmed and concealed; 3 and 4 with four spines; 5 and 6 with two spines each. The sixth or terminal segment constricted in the middle, bearing two spines near the anterior border, and with its posterior margin arcuate-emarginate. Uropoda acute at tip; their inner rami about a third as long as the sixth segment; outer rami conical and half as long as the inner.

About seventy-five specimens were collected. They were found in rotten logs, under dead leaves on the ground, in the hollow stems of plants, among moss in trees, in bromeliads, in masses of aerial rootlets, and under the bark of trees.

_Type Specimens_: Cotypes Cat. No. 50864, University of Michigan, Museum of Zoology. Collected under leaves on ground among the tree clumps on the “mouries,” July 30, 1914, Dunoon, British Guiana; F. M. Gaige, collector.

_Remarks_: This species resembles _Cubaris echinatus_ Brandt but differs from it in having 13 spines on each of the six posterior thoracic segments, and in lacking distinct coxopodites on the third thoracic segment.

_Sphaeroniscus portoricensis_ Richardson.

Forty-three specimens were taken from bromeliads on the summits of sand hills on July 30, and twenty-one from an abandoned termite nest on a mourie, August 20.
Circoniscus, new genus.

Description: First pair of antennae very small, inconspicuous, with three segments. Second pair of antennae short; flagellum with two segments. Eyes small, with about fifteen ocelli. Clypeus straight; epistome flat; anterior margin of head forming a thin projecting lamella.

First segment of thorax with epimera posteriorly cleft. Terminal segment of abdomen broader than long, triangular. Outer branch of all pleopoda with tracheae. Uropoda extending beyond the terminal abdominal segment; basal segment large, rectangular, flat; outer ramus conical; inner ramus long, pointed, slightly flattened.

This genus belongs in the Family Armadillididae. It is closely allied to Sphaeroniscus Gerstaecker, but differs in having only two segments in the flagellum of the second antenna.

Type: Circoniscus gaigei Pearse.

Circoniscus gaigei, new species.

Description: Body oblong, very convex, contractile into a ball. Color slaty above, creamy below, a pair of mottled white areas on the dorsal surface of each thoracic segment. Head set in first thoracic segment; front straight, with a reflected lamellar margin; epistome forming a triangular shield. Eyes small, with fifteen facets. Flagellum of second antenna with three segments.

First thoracic segment thrice as long as head, longer than any succeeding segment; epimera cleft on lateral margins one-fourth distance from posterior angles; a slight indication of distinct coxopodites just anterior to the clefts.

First two abdominal segments with the lateral parts concealed, the three following segments continuing the outline of
the body. Terminal segment a little more than half as long as broad, triangular, rounded at posterior end. Uropoda with large, flat basal segments; external ramus inserted in a notch at the inner post-lateral angle; inner ramus about as long as basal segment, slender, extending one-third its length beyond terminal abdominal segment.

_type specimens:_ Cotypes Cat. No. 50865, Museum of Zoology, University of Michigan; Dunoon, British Guiana; July 17, 1914; F. M. Gaige, collector. Taken from wet rotten logs in a clay jungle.

Other specimens were taken between July 17 and September 1 from rotten logs, aerial rootlets, loose bark of trees, and even from dry sand.

**Fig. 2. Circunciscus gaigei.** a1, first antenna; a2, second antenna; b, dorsal view of body; m1, first maxilla; m2, second maxilla; mb, mandible; mp, maxilliped; p, posterior end of body; u, uropod.

**Leptotrichus emarginatus,** new species.

_Description:_ Body minutely granulated and pubescent; head tuberculate. Color: head brown with small white markings; thorax white, with four irregular longitudinal brown stripes; abdomen with second and third segments white with brown band at middle of posterior margin; third, fourth, and
fifth segments brown with small white spot at anterio-median margin, last segment white with darker tip; ventral surface and paired appendages white, except the antennae and the tips of the outer rami of uropoda, which are brown.

Head with prominent rounded lateral lobes, a well developed median lobe is notched at the anterior end. Eyes of good size, with about twenty facets. Second antenna reaching beyond middle of second thoracic segment, with fourth segment of peduncle longer than third, with second segment of flagellum thrice the length of first.

![Fig. 3. Leptotrichus cmarginatus. a, second antenna; d, head; p, posterior end of body; u, uropod.](image)

Thoracic segments subequal in length, with lateral parts broadly expanded.

The first two abdominal segments have the lateral parts undeveloped. The third, fourth, and fifth are broadly expanded laterally and form a continuous line with the margins of the thoracic segments. The last segment of the abdomen is concave on its posterio-lateral margins and extends one-third its length beyond the tips of the preceding segment. Basal segment of uropod half the length of the exopod, which is conical; endopod linear and nearly two-thirds as long as exopod.

**Type Specimens:** Cotypes Cat. No. 50866, Museum of Zoology, University of Michigan; Dunoon, British Guiana; July 24, 1914; F. M. Gaige, collector. The types were taken under
the bark of dead wood. Other specimens were collected from the axils of leaves from three to ten feet above the ground on July 23, 25; August 8, 9; also in dry sand on Hubudibu Creek on September 1.

*Philoscia spinosa* Say.

This species has previously been reported only from Savannah, Georgia. Mr. Gaige collected thirty-one specimens from wet rotten logs in clay jungle on July 18, 23, and from rotten wood on ground in the Labba Creek sandhills on July 27.

*Philoscia olfersii* Brandt.

Thirty specimens of this species were taken, on July 23, 27, 30, in wet rotten logs and under fallen leaves. Originally described by Brandt from specimens collected in Brazil.

**Isopods from the West Indies.**

During the voyage to British Guiana in 1914, Mr. Gaige collected a few isopods on the islands of St. Thomas and St. Croix.

*Cubaris perlata* (Dollfus).

Specimens collected at Charlotte Amalie, St. Thomas, on August 2, agree with Dollfus' description except that the eyes possess seven facets.

*Porcellio laevis* Latreille.

Collected at Fredericksted, St. Croix, on August 2, 1914.

*Metoponorthus pruniosus* (Brandt).

Taken August 2, 1914, at Christiansted, St. Croix, and at Charlotte Amalie, St. Thomas.
Crustaceans from Texas.

The Walker-Newcomb Expedition to the Davis Mountains, Texas, during the summer of 1916, secured a few crustaceans as follows:

*Metoponorthus pruniosus* (Brandt).

This isopod was collected at three different localities in the Davis Mountains during June and July.

*Streptocephalus coloradensis* Dodds.

Fifteen specimens were collected from an ephemeral pond in Weihnacht’s Draw, near Toyahvale, July 12, 1916.

*Eulimnadia texana* Packard.

A male and three females were collected from an ephemeral pond in Weihnacht’s Draw, near Toyahvale. July 12, 1916.

Miscellaneous Crustacea Recently Acquired by the Museum.

*Cragonyx vitreus* Cope.

Specimens were taken from a well at Randolph, Wisconsin, March 15, 1916, by Mr. Frank G. Richardson.

*Limnetis gouldii* Baird.

Collected from a pond on Picnic Point, near Lake Mendota, Madison, Wisconsin, May 4, 1915, and May 12, 1917.

*Estheria belfragei* Packard.

This species occurs in the fish ponds of the U. S. Bureau of Fisheries at Fairport, Iowa. Specimens were sent to the writer by Mr. Schroedec of the Bureau’s station at that place.
ON THE OCCURRENCE OF BUFO FOWLERI IN MICHIGAN

By Alexander G. Ruthven

The similarity between *Bufo americanus* and *Bufo fowleri* has been referred to frequently in the literature of American herpetology. So closely do these forms resemble each other that they are often confused, and it has been suggested that hybridization occurs.¹ The distinguishing characters of *Bufo fowleri* that have been pointed out are: cranial crests usually parallel and considerably elevated, sometimes fusing posteriorly; muzzle projecting farther beyond the jaw; warts on dorsal surface smaller; granules of ventral surface smaller (occasionally absent); ² parotoids elongate-oval in form; iris silvery; head narrow, higher and shorter; profile abruptly rounded; hind legs longer; color above yellowish or greenish gray, never rich yellow, orange or red-brown; dorsal spots

² Deckert, loc. cit., p. 114.
large, distinct and arranged in pairs; an irregular pale band on the sides; ventral surface white and immaculate; song not distinctly vibrated.

As is well known, the structural and color characters are subject to considerable variations in both species, and Allard states that the characteristic song of *Bufo americanus* is occasionally given by *Bufo fowleri*, except that it is shorter. It is thus impossible always to distinguish the forms on the basis of any one character, but apparently this does not mean that *Bufo fowleri* has been based upon individual variations of *B. americanus* nor that it is a geographical race of the latter; for, the forms can be readily separated when the totality of characters is used in diagnosing specimens, the two species occur in the same regions, and specimens with the characters of *B. fowleri* do not occur at random in the range of *B. americanus*. The question of hybridization can only be determined with certainty by experiments.

The range of *Bufo fowleri* is given by Dickerson (loc. cit., p. 95) as follows: "Danvers, Woods Hole, and Cuttyhunk Island, Massachusetts. Common throughout Rhode Island. Probably common in other parts of Massachusetts, and perhaps in still other New England States. Specimens are in the American Museum of Natural History, in a collection representing the Batrachia of the vicinity of New York City." In 1907 and 1908 Allard was able to show that the form extended as far south as northern Georgia, and in 1911 Hancock referred some western Michigan toads to this species. Han-

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3 Dickerson (The Frog Book, p. 94) describes the arrangement of the dorsal spots as follows: "Six pairs along the vertebral streak—first pair, elongated spots placed obliquely on the eyelids and top of the head; second pair, rounded and small, between the anterior ends of the parotoids; third pair, greatly elongated, more or less pear-shaped, situated on the anterior part of the back; fourth, fifth, and sixth pairs irregular, the last often obscure."
cock's specimens were taken in the vicinity of Lakeside, Berrien County, in the southwestern part of the state. During the past summer the writer spent the greater part of the month of July in Berrien County, collecting only in the dune region between the towns of Lakeside and Sawyer, and obtained a large number of toads which apparently represent two forms.

In one form represented in the western Michigan material the warts on the dorsal surface are larger and conspicuously spinous; the parotoids are larger and tend to descend on the sides of the neck, so that they are generally twice as long as broad; the cranial crests are lower and distinctly divergent; the skin of the ventral surface is more coarsely granular, and the granules are often spinous. These specimens are clearly *Bufo americanus*. In the other form the warts on the dorsal surface are smaller and possess only minute spines; the warts on the hind legs being conspicuously smaller than in *Bufo americanus*; the parotoids are generally lower, distinctly elongate-oval in form and about twice as long as broad; the cranial crests are more elevated, and parallel or a little divergent; the skin of the ventral surface is finely granular, and the granules are never spinous. These specimens conform in structure to the descriptions of *Bufo fowleri*.

The two forms also differ strikingly and constantly in color. The specimens which are typically *Bufo americanus* in structure have the coloration of that species, the ground color being usually reddish or blackish brown; the dorsal spots less regularly disposed and constant, in many cases embracing but one wart; the abdomen generally yellowish or gray, in most specimens with dark spots. In the other form the general color above is light or dark gray; large white-edged black spots,

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1 Deckert, loc. cit., p. 114, describes the warts of *B. fowleri* as never spiny, but the original specimen examined, see p. 5, has small spines.
2 This has been noted for *B. fowleri* by Miller and Chapin, loc. cit., p. 316.
arranged as in *Bufo fowleri*, are present and usually embrace several warts; a lateral pale streak occurs; the vertebral stripe is constantly present and generally broad, and the ventral surface of the body is silvery white and immaculate, except that in some specimens a few dark spots are present in the pectoral region.\(^9\)

The two forms apparently do not differ in proportions, nor do those which resemble *B. fowleri* agree with the proportions of that species as given by Dickerson. The length of the head enters the total length a little less than 3.5 times, and the length of the hind leg to the heel equals the length of the body forward to some point on the parotoid. It should be noted, however, that the proportions just given are taken from preserved material; that while Miss Dickerson states in her key (loc. cit., p. 45) that the total length is 4½ times the head length in *B. fowleri* and 4 times the head length in *B. americanus*, in her descriptions of the species (loc. cit., pp. 63 and 94) the head length is said to enter the total length about 4 times in *B. fowleri* and 4-4½ times in *B. americanus*; and that Miller and Chapin (loc. cit., p. 316) state that no differences in proportions between the species can be noted.

Miller and Chapin (loc. cit., p. 316) state that the iris is bronze in color in *Bufo americanus*, and that it is silvery in *B. fowleri*; and Hancock (loc. cit., p. 257, legend of figure) intimates that this is a distinguishing character of the Michigan specimens examined by him. Allard,\(^10\) however, says that this character cannot be relied upon to separate the two species, and the writer has failed to find any constant difference in the color of the iris in the Michigan specimens.

The breeding season was past when the toads were collected;

\(^9\) Miller and Chapin, *loc. cit.*, p. 316, state that the chest of *Bufo fowleri* may be spotted.

\(^10\) Science, N. S., XLIV, p. 464.
but two distinct songs were heard, the sustained trill of *B. americanus* and the "metallic droning sound, not conspicuously vibrated" (Dickerson, *loc. cit.*, p. 95) characteristic of *B. fowleri*. The latter was traced to a specimen of the form which resembles *B. fowleri*.

These studies apparently show that there are two forms of the genus *Bufo* in western Michigan: one with the characters of *Bufo americanus*; the other in structure, color and song indistinguishable from *Bufo fowleri*. Furthermore a comparison of specimens of the latter form with one of the original specimens\(^\text{11}\) of *Bufo fowleri*, from Danvers, Massachusetts, reveals no differences except that the cranial crests in the eastern specimens are closer together. It is planned to study the forms in the breeding season to ascertain if there are differences in the breeding habits, and if the difference in the voice is constant.

\(^{11}\) Cat. No. 50246, Museum of Zoology, University of Michigan; formerly Cat. No. 518, Museum of Comparative Zoology.
COLEOPTERA COLLECTED IN NORTHEASTERN NEVADA BY THE WALKER-NEWCOMB EXPEDITION OF THE UNIVERSITY OF MICHIGAN

By A. W. Andrews

In the summer of 1912, the Museum was enabled, through the generosity of Dr. Bryant Walker and Dr. W. W. Newcomb, to send an expedition to Northeastern Nevada. The small collection of Coleoptera upon which this paper is based was made vicariously by the several members of the expedition while engaged in their special work. It is, therefore, very incomplete, but the list seems to be of sufficient interest to warrant publication. As the number of species is small, and as some of the material is as yet undetermined from lack of either male or female forms, little can be said in general regarding the collection. A few of the species range to Texas, others to California, while one at least is of very general distribution. Aquatic forms predominate in the collection,
while the common arid region forms of the Tenebrionidae are nearly lacking.

For a detailed account of the region reference should be made to "Occasional Papers of the Museum of Zoology," No. 8.

The writer wishes to express his indebtedness to Mr. H. C. Fall and Mr. J. D. Sherman for the determination of certain of the forms.

List of Species.

Dytiscidae.

_Bidessus affinis_ Say.—Collected in pond west of the bridge near Moline Canyon, July 22. This species has been taken at Fort Davis, Texas.

_Coelambus hydropicus_ Lec.—Specimens of this species were collected among weeds in Maggie Creek, July 11.

_Deronectes griseostriatus_ DeG.—This species was found in a series of ponds along Susan Creek, July 12.

_Agabus lugens_ Lec.—Specimens of a form very near to this species were taken on the Carlin Peaks, July 24.

_Rhantus binotatus_ Harr.—This species was taken in the pond west of the bridge near Moline Canyon, July 22.

Hydrophilidae.

_Helophorus linearis_ Lec.—This species was taken with the preceding one.

_Tropisternus limbalis_ Lec.—This form was taken simultaneously with the preceding.
Laccobius ellipticus Lec.—This species was taken in the spring on the Cortez Range, July 9.

Laccobius sp.—Several specimens taken with the preceding species are not referable to it nor to others of the genus.

Cymbioidea imbellis Lec.—This species was taken on the Carlin Peaks, July 29. It ranges to southern California.

SILPHIDAE.

Necrophorus guttula Mots.—This species was taken near the ranch house in James Canyon, August 2.

Silpha lapponica Hbst.—Data at last.

COCCINELLIDAE.

Coccinella transversoguttata Fab.—This species was collected along Annie Creek, July 12.

DERMESTIDAE.

Dermestes caninus Germ.—Specimens of this species were taken on a decaying bird on the plain of Maggie Creek, July 6.

PARNIDAE.

Dryops striatus Lec.—This species was found under stones in swift water in Annie Creek, July 12.

CERAMBYCIDAE.

Monilema annulatum Say.—A single specimen was taken in the Carlin Hills, August 6.

In addition to the foregoing the collection contains undetermined Carabidae of the genera Pterostichus and Stenophorus, a single species of each, and two species of Tenebrionidae of the genus Eleodes.
NOTES ON NORTH AMERICAN NAIDES. I

BY BRYANT WALKER

Friersoii has shown that the original type named by Lea for his genus Symphynota was *Unio alatus* Say and that consequently Symphynota becomes a synonym of Proptera Raf. and that Lasmigona Raf. as the earliest available name becomes the generic type.

Another consequence is that the group included by Simpson in the subgenus Symphynota is left without a name unless Lymnadea Sw. (Treat. Mal., 1840, p. 379) is available. But I do not think that it can be used. Swainson listed three species under his new genus:—*L. alata* Sw. (*U. alatus* Say), *L. fragilis* Sw. (*U. gracilis* Bar.) and "*L. compressa* Lea." In his text where he discusses the systematic position of Lymnadea (l. c. p. 265) he figures *alata* as the representative of the genus and in citing *compressa* on p. 379 prefixes it with an "?" showing that he was not certain that it really belonged to the genus.
The International Code (Art. 30-e) expressly provides that in designating a type “species which the author of the genus doubtfully referred to it” are excluded.

For these reasons I am of the opinion that the evident intention of the author will be best carried out and the provisions of the Code obeyed by considering alata as the generic type and, to save any possible question hereafter, I hereby designate *Lymnadea alata* Sw. (*U. alatus* Say) as the type of *Lymnadea* Sw.

To take the place of the unavailable *Symphynota* Lea as a name for the subgenus, I propose to substitute *Platynaias* with *Symphynota compressa* Lea as the type. The arrangement proposed by Ortmann (Naut. XXVIII, 1914, p. 42) will still hold good, but should be reversed as follows:

Genus *Lasmigona* Raf.
Subgenera *Lasmigona* s. s.
   Pterosygna Raf.
   Alasminota Ort.
   Platynaias Walk.

II

In 1840 Simpson in his Treatise on Malacology, p. 382, described a new genus of his subfamily Alasmodontinæ as *Calceola* and gave as the monotype, “*C. angulata Sw. Am. Tr. 1827, pl. 3 f. 1*.” Both the genus and species seem to have been overlooked by both Lea and Simpson in the preparation of their respective synopses.

Swainson never actually described a species as *Calceola angulata*, but his reference is evidently to the Trans. Amer. Phil. Soc. for that year and the species figured on pl. 3, f. 1 is the *Unio calceolus* Lea. It would seem that his generic name was adapted from the specific name used by Lea. Swainson
simply followed the common custom of his time which permitted the author of a new genus to rename all the species of earlier authors that he included in his new group.

It follows that Calceola Sw. is exactly the same group as that subsequently described by Simpson as Pressodonta and has priority over it.

III

In 1793 Spengler, who was a leading Swedish conchologist of that time, described in the Skrifter af Naturhistorie-Selkskabet, III, p. 55, a supposed new species of Unio from "North America" as Unio violaceus in the following words:

"Testa crassa, oblonga, antice hinc angulose flexa, interne violacea."

This description described nothing and might apply to any one of a very considerable number of North American species. But Lea in his Synopsis referred it to Unio complanatus and in this was doubtfully followed by Simpson.

In 1913, Haas (Kobenhavn Nath. Medd. 65, pp. 51-66) published a paper on Spengler's Unios and figured the type of his Unio violaceus, from which it would appear to be an abnormal specimen of the well known Unio complanatus. The question is whether Spengler's name, his type having in 1913 for the first time been adequately described and figured, should be given preference over the definite description of Dillwyn in 1817.

The conditions of a valid specific description are explicitly defined by the Code and have been further construed by Opinion I of the International Committee, in which it is held that the "indication" required by the rule does not include museum specimens. Dr. Pilsbry has aptly stated the proper construction of the requirements of the Code in another connection (Pr. A. N. S. P., 1915, p. 549) and substantially as
follows: the use of such a name depends upon whether it could be identified by descriptions published prior to any other recognizable name for the same species. That it can be recognized from the type or other specimens of the author does not entitle his name to acceptance unless the published description is adequate.

It would seem clear from this that *Unio violaceus* Speng. must be considered to date from 1913 and not from 1793 and that consequently it is a synonym of *U. complanatus* Dill.

IV

*Hemilastena* was proposed as a generic term by Agassiz in 1852, and the type is expressly stated to be *Unio dehiscens* Say ("earlier well described as *Hemilastena lata* by Rafinesque"), for this reason and not because *Hemistena* Raf., 1820, is a contraction of *Hemilastena*, which is entirely immaterial as the two names are quite different, it is clearly a synonym of *Lastena* Raf. as stated by Frierson (Naut., XXVII, 1914, p. 8), and the genus of which *Alasmodonta ambigua* Say is the type will consequently be known as *Simpsoniconcha* Frierson.

V

In 1831 Rafinesque, in the Continuation of his Monograph, p. 3, described a new species of *Unio* from the Cumberland River as follows:

"*Unio rimosus*, (*Eurynia rimosas*, 1823). Shell elliptic, thick, thinner, broader and rimose behind; surface olivaceous nearly smooth, inside bluish white. Length 2/3, diameter 1/6, axis 1/4 of length.

"In the Cumberland river, rare, small 1½ inch. Resembling some *Amblemas*, but evidently transversal, cardinal tooth crenulate, lamellar smooth, short, nearly horizontal, but
a little curved towards the back. Perhaps a peculiar S. G. near to Epioplasma, it might be called Lemiox.”

This species was first identified with the well known *Unio cælatus* Con. by Frierson (Naut. XXVIII, 1914, p. 7), and the identification has been accepted by Ortmann (Naut. XXX, 1916, p. 39) who considers the species (*cælatus*) worthy of generic rank on account of its unique surface sculpture and certain anatomical peculiarities.

The validity of the use of Lemiox as the name for this genus depends upon the certainty of the identification of *rimosus* with *cælatus*. This approximation rests wholly upon Rafinesque's use of the word, "rimose" as a descriptive term, as aside from this the species would be wholly unidentifiable. According to the Century Dictionary rimose means "chinky, like the bark of a tree" and in entomology the surface sculpture of insects showing "many minute, narrow and generally parallel excavations." While at first blush it must be admitted that this seems quite an apt description of the peculiar surface sculpture of *cælatus*, it is not exactly correct and the remaining characters given by Rafinesque for his species do not at all apply. He says that the shell of his species is nearly smooth, that it is broader and rimose behind, and that it is one and one-half inches long, the altitude being $2/3$ and the diameter $1/6$ of the length. None of these are true of *cælatus*, the corrugations are not minute, but are very heavy and coarse, they are not confined to the posterior portion, but cover three-fourths of the entire shell, which is not wider behind, and the diameter of a specimen of *cælatus* of the length given by Rafinesque is nearly one-half instead of one-sixth of the length.

Rafinesque's description would apply much better to *Medionidus conradicus* Lea than it does to *cælatus* Con. The
description of the lateral tooth also agrees better with that of conradicus.

In short the perennial question as to the adequacy of Rafinesque's descriptions again appears.

If the identification of rimosus with calatus is revised or the description of rimosus rejected wholly, as it should be, for indefiniteness, a new name will have to be found for the genus typified by calatus Con. and characterized by Ortmann.
NOTES ON THE BIRDS OF ALGER COUNTY, MICHIGAN

By Norman A. Wood

One of the most interesting regions in Michigan to the naturalist is the Upper Peninsula. Since 1903 the Museum of Zoology has been investigating the animals and plants of this region and much of the work accomplished has been made possible by the Hon. George Shiras 3rd, who has a keen interest in the study of the fauna of the state and has contributed toward the expenses of several of the expeditions. In 1916, Mr. Shiras, in addition to other aid, placed his delightful summer home in Alger County, Peter White Camp, at the disposal of the Museum and the work was conducted in its vicinity. One paper\(^1\) upon the results of this expedition has appeared and several more are in preparation.

The camp is situated in the northwest corner of Alger County, about four miles south of Deerton on the Whitefish River. The region studied lies largely to the south of Onota and Deerton and is a roughly triangular area about ten miles

on a side, bounded in a general way by Silver Lake, Howe's Lake, Deerton and Deer Lake. It is underlaid with sandstone, which, though never far from the surface, only outcrops along the lakes and rivers. The Whitefish River forms the main drainage system for the region.

In general the country is flat without notable relief. Four lakes were studied in detail. Whitefish Lake, which occupies a deep gorge through which runs the Whitefish River, has been made famous by Mr. Shiras' flash light pictures of animals. Howe's Lake is a rather large, shallow body of water with a muddy bottom and soft and marshy shores. It was a favorite resort for loons, black ducks and mergansers. Silver Lake is much smaller than the preceding and the shores are heavily forested. Barn swallows, house wrens, bronzed grackles and red-winged blackbirds were found breeding there. Cranberry Lake is little more than a small pond in a spruce-cedar-tamarack swamp a mile northeast of Peter White Camp. Here the Lincoln's sparrow was heard singing in July, and white-throated sparrows were abundant. A fifth and larger lake, Deer Lake, is situated near Deerton. Its shores are largely rocky except for a sandy area on the east. As few birds were noted at Deer Lake, it is of little importance in this report.

The whole region is covered with a heavy hardwood forest composed chiefly of hard maple, yellow birch and beech, with local mixtures of hemlock. White pine is scattered throughout the forest but never occurs in pure stands. Basswood and ironwood are usually present, while in the swamps spruce, balsam and arbor-vitae abound. Along the rivers the flats are covered with white elm and black ash; of the former a few immense trees occur in the hardwood forest about Silver Lake.
At the west end of Howe's Lake is a large tamarack swamp, while a smaller one lies at the end of Cranberry Lake.

Clearings occur along the railroad right of way. These have been repeatedly burned over, and farms have been started near the small stations of Onota, Deerton and Rock River. One extensive clearing designated as Schaffer's clearing, a rather recently made one extending from Onota almost to Whitefish Lake, formed an important habitat for birds that nest or feed in the open. It is thickly covered with grass, which attracts such birds as the meadow lark, vesper sparrow and bluebird.

As would be expected of a region so diverse as to offer conditions from cultivated farm lands to original forest, the bird life was interesting and abundant both in numbers of species and individuals. Inasmuch as the period of observation extended from May 24 to July 27 both migrants and breeding birds are recorded in the following list.

List of Species.

1. *Gavia immer* (Brünn.). Loon.—First recorded on May 27 on Howe's Lake. One adult was noted almost daily on Whitefish Lake, where it was joined on July 23 by a young bird.

2. *Larus argentatus* Pontopp. Herring Gull.—The herring gull is probably only a straggler from Lake Superior in this region as it was only occasionally observed. It was first recorded on May 25.

3. *Sterna hirundo* Linn. Common Tern.—This tern has been observed during the spring migration. (Shiras.)

4. *Mergus americanus* Cass. Merganser.—This species is not uncommon during the spring and fall migrations. (Shiras.)
5. *Lophodytes cucullatus* (Linn.). Hooded Merganser.—On May 25 an adult female and on June 15 eight young of this species were observed on Whitefish Lake.

6. *Anas platyrhynchos* Linn. Mallard.—On July 21 a pair of adult mallards appeared on Silver Lake. They were more common during migration.

7. *Anas rubripes* Brewst. Black Duck.—This species occasionally breeds in the region. A pair of adults was seen on Whitefish Lake on May 25, and on June 3 ten young were swimming about in the river.

8. *Mareca americana* (Gmel.). Baldpate.—A spring and fall migrant. (Shiras.)

9. *Nettion carolinense* (Gmel.). Green-winged Teal.—A migrant. (Shiras.)

10. *Querquedula discors* (Linn.). Blue-winged Teal.—Like the preceding species this teal has been reported only during the migration seasons. (Shiras.)

11. *Dafila acuta* (Linn.). Pintail.—A rare migrant. (Shiras.)

12. *Aix sponsa* (Linn.). Wood Duck.—This species has been observed to nest occasionally in the region. (Shiras.)


15. *Marila marila* (Linn.). Scaup Duck.—Fairly abundant during migration. (Shiras.)

16. *Marila affinis* (Eyton). Lesser Scaup Duck.—More common than the preceding species. (Shiras.)

17. *Clangula clangula americana* Bonap. Golden-eye.—A spring and fall migrant. (Shiras.)
18. Charitonetta alcola (Linn.). Buffle-head.—Common during migration. (Shiras.)


20. Branta canadensis canadensis (Linn.). Canada Goose. —Common during migration. (Shiras.) In the spring of 1916 Mr. Anderson saw a big flock light on the marsh along the river.

21. Botaurus lentiginosus (Montagu). Bittern.—This species is occasionally seen at the edge of Whitefish Lake and a nest with young was found near Rumley in July, 1916.

22. Ardea herodias herodias Linn. Great Blue Heron.—A pair of adults was seen daily about the river and lake in 1916.

23. Rallus virginianus Linna. Virginia Rail.—Mr. Shiras has a few records for this species.

24. Porzana carolina (Linn.). Sora.—Common during the fall migration. (Shiras.)

25. Gallinula galeata (Licht.). Florida Gallinule.—Rare. (Shiras.)

26. Fulica americana Gmel. American Coot.—Only observed during migration. (Shiras.)

27. Philohela minor (Gmel.). Woodcock.—Noted occasionally along the river.

28. Gollinago delicata (Ord.). Wilson’s Snipe.—A common migrant. (Shiras.)

29. Pisobia minutilla (Vieill.). Least Sandpiper.—A rare fall migrant. (Shiras.)

30. Totanus melanoleucus (Gmel.). Greater Yellow-legs. —Specimens of this species were taken in the big marsh north of Peter White Camp by Mr. Anderson in the spring of 1916.

31. Totanus flavipes (Gmel.). Yellow-legs.—This is a more common migrant than the preceding species. (Shiras.)
32. Helodromas solitarius solitarius (Wilson). Solitary Sandpiper.—First observed on May 25. Adults with young of the year were on Whitefish Lake on July 11. Although the species has never been known to nest in Michigan, this record seems to indicate such a possibility. At least a journey of a hundred miles seems a difficult flight for such young birds.

33. Actitis macularia (L.inn.). Spotted Sandpiper.—A pair of these sandpipers evidently nested in the region as they were seen daily. An adult with three newly hatched young was observed at Onota on June 25.

34. Oxyechus vociferus (Linn.). Killdeer.—An adult and three young were recorded at Onota on June 25 and another pair on June 26 at the big marsh north of Peter White Camp.

35. Canachites canadensis canace (Linn.). Canada Spruce Grouse.—Rarely observed. (Shiras.)

36. Bonasa umbellus togata (Linn.). Canada Ruffed Grouse.—Two broods of young were recorded on July 14 but the species was not common. This may have been due to the scarcity of food in the region.

37. Accipiter velox (Wilson). Sharp-shinned Hawk.—Evidently rare as it was observed but twice during the summer of 1916.

38. Accipiter cooperi (Bonap.). Cooper’s Hawk.—A rare resident. Recorded on May 31, June 9 and June 22.

39. Buteo borealis borealis (Gmel.). Red-tailed Hawk.—Observed on July 13 and 14 at the south end of Whitefish Lake and on July 21 at Silver Lake.

40. Astur atricapillus atricapillus (Wilson). Goshawk.—Common during spring and fall migrations. (Shiras.) Recorded on May 28 near Peter White Camp.
41. *Buteo lineatus lineatus* (Gmel.). Red-shouldered Hawk.—Observed but once, on May 24, near Peter White Camp.

42. *Buteo platypterus* (Vieill.). Broad-winged Hawk.—The most common nesting hawk in the region. Observed daily during June and July.

43. *Haliæctus leucocephalus leucocephalus* (Linn.). Bald Eagle.—Rare. An immature specimen was taken on Whitefish Lake in 1905.

44. *Falco sparverius sparverius* Linn. Sparrow Hawk.—A rare resident. First observed on July 9 in a clearing near Deerton.

45. *Pandion haliaëtus carolinensis* (Linn.). Osprey.—First noted on June 8 on Whitefish Lake.

46. *Strix varia varia* Barton. Barred Owl.—Observed on July 17 and occasionally heard calling at night.

47. *Bubo virginianus pallescens* Stone. Western Horned Owl.—This species was not observed but the call was heard frequently and specimens have been trapped in fall and winter by the caretaker at Peter White Camp.

48. *Nyctea nyctea* (Linn.). Snowy Owl.—A fall and winter resident. (Shiras.)

49. *Coccyzus americanus americanus* (Linn.). Yellow-billed Cuckoo.—Occasionally seen. (Shiras.)

50. *Coccyzus erythropthalmus* (Wilson). Black-billed Cuckoo.—Rare. First noted on June 24 in the hardwoods south of Peter White Camp.

51. *Ceryle alcyon* (Linn.). Belted Kingfisher.—Not common. A pair nested in a low gravel pit at the edge of the Whitefish River.
52. *Dryobates villosus villosus* (Linn.). Hairy Woodpecker.—First recorded on June 8. Only occasionally observed.

53. *Dryobates pubescens medianus* (Swains.). Downy Woodpecker.—More common than the preceding species but rarer than one would expect in a region of hardwoods.

54. *Sphyrapicus varius varius* (Linn.). Yellow-bellied Sapsucker.—A common breeder in the hardwood forests, where numbers were seen daily. Many of the trees, especially hemlocks and mountain ash, were thickly perforated with their work: some were completely girdled. During July the young ones seemed to live entirely on the dying trees.

55. *Phaetornis pileatus abieticola* (Bangs). Northern Pileated Woodpecker.—This species was rare and its work was seldom seen. On May 25 an adult male was observed on a dead spruce near Whitefish Lake.

56. *Colaptes auratus luticus* Bangs. Northern Flicker.—Rare. Recorded on June 5 at the edge of Whitefish Lake and on July 22 at a clearing near Peter White Camp.

57. *Chordeiles virginianus virginianus* (Gmel.). Night-hawk.—This species nested in the clearings near Deerton and was occasionally seen flying over Whitefish Lake at twilight.

58. *Chactura pelagica* (Linn.). Chimney Swift.—Two pair of chimney swifts nested about the buildings at Peter White Camp and in July eight young appeared with the adults.

59. *Archilochus colubris* (Linn.). Ruby-throated Hummingbird.—A common resident. A pair nested near Peter White Camp and were around all summer.

60. *Tyrannus tyrannus* (Linn.). Kingbird.—Not common. A pair nested at the north end of Whitefish Lake, and the species was recorded on June 29 at Silver Lake and on July 27 at Deerton.
61. *Sayornis phoebe* (Latham). Phoebe.—A common resident which nested under all the bridges in the region.

62. *Nuttallornis borealis* (Swains.). Olive-sided Flycatcher.—Observed on May 24 at the edge of Whitefish Lake and occasionally after that.

63. *Myiocharis virens* (Linn.). Wood Pewee.—Occasionally observed in the hardwoods.

64. *Empidonax trailli alnorum* Brews. Alder Flycatcher.—Not rare among the alders along the river and the north end of Whitefish Lake.


66. *Cyanocitta cristata cristata* (Linn.). Blue Jay.—Several pair of this species nested in the woods about Peter White Camp, where they visited the food boxes daily.

67. *Corvus corax principalis* Ridgw. Northern Raven.—A flock of seven ravens, five of which were young, were observed on May 27 in the hardwoods near Peter White Camp. They were seen frequently during the summer soaring and sailing in circles like hawks.

68. *Corvus brachyrhynchos brachyrhynchos* Brehm. Crow.—A pair of crows, the only ones observed in the region, nested in a pine near Peter White Camp and were frequently seen chasing the ravens away from the vicinity of their nests. The young left the nest on June 11.

69. *Dolichonyx oryzivorus* (Linn.). Bobolink.—Rare. Last observed in 1913. (Shiras.)

70. *Molothrus ater ater* (Bodd.). Cowbird.—The species was recorded on May 31, June 19, and July 19, from the vicinity of Peter White Camp.
71. *Agelaius phoeniceus phoeniceus* (Linn.). Red-winged Blackbird.—Observed on May 25 at Whitefish Lake, on June 7 at Silver Lake, and on June 2 among the tag alders along the river.

72. *Sturnella magna magna* (Linn.). Meadowlark.—Rare in the vicinity of Peter White Camp although they are common a few miles east. Recorded on June 25 near Rock River and on July 14 just east of Whitefish Lake.

73. *Icterus galbulus* (Linn.). Baltimore Oriole.—Rare. A single specimen was noted at the edge of the river near Whitefish Lake. ²

74. *Quiscalus quiscula aeneus* Ridgw. Bronzed Grackle.—On June 7 a pair and young of the year were seen at Whitefish Lake and in July the species was occasionally observed around Peter White Camp, but it was not common.

75. *Carpodacus purpureus purpureus* (Gmel.). Purple Finch.—Frequently seen in the clearing at Peter White Camp and in the hardwoods.

76. *Acanthis linaria linaria* (Linn.). Redpoll.—Common during the migrations. (Shiras.).

77. *Astragalinus tristis tristis* (Linn.). Goldfinch.—This species came to feed daily on the dandelion seeds in the clearing about Peter White Camp. It was also observed on June 7 at Whitefish Lake and at Deerton and Onota in July.

78. *Spinus pinus* (Wilson). Pine Siskin.—Noted on May 27 at the river’s edge.

79. *Poecetes gramineus gramineus* (Gmel.). Vesper Sparrow.—Rare. They were observed near Peter White Camp on May 31 and July 14 and at Onota on July 9.

² Barrows (Michigan Bird Life) gives Van's Harbor, Delta County, which is fifty miles southwest of Peter White Camp, as the northernmost record for the state.
80. *Zonotrichia albicollis* (Gmel.). White-throated Sparrow.—Occasionally seen in the hardwood forest about Peter White Camp. Much more common in the burnings and clearings near Deerton and Onota.

81. *Spizella passerina passerina* (Bechstein). Chipping Sparrow.—This species nested commonly in the shrubs and visited the food boxes regularly for seeds.

82. *Spizella pusilla pusilla* (Wilson). Field Sparrow.—A rare resident. It was seen but twice, on June 25 and July 14, in meadows.

83. *Junco hyemalis hyemalis* (Linn.). Slate-colored Junco.—This species was abundant around the clearings and burnings. A pair nested near Peter White Camp and visited the food boxes daily.

84. *Melospiza melodia melodia* (Wilson). Song Sparrow.—A common resident. Seen frequently along the edges of the rivers and streams, where they fed close to the water's edge.

85. *Melospiza lincolni lincolni* (Aud.). Lincoln's Sparrow.—Rare. A single specimen was heard singing in a small bog at Cranberry Lake, July 24. This was a male with enlarged testes, indicating that it might have been nesting in the region. So far as the writer has been able to determine, this is the first summer record for this sparrow in Michigan.

86. *Melospiza georgiana* (Lath.). Swamp Sparrow.—Observed on May 25. Probably a migrant as no more were noted.

87. *Passer domesticus domesticus* (Linn.). English Sparrow.—Not recorded from Peter White Camp but common at Deerton and Onota.

88. *Zamelodia ludoviciana* (Linn.). Rose-breasted Grosbeak.—Observed occasionally during June and July. A pair were often to be seen feeding in a potato patch near camp.
89. *Passerina cyanea* (Linn.). Indigo Bunting.—Mr. Shiras has records for this species near Peter White Camp.

90. *Piranga erythromelas* Vieill. Scarlet Tanager.—Probably only a migrant inasmuch as only one was seen, May 29.

91. *Petrochelidon lunifrons lunifrons* (Say). Cliff Swallow.—Recorded only on July 14, when three were feeding over Whitefish Lake.

92. *Hirundo erythrogastera* Bodd. Barn Swallow.—On June 7 a pair of barn swallows were building a nest in a boat house at Silver Lake, on June 25 a nest with four young was found in an old shed at Onota, and in July several were observed feeding over Whitefish Lake.

93. *Iridoprocne bicolor* (Vieill.). Tree Swallow.—A pair fed daily about the clearing and over the river and lake. On June 26 two nests were found in an old burning.

94. *Bombycilla garrula* (Linn.). Bohemian Waxwing.—Occasionally seen during migrations.

95. *Bombycilla cedrorum* Vieill. Cedar Waxwing.—Common. In May a flock of about twenty came daily to the apple trees at Peter White Camp.

96. *Lanius ludovicianus migrans* W. Palmer. Migrant Shrike.—Recorded as rare by Mr. Shiras.

97. *Vireosylyva gilva gilva* (Vieill.). Warbling Vireo.—Occasionally seen in the hardwoods.

98. *Mniotilta varia* (Linn.). Black and White Warbler.—This species was seen occasionally from May 27 until the last of July.

100. *Dendroica aestiva aestiva* (Gmel.). Yellow Warbler.—The writer saw two yellow warblers on May 23 at the edge of Whitefish Lake. These were the only ones noted.

101. *Dendroica carnulescens carnulescens* (Gmel.). Black-throated Blue Warbler.—Not uncommon in the heavy hardwood forests. An adult and young were seen July 11 west of Whitefish Lake.

102. *Dendroica coronata* (Linn.). Myrtle Warbler.—An adult and young were noted on July 24 near the edge of Whitefish Lake, and the species was not uncommon in the spruce-hemlock forest.

103. *Dendroica pensylvanica* (Linn.). Chestnut-sided Warbler.—Observed occasionally in May and June. On July 19 a female with young of the year was found in the second growth forest near Deerton.

104. *Dendroica castanea* (Wilson). Bay-breasted Warbler.—Not observed after May 27, when two were flushed from conifers near the river.

105. *Dendroica fusca* (Müller). Blackburnian Warbler.—Fairly common among the hemlocks. Adults and young were seen near Whitefish Lake on July 24.

106. *Dendroica virens* (Gmel.). Black-throated Green Warbler.—A common summer resident in the spruce-hemlock forest. Adults and young were recorded on July 24 near the edge of Whitefish Lake.

107. *Seiurus aurocapillus* (Linn.). Oven-bird.—Frequently observed during July and August in the heavy hardwood forest.

108. *Seiurus noveboracensis notabilis* Ridgw. Grinnell’s Water-Thrush.—Abundant during June and July about the shore of the lake and river. The first young were recorded on July 25.
109. *Geothlypis trichas trichas* (Linn.). Maryland Yellow-throat.—On June 8 a few migrating yellow-throats appeared in the dense growth of tag alders near the river and lakes.

110. *Wilsonia canadensis* (Linn.). Canada Warbler.—Not a common resident. Occasionally observed during June and July at the edge of a cedar swamp.

111. *Setophaga ruticilla* (Linn.). Redstart.—Not abundant. Seen most commonly in the hardwoods.

112. *Dumetella carolinensis* (Linn.). Catbird.—A pair of catbirds nested near Peter White Camp in 1915, the only time they had been recorded by Mr. Shiras as residents. On May 26, 1916, one bird came back and fed daily on the suet in the food boxes.

113. *Troglodytes aëdon aëdon* Vieill. House Wren.—This species nested at Peter White Camp in 1915 and in 1916 at Silver Lake. It was not common.

114. *Nannus hiemalis hiemalis* (Vieill.). Winter Wren.—Rare. Recorded on June 20 at Whitefish Lake.

115. *Certhia familiaris americana* Bonap. Brown Creeper.—Observed on May 25 and occasionally after that in the forest near Whitefish Lake.

116. *Sitta carolinensis carolinensis* Lath. White-breasted Nuthatch.—Not abundant. A few visited the suet tree at Peter White Camp. But one pair was known to breed in the region in 1916.

117. *Penthestes atricapillus atricapillus* (Linn.). Chickadee.—Observed in all habitats, but most common among the tag alders on the edge of the river and lakes.

118. *Hylocichla ustulata swainsoni* (Tschudi). Olive-backed Thrush.—Abundant. Its favorite nesting places were among the rocky ravines along the shores of Whitefish Lake.

120. *Sialia sialis sialis* (Linn.). Bluebird.—A pair of bluebirds were recorded at Peter White Camp on May 24. The only nests were found in the clearings two miles from the camp. The species was also observed at Whitefish Lake, Onota, Deerton and Rock River.
During the summer of 1917 the Museum of Zoology sent expeditions to Hillsdale, Branch, and Berrien Counties, in the extreme southern part of Michigan. A study of the mollusks of this region resulted in additional records for each county, among them two species new to the state. Of these _Pleurobema clava_ (Lam.) represents a genus not before recorded for Michigan, but whose presence was expected since its range as given by Sterki¹ and Simpson² includes the Maumee Basin. Clark and Wilson³ list this species from the Upper Maumee and the St. Joseph.

The only specimen procured was taken between Woodbridge and Amboy Townships, Hillsdale County, in a small branch of the St. Joseph of the Maumee. The stream was at this point

² Descriptive Cat. of the Naiades, 1914, p. 736.
³ Bur. Fish., Doc. 757, 1912, p. 43.
not more than ten feet wide, two or three feet deep, swift, and filled with pebbles and small stones. Assiduous search in other branches of the same stream failed to add to the number of specimens, which was due probably to the fact that the greater part of that section of the county is under cultivation, and the natural streams have been cleared of vegetation in order to be used as drainage ditches.

The second species new to Michigan has been identified by Bryant Walker as *Planorbis dilatatus buchanensis* (Lea). Two large specimens and a number of small ones were collected near Harbert, Berrien County. These were all taken from dead leaves and sticks submerged in a small pond above a dam. The largest specimen measures as follows: greater diameter 4.25 mm., lesser diameter 2.75 mm., altitude 1.5 mm. This differs from Lea's *buchanensis*1 in its greater size and distinctly angular aperture due to the strong carina. It agrees in all points with a specimen from New Philadelphia, Ohio, with which it has been compared. The surface sculpture of incised revolving lines cannot be compared with that of *P. buchanensis* since the sculpture is not mentioned in the original description. The original specimens of *P. buchanensis* were from "near Cincinnati, Ohio," and the only other record until the present one was New Philadelphia, Ohio.5

The typical *P. dilatatus* was described by Gould6 from Nantucket and Hingham, Massachusetts. According to available records the range of the typical form extends from New England to Florida, north to Ohio and Ontario, and west to the Mississippi. A single record from Texas indicates a possible

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3 Inv. Mass., 1841, p. 210, fig. 140. "In July, 1840, Mr. T. J. Whittemore, found it in great numbers at Hingham..."
extension of the range to the south and west. With the assistance of Dr. Bryant Walker the following fairly complete list of references to records has been made and to it are added the localities of specimens in his collection.


Beauchamp, Wm.—L. & F. W. Shells of Onondaga Co., N. Y., 1886, p. 4. No exact locality given and "identification doubtful."


Lewis, James.—L. & F. W. Shells of Ala., 1876, p. 27. "N. W. Georgia."

Mazyck, Wm.—Contrib. from Charleston Mus., II, 1913, p. 3. Near Charleston, S. C.


The figures of both the typical *dilatatus* and the variety given by Binney (loc. cit.) are small and lack details, hence it has been considered advisable to publish the present figures from camera lucida outlines. *Planorbis dilatatus* was drawn from a specimen loaned by Dr. Walker, No. 4993 of his collection, and is from the collection of T. J. Whittemore. Though it has no exact locality it is assumed that it came from Hingham, Mass., and if not one of the original lot mentioned by Gould (loc. cit.) it is at least a topotype. *Planorbis d. buchanensis* was drawn from the largest of the Berrien County, Michigan, specimens, evidently a fully adult shell.
PLATE I.

Figs. 1, 2, 3. Planorbis dilatatus Gld. × 10.

Figs. 4, 5, 6. Planorbis dilatatus buchanensis (Lea). × 10.
Planorbis dilatatus

Planorbis dilatatus buchanensis
I. Two Interesting New Colombian Gomphines (Odonata)

By E. B. Williamson

The genus and species described in this paper were taken in Colombia in 1917. A detailed account of the expedition and a description of the region in which the collections were made have been given in a previous paper.¹

Erpetogomphus sabaleticus, new species

Description: Abdomen, male 33 mm., female 32 mm.; hind wing, male 26 mm., female 28.5 mm.

Male.—Head exactly like tristani, as described by Calvert, ² except that the hind margin of the occiput, in the median line, has a short shallow rounded depression.

¹ A Collecting Trip to Colombia, South America, Miscellaneous Publications, Museum of Zoology, University of Michigan, No. 3, February, 1918.
Prothorax also like \textit{tristani}, except that the submedian dorsal spots on the middle lobe are wanting in \textit{sabaleticus}, and the posterior lobe is divided in its anterior half by a broad brown band which is continued posteriorly as a yellowish or paler area than the adjoining green.

Thoracic pattern as figured (plate II, fig. 9); essentially the same as \textit{tristani}, a few minor differences are no more than individual variations.

Adomen like \textit{tristani}; a green dorsal basal spot on 2, fading out posteriorly, but no pale dorsal posterior spot in either species; Calvert's description of the dorsal abdominal markings requires some correction; the pale yellowish or whitish middorsal stripes are confined to 3-6, 7, as frequently in gomphines, having an entirely different pattern; moreover, on 3-5 these dorsal stripes reach the apices of the segments as thread-like lines; the basal two-fifths or half of 7 is yellow, this pale area with a narrow, median, interrupted, transverse brown ring; 10 is conspicuously paler than 9 in both species, being that dull reddish orange or brown which appears in the coloration of many gomphines; 9, and more conspicuously 10, narrowly margined apically with black; lateral spots on 3-6 pale gray, as described in \textit{tristani}.

Form of abdomen as described for \textit{tristani}, except that the hind margin of 9 is as figured (plate II, fig. 10). It is the same in the specimen of \textit{tristani} given me by Dr. Calvert.

Genitalia of 2 indistinguishable from those of \textit{tristani} as figured and described by Calvert.

Abdominal appendages as figured (plate II, figs. 10 and 11). The superior appendages are distinguished at once from those of \textit{tristani} by the more apical position of the dorsal and ventral branches of each appendage, as seen in profile, and by the greater development in \textit{sabaleticus} of the dorsal branch and the
lesser development of the inferior branch. The inferior appendage is higher and curved forward farther so the enclosed space at the apex, as seen in profile, is vertical rather than horizontal as it is in *tristani*. Superior appendages yellow or yellowish, shading into black at the apices of the various branches; the inferior dark, almost black, shining reddish brown. In the specimen of *tristani* given me by Dr. Calvert the ventral branch of the superior appendage, as seen in profile, is more triangular and more sharply set off than in the type specimen, as figured by Calvert.

Legs as described for *tristani*, except that the pale under color of the middle femora is greenish brown, darker and duller than the under color of the first femora, and this color is not limited to a distal spot on the middle femora, but is continuous the length of the femora.

Female.—Head, thorax and abdomen as described for *tristani*; the coloration of head and thorax essentially like that of the male. Segments 3-10 badly faded and discolored, more or less blotched with brown and black; the median dorsal stripes on 3-6 nearly or quite obliterated, seen here and there as minute spots or short thread-like lines of color; the basal lateral spots on 3-6 are obscure but discernible; on 7 the pale areas in the blotched pattern are greater in extent than on 3-6, but in its discolored condition no description is possible, and unfortunately no living color notes were made of this specimen; 8-10 are progressively darker, 8 being largely reddish brown, and 10 being largely black. Vulvar lamina as in *tristani*.

Male and Female.—Wings clear in the male with yellowish tinges basally to about the level of the triangles; yellowish smoky tinged throughout in the female. Antenodals of front wings 15-16, of hind wings 11-12; postnodals of front
wings 12-13, of hind wings 10-12; distal thickened antenodal the fifth in the four wings of the male and one hind wing of the female; in both front wings of the female it is the sixth, and in one hind wing it is the fourth.

The wings of both tristani and sabaleticus are narrower than in other species of the genus known to me. In plate I, fig. 4, crotalinus is figured for comparison with sabaleticus. The narrower wing results primarily from a reduction of the anal area with consequent modifications of distal posterior parts adjusting themselves to this reduction. In my male specimen of tristani there are in the hind wings 10 marginal cells between Cu₂ and A₁; in the male of sabaleticus there are 12 in one hind wing and 11 in the other, in the female there are 12 and 13.

The following general description of the living colors of the male was made as soon as the specimen could be safely removed from the cyanide bottle. Eyes above dark dull blue, gray beneath. Face dark brown, frons green. Thorax rich dark brown marked with brilliant grass-green. Abdominal segments 1 and 2 and base of 3 brown; apex of 3 and 4-6 black; dorsal markings 1-6 green; basal lateral spots 3-6 light gray or pearl, on 3 with a greenish cast; basal area of 7 pale green above, sides gray like preceding lateral spots; apical part of 7 dark brown, 8 paler, 9 still paler and 10 light reddish brown, narrowly black at apex.

Throughout the above description it has been assumed that the student had before him Calvert's figures, description and discussion of Erpetogomphus tristani (Entomological News, Vol. XXIII, July, 1912, plate XVII, pp. 289-295). In view of the close relationship of tristani and sabaleticus, Calvert's paper and the present article are in a sense complementary. The two species seem inseparable on any other character than
the male abdominal appendages. I sent my two Colombia specimens to Dr. Calvert for examination. He not only compared them with the original male and female of *tristani*, but kindly sent me, for my own collection, a second male of *tristani* which he had received from Professor Tristán. This specimen was taken at Nicoya, Guanacaste, Costa Rica, in February, 1912. Dr. Calvert’s conclusion was that the Colombian and Costa Rican males were specifically distinct by their appendages, but he was unable to find any differences, other than the slight one of size, in the females. He compared the condition here found in Erpetogomphus to an analogous condition in the genus Hetaerina where the males of certain species are easily recognized while their respective females can not be distinguished.

**Habitat:** Colombia.

**Type Specimens:** One male, Cristalina, 28 kilometers on the railroad above Puerto Berrio, Department of Antioquia, February 19, 1917; 1 female, Maraquita, Department of Tolima, February 3, 1917; collected by J. H. and E. B. Williamson; in the collection of E. B. Williamson: the male the type of the species. The specific name refers to the beautiful little stream, the Quebrada Sabaleticus, where the male was taken.

**Habits:** I have elsewhere (*loc. cit.*) described the various localities in which we collected in Colombia. The female, here identified as *sabaleticus*, was taken along the upper San Juan near Maraquita. As I came out from a small gully into the stream bed it flew down from above the stream and alighted on a flat horizontal leaf a foot or two above the ground. It was the only Erpetogomphus seen about Maraquita. The male was taken along the Quebrada Sabaleticus and, like the female, in forest. I was stalking a large, handsome Gomphoides resting on the tip of a stick at one end of a small pool. It flew up
through the trees, a regular performance, as I attempted to approach, and at the same moment our mozo hissed and pointed to the bushes at my elbow. There, so close I had to move back a step to strike at it, resting on a flat leaf about five feet above the water, was this beautiful bright green and rich brown Erpetogomphus. The next day, when he had one of the elusive Gomphoides in his net, an Erpetogomphus alighted in the characteristic position near J. W., but flew before he could strike at it. We saw no other specimens of the genus in Colombia.

Remarks: In Dr. Calvert’s discussion of tristani, so frequently referred to above, he points out that Costa Rica marks the southern range of the genus Erpetogomphus as then known. However, only two species are recorded from Costa Rica and there is an absence of records in the large area intervening between Costa Rica and Guatemala, the latter country being in 1905 the southern known range of the genus. The discovery of this new species six hundred miles or more up the Magdalena River in Colombia is a wide extension of the known range of the genus; and the close relationship of the Costa Rican and Colombiam species calls attention again to the South American affinities of the Costa Rican fauna.

Ischnogomphus, new genus

Description: Slender, dull colored, belonging to the legion Gomphus of de Selys, and to that small group of genera in the legion in which the cross-veins between $M_{1-3}$ and $M_{4}$ are numerous and unspecialized. Its closest ally is Cyanogomphus from which it is separated by the anal area of the front wings being one cell wide, instead of two or more, and by the absence of an anal triangle in the male.

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Type: *Ischnogomphus jessei*, new species.

Remarks: The group of genera of the legion *Gomphus* of de Selys, which is separated from the other genera of the legion by the possession of numerous cross-veins between $M_{1-3}$ and $M_4$, includes *Agriogomphus*, *Cyanogomphus*, *Epigomphus*, *Ischnogomphus*, *Leptogomphus*, *Macrogomphus* and *Microgomphus*.

**Distribution of Characters Within the Group**


   3a. Distal thickened antenodal the sixth or more distal: *Epigomphus*, *Leptogomphus*, *Macrogomphus*.

4. One cubito-anal cross-vein in addition to the inner side of the subtriangle: *Agriogomphus*, *Cyanogomphus*, *Ischnogomphus*, *Leptogomphus*, *Macrogomphus*, *Microgomphus*.
   4a. Two cubito-anal cross-veins in addition to the inner side of the subtriangle: *Epigomphus*, *Macrogomphus*, *Microgomphus*.

5. One row of postrigonal cells in the front wings: *Agriogomphus*.

6. One row of postrigonal cells in the hind wings: *Agriogomphus*, *Cyanogomphus*, *Epigomphus*.

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7. Anal area of the front wings one cell wide: *Agriogomphus, Ischnogomphus, Microgomphus*.

7a. Anal area of the front wings two or more cells wide: *Cyanogomphus, Epigomphus, Leptogomphus, Macroagomphus*.

8. Two postanal cells in the hind wings: *Agriogomphus, Cyanogomphus, Ischnogomphus, Microgomphus*.

8a. Three postanal cells in the hind wings: *Cyanogomphus, Epigomphus, Leptogomphus, Macroagomphus*.

8b. Four postanal cells in the hind wings: *Leptogomphus, Macroagomphus*.

9. Anal area in hind wings, distal to the postanal cells, two cells wide: *Agriogomphus, Cyanogomphus, Ischnogomphus, Microgomphus*.

9a. Anal area in hind wings, distal to the postanal cells, three cells wide: *Epigomphus, Cyanogomphus, Leptogomphus*.

9b. Anal area in hind wings, distal to the postanal cells, four or more cells wide: *Macroagomphus*.

10. Anal triangle present in the male: *Cyanagomphus, Leptogomphus, Macroagomphus*.

10a. Anal triangle not present in the male: *Agriogomphus, Epigomphus, Ischnogomphus, Microagomphus*.

An Artificial Key to the Genera of the Group

a. Basal antenodal of second series not present.

b. One row of postrigonal cells in the front wings, *Agriogomphus*.

bb. Two rows of postrigonal cells in the front wings.

c. Anal area in the front wings one cell wide, in the hind wings two cells wide: *Microgomphus*.

d. Anal area in the front wings two or more cells wide, in the hind wings three cells wide: *Leptogomphus*.

aa. Basal antenodal of second series present.

b. Anal area in the front wings one cell wide: *Ischnogomphus*.

bb. Anal area in the front wings two or more cells wide.

c. Distal thickened antenodal the fifth: *Cyanogomphus*.

d. Distal thickened antenodal the sixth or more distal.

e. One cubito-anal cross-vein in addition to the inner side of the subtriangle: *Leptogomphus*.

ee. Two cubito-anal cross-veins in addition to the inner side of the subtriangle: *Epigomphus*.

dd. Anal area in the hind wings four or more cells wide: *Macroagomphus*.
Only the discovery of more specimens can tell how valuable as a character for erecting a genus, distinct from Cyanogomphus, the front wing anal area of one cell width may prove. In the group of genera to which this proposed new genus belongs venational specialization has not been carried as far as in other genera in the legion Gomphus, a fact which weakens this character for purposes of generic definition.

It may be noticed by comparing the descriptions and figures of the second hamules of the males of *Cyanogomphus waltheri*, *C. conchinus*, and *Ischnogomphus jessi* that in the first two there are apical tufts of hairs which are entirely lacking in the third. But against this, one may set the peculiar first hamule which is very much alike in *C. waltheri* and *I. jessi*. The form of the tibiae of *I. jessi* is a striking character. In dragonflies generally the tibiae are roughly triangular or semi-circular in cross section, but in *I. jessi* they are on all three legs rectangular in cross section, being nearly square, and the four-sides are flat and the angles well defined. The third tibiae of *C. conchinus* show this character less perfectly, but in *I. jessi* it is equally well developed in all the tibiae. The inferior abdominal appendage of the male is very similar in *C. waltheri* and *C. conchinus*, and very different in *I. jessi*. Moreover the apex of segment 10 is much more nearly the usual form in *I. jessi*, while segment 9 has the dorsum strongly produced apically (or the sides apically excavated), in marked contrast to segment 9 in the two species of Cyanogomphus where the segment is of the usual form. When *Cyanogomphus tumens* is better known it may be found to belong to another genus. I believe such will prove to be the case and it is not improbable that it will be found to more resemble Ischnogomphus than the eastern South American Cyanogomphus.
Ischnogomphus jessei, new species

Description: Abdomen, male 32.5 mm.; hind wing, male 24 mm.

Male.—Rear of head and mouth parts pale gray, irregular dark areas and mottlings about the foramen and a small spot against the eye about the lower level of the foramen; face and frons leaden gray; the labrum and frons more bluish with the enclosed parts more greenish, labrum with a black basal triangular spot, the apex of which just fails to meet a broad transverse bar of black across the apex of the labrum, this bar carried narrowly up the sides of the labrum for about half its length; apex of labrum broadly concave; head above, excepting frons, brown with ill defined pale areas in front of the lateral ocelli; keel behind the lateral ocelli two-lobed, concave in the median line; occiput posteriorly straight, without a posterior keel or edge, but rounded off, with short, scarcely discernible hair; rear of head swollen as described for Cyano-gomphus tumens and C. conchicus; antenna with the third joint very small, scarcely half the length of the second.

Prothorax brown, obscure, the middle lobe the palest and the hind lobe the darkest, an obscure median pale spot on the latter; front border very narrowly grayish white.

Dorsum of thorax and, on either side, the mesepimeron dull blue; posterior to the mesepimeron slightly paler and with a greenish cast; a middorsal black stripe; a broad interrupted black stripe parallel to the median stripe and about midway between the latter stripe and the humeral suture; a narrow antehumeral stripe wider above, and a narrow posthumeral stripe wider below; an extensive ill defined dull area at the first lateral suture, and restricted obscure markings on the metepimeron; under parts greenish or bluish white.
Abdomen slender; seen from above, basal half of 1 brown, apical half dull blue, the same color as the dorsum of the thorax; 2 black, with a median dagger-shaped pale dull blue spot, the point of the dagger at the apex of the segment; 3-6 black with a pale dull blue basal transverse narrow ring; 3 with a median longitudinal light brown or yellowish dorsal stripe the entire length of the segment; 4 has this reduced to a line, often interrupted but discernible at the apex as well as the base of the segment; basal half of 7 dull leaden blue; apical half of 7 and 8-10 black. In side view 1 has the lower half, beginning at the level of the lateral apical tubercle, pale greenish blue, the same color as the metepimeron; 2 with the pale area duller and bluer, and reaching dorsad to a slightly higher level than on 1, with some fairly defined black areas near or along the inferior border; 3-6 with extensive pale basal areas joined basally with the basal rings, occupying the basal half of 3, two-fifths of 4, and third of 5 and 6; basal half of 7 pale dull blue, continuous with the dorsal color but apparently of a different shade; 8 and 9 with ill defined restricted pale basal areas at the extreme lower border; 10 entirely black. Appendages dark brown or black basally, shading out to yellowish, the acute apex of the superiors and the apex of the dorsal subapical spine of each branch of the inferior tipped with black.

Stigma black, covering 4, or a little more than 4, cells; brace vein scarcely developed. Wings hyaline, venation black; antenodals of the front wings 12-14, of the hind wings 9-11; postnodals of the front wings 9, of the hind wings 8-9; 5 spines or small plates on the posterior border of the wing basally to the anal angle, the basal one the smallest and placed distal to the basal cross-vein, the apical one on the anal angle; the left hind wing with a cross-vein in the supertriangle; the
distal thickened antenodal the fourth in the right front wing and in the left hind wing; if the antenodals of the first series alone are counted; if the second series are counted the distal thickened antenodal is always the fifth, the basal antenodal of the second series, proximal to the proximal thickened antenodal, not being counted in any case.

Femora dark above, for the full length on the first, for the apical three-fourths or more on the second, and the apical half or less on the third, shading out basally on the second and third; first femora beneath yellowish or greenish, second and third beneath and above basally leaden blue; ventral surface of all femora with similar numerous small black spines, uniformly distributed but not forming transverse or longitudinal lines; all the tibiae sharply four-angled in cross section, the ventral (inner) surface sharply black, the color surrounding the row of relatively long spines along each edge bounding the ventral surface; the other three surfaces of the tibiae pale greenish or yellowish, the angles marked by closely set minute black spines; tarsi black, the second joint of the tarsi of the third legs with the dorsal (outer) surface yellow; claws similar to *Cyanogomphus conchinus*.

First hamule black; second hamule greenish, a constricted black bar across it at about one-third its length; the apical fourth black, darkest at apex, shading out basally; seminal vesicle black. On the second hamule there are short hairs only on the basal half and no hairs or tufts on the bare apical half as contrasted with *Cyanogomphus*. On the posterior and inner surface of the auricle, not visible in a lateral view, are six or seven small black denticles in two rows.

Superior appendages in dorsal view simple, concealing the inferior, similar in outline to the same parts in ventral view.

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Superior appendages and branches of the inferior minutely tuberculate, each tubercle with a moderate bristle, longest on the ventral and posterior parts of the branches of the inferior; ventral branch of the superiors smooth and shining, terminating in a point slightly more obtuse than the apex of the superiors. The two branches reach, but do not overlap, the broad flat plate which makes the basal part of the inferior; at the extreme apex they are slightly divergent and directed about cephalad.

The following general color description was made from the recently killed specimen: eyes above light blue, beneath gray. Thoracic dorsum blue-gray, pale, marked black, the dark stripes, on either side of the median black area, interrupted and brown in color below the interruption; sides about the same color as the pale color of the dorsum, becoming slightly greenish below and behind. Abdomen black, marked with pale blue gray, including the basal half of 7.

*Habitat:* Colombia.

*Type Specimen:* Quebrada La Camelia, near Cristalina, Department Antioquia, February 18, 1917, one male, J. H. and E. B. Williamson, collection of E. B. Williamson. Named for Jesse H. Williamson, whose daily companionship and assistance in Colombia made our trip both pleasant and successful.

*Habits:* The small streams or quebradas where we collected near Cristalina have been referred to before.5 We reached the Quebrada La Camelia, on our visit to it, just where it issued from the forest to flow across a brushy pasture. Two or three hundred yards above this point, when approaching a short pool with a small patch of exposed sand, I saw an ob-

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5 A Collecting Trip to Colombia, South America, Miscellaneous Publications, Museum of Zoology, University of Michigan, No. 3, February, 1918.
securely colored dragonfly fly from the sand or near it to rest on the leaf of a bush growing on the very steep creek bank. In attempting to ascend the bank to come within striking distance, I frightened it, and it flew up through the forest, being lost sight of at once. I continued my way up the quebrada but thoughts of the peculiar and unidentified dragonfly I had seen remained with me. Twenty minutes or half an hour later I retraced my steps. I approached the little sand bar in the pool very slowly and scrutinized it carefully for a resting dragonfly, but detected nothing. At the next step, however, it again raised, as nearly as I could tell, from the sand, and alighted as before, on the horizontal leaf of a bush, fortunately this time at a lower elevation. A moment later it was in my net with a mass of leaves and twigs which I mowed from the bush in my anxiety to make the capture of the dragonfly certain. The next day on the Quebrada Sabaleticus I saw two dragonflies with identical habits, both rising from little sand banks which I had previously inspected and alighting on horizontal leaves of trees or bushes. In one case I had a good view of the insect on the leaf, but both flew before I could get within striking distance. I am fairly certain both were *Ischnogomphus jessei*. No others were seen by us. If its habits, as far as we saw them, are typical, this species must be carefully searched for if the collector is to find it. In the prevalent patchy sunlight on the sand bars they must be very well concealed indeed. One who has collected fairly conspicuous gomphines in a similar habitat knows how well "marked down" an individual must be, if it is to be readily detected. The flight of *Ischnogomphus jessei* moreover is swift and direct, and it alights without any pause or fluttering. Add to this its apparent timidity and the difficulty of its capture is evident.
PLATE I

Figures 1-4. Wing photographs. Fig 1, Ischnogomphus jessci. type male; 2, Cyanogomphus tumens. type female; 3, Erpetogomphus sabaleticus, type male; 4, Erpetogomphus crotalinus, male, Durango. Mexico, Biol. Cent. Am., p. 165. Magnification in fig. 2 greater than in the others, where it is equal.

Notice the slender abdomens of Ischnogomphus jessci and Cyanogomphus tumens as compared with Erpetogomphus sabaleticus. The male of C. tumens is doubtless more slender than the female figured.

Figures 1, 3 and 4, photographs by C. H. Kennedy, Department of Entomology, Cornell University; fig. 2 from Dr. Calvert.
Figures 5. 6. 7 and 8. *Ischnogomphus jessci*, type male; 5. diagram of thoracic color pattern; 6. abdominal segment 2 with its genitalia, in profile; 7. abdominal segments 9 and 10 and the appendages, in profile; 8. postero-ventral view of the abdominal appendages and segment 10.


Figures 6, 7 and 8 slightly greater magnification than 10 and 11; the former figures drawn to about the same magnification as figures 7-10, plate IX, Entomological News, Vol. XXVII, April, 1916; the latter figures to about the same magnification as those in plate XVII, Entomological News, Vol. XXIII, July, 1912.
DIPTERA COLLECTED ON WHITEFISH POINT, CHIPPEWA COUNTY, MICHIGAN

By A. W. Andrews

While engaged in detailed coleopterological studies as a member of the Shiras Expeditions sent out from the Museum of Zoology, University of Michigan, to the Whitefish Point region in the Northern Peninsula of Michigan in 1913 and 1914, the writer became interested in the complex dipteran fauna there. As extensive collections were made in that order as his special work permitted. These collections were begun in 1913 in the month of July, and they were continued during a part of the same month and the first few days of August of the following year. No attempts were made to collect Tipulidae, Culicidae or the great number of the smaller species which can be secured by beating, sweeping and detailed search in the proper habitats.

The Whitefish Point region may be called a fly country preeminent. The Diptera seem to preponderate in sheer numbers over all other insects, and in all too many cases are
omnipresent. So obnoxious and persistent are some of the pests that the cattle are forced to feed largely at night, and are kept shut up in dark sheds during the day when the flies are active. On account of a general lack of flowers and flowering shrubs from July 2 to 15, 1913, the Syrphidae were not present in much variety of species. A small patch of raspberry bushes in flower made a center of attraction for many Diptera, and a number of species were collected about these bushes that would otherwise have been overlooked. From July 18 to August 2, 1914, conditions were rather better as regards flowering vegetation, and many species of flies were taken on the blossoms of spiraea, tansy, dewberry, etc.

The conditions observed lead to the conclusion that the optimum of the collecting season for Diptera in the region is from August 1 to 15, although of course some species have disappeared by that time and others probably have not appeared. Without doubt a professional dipterist would find Whitefish Point an excellent region in which to collect, and on account of the variety of conditions, with the diverse flora and the relatively short and rapidly succeeding seasons, several summers' work would undoubtedly be well repaid.

The following list does not pretend to be complete in any sense, but the paucity of investigations that have been made in the region seem to afford a reason for its publication. All specimens represent time taken from the writer's coleoptera studies with the hope of stimulating further research in the region.

The writer wishes to express his indebtedness to Mr. H. S. Harbeck of Philadelphia for the determination of the majority of the forms. The list is arranged according to Prof. J. M. Aldrich's "Catalogue of North American Diptera" (Miscel. Pub., Smith Inst., vol. 46).
List of Species

Stratiomyidae

Stratiomyia badia Walker.—On spiraea blossoms, July 22, 1914.
Stratiomyia apicuLa Loew.—On raspberry blossoms, July 4, 1913.
Stratiomyia discalis Loew.—On raspberry blossoms, July 4, 1913.
Stratiomyia lativentris Loew.—On milifolium and raspberry flowers, July 4, 1913.
Stratiomyia piscipes Loew.—On dewberry blossoms, July 4, 1913.
Stratiomyia sp.?—On viburnum blossoms, July 4, 1913.

Tabanidae

Pangonia tranquilla Osten Sacken.—Along northwest shore road, July 24, 1914; also found in washup on beach at various dates.
Chrysops exicitans Walker.—Common along roads and in the woods.
Chrysops niger Macquart.—Rather common on trail to bay, July 4-10, 1913.
Chrysops lupus Harbeck (?)—Along trail, July 4, 1913.
Chrysops indus Osten Sacken.—In woods near Post Office, July 4, 1913.
Tabanus atratus Fabricius.—A single specimen collected about a horse near the Post Office, July 19, 1914.
Tabanus rhombicus Osten Sacken.—A single specimen near west shore, July 21, 1914.
Tabanus trispilus Wiedemann.—Near barn, July 10, 1913.
Tabanus zonalis Kirby.—Along roads and in washup on the beach.
Tabanus epistates Osten Sacken.—About horses, July 19, 1914.
LEPIDÆ

Chrysopila ornata Say.—On low shrubs, July 4, 1913.
Chrysopila quadrata Say.—Resting on foliage near shore, July 23, 1914.

BOMBYLIDÆ

Anthrax alternata Say.—Along sandy road, July 24, 1914.
Anthrax fulviana Say.—Along sandy road, July 6, 1913.
Anthrax lateralis Say.—On spiraea blossoms near Post Office, July 24, 1914.
Anthrax sinuosa Wiedemann.—Along road on shore, July 24, 1914.
Anthrax sp?—On sandy road, July 4, 1913.
Anthrax sp?—Near shore, July 4, 1913.
Anthrax sp?—Data as last.
Spogostylum anale Say.—Sandy road near shore, July 22, 1914.
Spogostylum adipus Fabricius.—July, 1914.
Exoprosopa dorcadion Osten Sacken.—On shore of Lake Superior, July 21, 1914.
Systachus sp?—July 21, 1914.
Sparnopolius fulvus Wiedemann.—On spiraea blossoms, July 26, 1914.

THEREVIDÆ

Thereva senex Walker.—Near shore of Lake Superior, July 26, 1914.
Thereva vialis Osten Sacken.—On herbage along shore road, July 22, 1914.
Thereva sp?—On balsam in woods near shore, July 22, 1914.
Thereva sp?—Data as last.
Thereva sp?—On sweet gail on sand dunes, July 19, 1914.
Thereva sp?—Data as last.
ASILIDÆ

Cyrtopogon sp?—
Stichopogon trifasciatus Say.—Along trail, July 23, 1914.
Pogonosoma dorsatum Say.—Near shore of bay, July 4, 1913.
Dasyllis posticata Say.—Resting on maple foliage near shore.
July 3, 1913.
Laphria gilva Linné.—Data as last.
Promachus bastardii Macquart.—Common along sandy roads
and in the shore washup.
Asilus notatus.—Along sandy road near shore, July 20, 1914.
Asilus sp?—Data as last.

SYRPHIDÆ

Chrysotoxum pubescens Loew.—On raspberry flowers, July
20, 1913.
Chrysotoxum sp?—On shore of Whitefish Bay, July 2, 1913.
Platychirus peltatus Meigen.—On milifolium flowers near
shore, July 4, 1913.
Leucozona lucorum Linné.—Along trail to bay, July 6, 1913.
Didea laxa Osten Sacken.—On dewberry blossoms, July 27,
1914.
Conidica lata Coquillet.—On raspberry flowers, July 4, 1913;
on spiraea flowers, July 24, 1914.
Syrphus arcuatus Fallen.—On flowers of mountain ash near
shore of Lake Superior, July 5, 1913; on dewberry flowers
near bay, July 23, 1914.
Syrphus ribesii Linné.—On milifolium flowers near Post
Office, July 23, 1914. Two specimens of a form close to
this species were taken on spiraea blossoms near the Post
Office, four other specimens were taken by Mr. McAlpine
at the same time in the locality.
Syrphus sp.?—Two specimens on spiraea blossoms, July 26, 1914.

Allograpta obliqua Say.—On yellow tansy flowers on dune near shore of Lake Superior, July 14, 1914.

Mesogramma marginata Say.—July, 1914, by Mr. McAlpine.

Mesogramma polita Say.—On tansy flower on sand dune, July 26, 1914.

Spharophoria cylindrica Say.—Several specimens taken by Mr. McAlpine in July, 1914.

Spharophoria scripta Linné.—On tansy flowers near shore of Lake Superior, July 24, 1914.

Spharophoria sp.?—Taken by Mr. McAlpine, July, 1914.

Volucella evecta Walker.—On foliage along trail to bay, July 4, 1914.

Sericomyia militaris Walker.—On raspberry flowers, July 4, 1913.

Eristalis arbustorum Harbeck.—On flowers of dewberry, July 20, 1914.

Eristalis dimidiatius Wiedemann.—On raspberry flowers, July 6, 1913; common on spiraea during, July, 1914.

Eristalis flavipes Walker.—On flowers of shrubs near Post Office, July, 1913 and 1914.

Eristalis flavipes Walker var. melanostomus Loew.—On spiraea flowers, July 28, 1914.

Eristalis tenax Linné.—On log near bay, July 4, 1913; on dewberry flowers, July 20, 1914.

Eristalis transversus Wiedemann.—On spiraea flowers, July 22, 1914.

Tropidia quadrata Say.—On tansy flowers, July 22, 1914.

Helophilus latifrons Loew.—On spiraea flowers, near Post Office, July 24, 1914.
Helophilus similis Macquart.—On spiraea flowers near Post Office, July 24, 1914.

Helophilus sp.?—Taken by Mr. McAlpine, July, 1914.

Helophilus sp.?—On tansy flowers near Lake Superior, July 24, 1914.

Syritta pipiens Linnc.—Taken by Mr. McAlpine in 1914.

Criorhina decora Macquart.—On flowers of milifolium near lake shore, July 3, 1913.


Temnostoma equalis Loew.—Data as last.

Temnostoma alternans Loew.—On milifolium flowers in field near Post Office, July 26, 1914; on spiraea flowers near Lake Superior, July 27, 1914.

**CONOPIDÆ**


**TACHINIDÆ**

Metopia leucocephala Rossi.—On dewberry flowers near Lake Superior, July 24, 1914.

Microphthalma disjuncta Wiedemann.—In long grass on dunes on shore of Lake Superior, July 20, 1914.

Peleteria tessellata Fabricius.—On milifolium and spiraea flowers, July 28, 1914.

Peleteria robusta Wiedemann.—On sand flats, July 24, 1914.

Archytas analis Fabricius.—On raspberry flowers, July 4, 1913; on spiraea, July 24, 1914.

Bombyliomyia abrupta Wiedemann.—On raspberry flowers, July 4, 1913.
Philodexia tibialis Desvoidy.—On spiraea flowers, July 18, 1914.

Sarcophagine

Sarcophaga sp.?—On spiraea flowers and on sandy plain, July 23, 1914.

Muscide

Cynomyia cadaverina Desvoidy.—On spiraea flowers, July 26, 1914.

Phormia regina Meigen.—On carrion, July 20, 1914.

Musca domestica Linne.—In Post Office, July 22, 1914.

Stomoxys calcitrans Linne.—On yellow tansy flowers, July 24, 1914.

Scatophagide

Scatophaga stercoraria Linne.—On lake shore, July 20, 1914.

Oscinide

Pegomyia sp.?—Taken by sweeping grass along roadside, July 3, 1913.
A COLLECTION OF LEPIDOPTERA FROM WHITEFISH POINT, MICHIGAN

BY W. S. McALPINE

INTRODUCTION

Hardly a more interesting part of the state could have been selected for investigation than the Whitefish Point region; its northern location together with its sand dune topography and the isolation of the area to a certain degree are factors which naturally arouse curiosity as to the probable plant and animal associations.

As a member of the Shiras Expedition to Whitefish Point, from July 21 to August 1, 1914, the writer's time was devoted principally to the study and collection of the Lepidoptera. The expedition was sent out by the Museum of Zoology of the University of Michigan in a further continuation of the biological survey begun in 1912, and was supported by Hon. George Shiras 3rd. The work was done under the general direction of Dr. A. G. Ruthven, director of the Museum.

A small collection of Lepidoptera and notes on the group were made during the early part of July, 1913, by Mr. A. W.
Andrews, coleopterist of the expedition. This material together with the results of the writer's work in the following season form the basis of this report.

**Location and General Features of the Region**

Whitefish Point extends into the southern end of Lake Superior, its tip lying some thirty-four miles northeast of Sault Sainte Marie. Its base is rather indefinite but for purposes of this work may be arbitrarily fixed as extending from Vermillion on the north beach to the Shelldrake River and down this river to the village of Shelldrake.

All of the Whitefish Point country is low, and of comparatively recent development through combined wave, current and wind action; it is made up entirely of sandy ridges or old dunes and extensive swamp areas. It is only in the swamps or just bordering them that humus of any depth has accumulated. Reference to the accompanying sketch map will best explain general features of the more recently developed portions where practically all of the collections were made.

The low sand and sand-gravel ridges are more prominent and higher near the base of the Point than elsewhere and usually parallel the beach. They have elevations of from ten to thirty feet, while the extensive swampy and marshy tracts are but little above lake level. According to Leverett (Surface Geology of the Northern Peninsula, Geological Survey of Michigan, Pub. 7, 1911), many of these low sandy ridges were developed at the time of the Nipissing Great Lakes, the last of the old glacial lakes.

Since the last change in lake level considerable altering of shore line has occurred. This is evident on the north shore where rather high sand banks have been cut into in places, and that it is even progressing rapidly at the present time is
shown by the filling in and building up of wide beaches in places along the east and north shores and in the formation of sand bars near the end of the Point.

This country is fairly well timbered except for the open marshy tract although the timber, of which the jack pine predominates, is small and becomes more scattered and scrubby near the end of the Point.

Rather extensive areas were burned over several years ago, particularly along the east beach, and these support young scattered trees, mostly aspen, birch and jack pine. Other areas have been burned over recently, the one shaded on the map was burned at the time we were in the field. Near the base of the Point, near the Shelldrake River, the timber is better with white and Norway pine on the ridges although much of this forest has been lumbered.

Proceeding south and west from the base of the Point there is a gradual rise to sandy till moraines which run approximately north and south and which join the large moraine belt extending from about Point Iroquois in a northwesterly direction to Grand Marais. These morainal belts, which support dense hardwood forests, thus isolate in a partial degree the Whitefish Point country with its sand dunes and its predominating conifer forest from the country to the south.

Our field headquarters were located at the Whitefish Point Post Office, about three miles from the end of the Point and near the north beach. In going there we went first to Sault Sainte Marie, took the Shelldrake Lumber Company's tug to Shelldrake, and from there drove about seven miles by mail stage to the Post Office. This is the most comfortable way to go, although one may save a little time by taking the mail stage from Eckerman on the Sault Sainte Marie R. R. through Emerson and Shelldrake—about a thirty-five mile drive over
rather rough corduroy and sand roads. The party came back by the latter route.

As would be expected there are but few settlers at the Point and these depend mainly upon other resources than agriculture for a living. Fishing, lumbering, blueberry picking and hunting are the chief pursuits, although some cultivation of small patches of ground enriched by mixing the sand with muck from the low areas is accomplished. Wild hay for cattle and horses is to be obtained in the open marshes. A few settlers make quite an income from the cranberry marshes.

Near the end of the Point and near the east beach is a fishing station belonging to the Booth Fishing Company, and at the Point is the government light house. At Vermillion near the base of the Point on the north beach is a life saving station and mail is delivered daily between Vermillion, Whitefish Point Post Office, Shelldrake and Eckerman.

Shelldrake is a typical small lumbering town, owned principally by the Shelldrake Lumber Company. A narrow gauge lumber railroad runs westerly from town for several miles.

Habitats

As the time was limited to about ten days in the field extensive investigations as to the habitats or life histories of the insects taken could not be expected, although every effort was made to obtain and record as much data as possible regarding each specimen collected. Lures and traps were necessarily resorted to thus enabling one to make a fairly representative collection from the Point.

Wash up on Beach: A number of specimens were found in the wash up, and a few species were not taken elsewhere. Practically all were found on the north beach within two or three miles of the Post Office. The prevailing winds at the
Point are from the northwest, usually rather cool breezes. Preceding a storm by a day or so the wind would shift to the south with a rise in temperature; it would then suddenly shift back again to the northwest with the accompanying storm. It was just after such storms that insects of all sorts were found on the beach, and as they were usually alive though badly battered when just washed up it would seem that all came from the Point or the near vicinity. Many insects would fly out or would be blown out over the water with the warm south wind and would naturally be beaten down with the north wind and the storm. They were then washed on shore, probably with the aid of currents. The shore birds had a great feast at this time, and the collector had to act quickly if he would get ahead of them.

Two live specimens of *Thecla edwardsii* and the upper wings and head of *Catopsilia cubule* were found in the wash up. Neither were taken elsewhere, and this is apparently the only record for *Catopsilia cubule* for Michigan.

*Lower Beach:* A few butterflies were attracted to the damp sand or by decayed fish, insects, etc. *Grapta j-album* and *Limenitis arthemis* were noticed in particular.

*Wide Upper Beach:* This part of the beach is dry throughout the summer and is only touched by the lake during some of the severe fall storms. The vegetation consists of coarse dune grass, beach pea and occasional clumps of scrubby willow. This seems to be the habitat for a few grass moths and occasionally a butterfly was seen. The upper limits of the upper beach are rather indefinite but would include such sand dunes as have similar vegetation. Near the mouth of the outlet to Cranberry Lake close to the Post Office is such a low sand dune area, and, in addition to beach grass, etc., a kind of spiraea grows in clumps and attracts numbers of butterflies.
It was, as a rule, rather breezy in this habitat, and the butterflies were attracted to the spiraea that was somewhat protected from the wind usually by a small dune or hillock. Such butterflies as *Argynnis atlantis*, *Colias interior*, *Limenitis arthemis* and *Grapta j-album* were particularly abundant and *Pieris napi*, *Terias lisa* and others were occasionally seen. Mr. Andrews found *Junonia cania* and *Colias philodice* quite frequently at the spiraea blossoms during the early part of July, 1913, although they were not noticed the following year.

Swamp Areas, (a) Open Grassy Meadows: These meadows occur east of Cranberry Lake and eastwardly from Long Marsh Lake. The vegetation besides marsh grass consists of occasional clumps of flowering plants and shrubs such as spiraea, ninebark and willow. A few moths and butterflies frequent this habitat. The writer noticed among the latter *Breithis myrina*, *Breithis bellona*, *Phycoides tharos*, *Argynnis atlantis* and *Colias interior*. But few butterflies were seen in the grassy marshes near Long Marsh Lake probably because the situation was a little too windswept. The low sparsely timbered sand ridges between the marshes and north beach did not afford sufficient protection from the prevailing westerly winds. The writer expected to find some species of Hesperidæ in this habitat but was disappointed.

(b) Cranberry Marshes: Along the northwestern end of Cranberry Lake is a cultivated cranberry marsh owned by Mr. House. There is also a small marsh just east of Clarke Pond and adjoining it is a grassy marsh. Also small wild cranberry marshes occur along the southwestern edge of Cranberry Lake and along the western end of Doe Lake, in connection with typical spruce, tamarack, and sphagnum bogs.

In the marsh near Clarke Pond a few specimens of *Chrysophanus epixanthus* as well as several other species of butterflies
were found. *Colias interior* and *Argynnis atlantis* were attracted by a small orchid and other flowers. Among the butterflies *Colias interior*, *Chrysophanus epixanthe* and such moths as *Diastictis brunneata* and *D. sulphurea* were frequently found in the wild cranberry marshes and sphagnum bogs along Cranberry and Doe Lakes.

(c) *Tamarack Swamps*: Extensive tamarack swamps occur as shown on the accompanying map. A variety of small shrubs and plants which sometimes form dense thickets occur in this habitat. Little collecting was done here.

*Sandy Ridges or Old Sand Dunes, (a) Open Mixed Woodland*: In this habitat the jack pine predominates with scattering mixed stands of hard maple, white pine, aspen, birch and a little black oak, while spruce and tamarack sometimes occur on the lower portions adjacent to swamp areas. A varied ground cover of blueberry, many allied plants and brake fern usually occur, although in some places reindeer moss and xerophytic grasses form the ground cover. Many sandy ridges at the Point would fall under this habitat, especially those along the mail road from Whitefish Point Post Office to the schoolhouse and from the Post Office towards Vermillion for about two or three miles.

Such butterflies as *Limenitis arthemis* and *Grapta j-album* were quite common along the roadside, while *Colias interior* and *Argynnis atlantis* were frequently seen. Such Geometridæ as *Deilinia variolaria*, *Metrocampa perlata*, *Sciagraphia granitata*, *Xanthotype crotaria* and others were frequently flushed up from the underbrush. Among the microlepidoptera many species of the Tortricidae were beaten from shrubs along the roadside. A number of species of Geometridæ were found on the trunks of trees where they had taken refuge for the day.
One specimen of *Grapta gracilis* was found along the roadside to Vermillion about two miles from the Post Office. This seems to be the first record for the species for Michigan.

Dewberry bushes and spiraea which grew along the road to Vermillion about a mile from the Post Office also attracted insects.

(b) *Jack Pine Ridges*: Where the jack pines grow close together there is practically no ground cover but pine needles. A few jack pine ridges occur easterly from the Post Office, and but few insects are found in this habitat.

(c) *Old Burned-over Areas*: These areas are sometimes almost bare and but sparsely covered with xerophytic grasses, though usually a wild profusion of brake ferns, blueberries and allied plants grow with an occasional jack pine, aspen or birch. Such areas occur along the mail road from a little north of Shelldrake approximately to the schoolhouse east of the Post Office. Dewberry and spiraea grow in some places and attract butterflies and moths.

The butterflies common to the open mixed woodland were also frequently seen here, but moths were scarce.

One fresh specimen of *Euptoieta claudia* was found on a small sand ridge which was covered with short xerophytic grasses, etc., just across a narrow marsh strip southwest of Clarke’s. It was very warm on these dry sandy ridges where they were protected from the winds.

(d) *Cultivated Gardens and Meadows*: As before noted the few settlers usually have small garden patches and meadows on the lower ground adjacent to swamp areas. Such a garden patch and meadow lay just southwest from the Post Office and near Cranberry Lake. Mr. Clarke and Mr. Yeoman also had gardens near their homes and these were visited. Such flowers as milfoil, white clover, wild parsnip with
various grasses, timothy, etc., grew in the meadows and some spiraea and dewberry occurred along the ditches, while in the gardens were numerous cultivated plants.

Such butterflies as *Pamphila peckius* and *P. cernes* were frequently found in the meadows on white clover and numbers of others were attracted to the spiraea and dewberry. Many Microlepidoptera, especially *Pyralidae*, were flushed up from the grasses, *Nomophila noctula* was common as usual. In the garden at Yeoman’s several specimens of *Pieris napi* and *P. rapae* were found.

*Sugar Lures*: Sugar lures were put out every evening in the mixed woodland near the Post Office. Among the Geometridae, *Alcis sulphuraria*, *Eunatrona cunigerata*, and *Diastictis inceptaria*, and among the Noctuidae, *Epizeuxis americalis*, *Catacola unijuga* and *C. briescis*, *Mamestra imbrifera*, *M. purpurissata*, and *M. lorea*, *Peridroma occulta*, *Hadena arctica*, *H. devastatrix*, *H. verbascoides*, *Diphthera fallax*, *Scoliopteryx libatrix*, *Trigonophora periculosa* and *Noctua haruspica* and also *Pseudothyatira cymatophorides* were frequently seen. Most of the species captured were probably residents of the open mixed woodland habitat.

During the daytime the sugar on the trees attracted a few Grapta butterflies.

*Light Lure*: At night a lantern was set up in an opening near the Post Office. A few moths were attracted but the results were rather disappointing. Several moths were attracted to the lights in the windows of the Post Office. Among these the Arctiidae, *Eubaphe aurantiaca* and *Apantesis william-sii* were common.
It is always interesting in looking over a list of insects from such a locality to make a comparative study with other lists from different sections of the country and especially from the state in which the locality is situated. Few such local lists have been published in Michigan and the adjoining territory, although considerable collecting has been done. The following Michigan lists are known to the writer.


Since the collections were made at the Point in 1914 the writer has had an opportunity to collect Lepidoptera in the Upper Peninsula (near Manistique in 1915, and near Mar-
Occasional Papers of the Museum of Zoology

quette in 1916) and in the Lower Peninsula (near Benton Harbor in 1917, in connection with the biological survey of the state) reports of which will be published at a later date, and has also seen collections made by Dr. W. W. Newcomb at Eckerman, Chippewa County, in 1915 and in Dickinson County in 1909.

In looking over the list of Whitefish Point butterflies the most striking features seem to be the presence of several rather southern species which one would hardly expect to find so far north, the small numbers of true boreal species, the dominance as regards species of the usual forms found in the northeastern temperate region of the United States, that is the New England states, New York, Ohio and Lower Peninsula of Michigan, and the presence of a few western forms.

The occurrence of such butterflies as Junonia caniia, Euptoieta claudia, Terias lisa and Catopsilia cubule and the hawk moth Aellopos tantalus, although the latter is not common, certainly makes one believe that the Whitefish Point country is at least somewhat attractive to those southern butterflies which have any inclination at all to migrate, and it is very possible that some of the species listed bred at the Point. On the dry sandy ridges it is very warm as a rule, and undoubtedly the vegetation in some places corresponds well to certain sand dune regions along the Lake Michigan shore. At Whitefish Point and along the coast, killing frosts do not occur as a rule until October, while back from the coast a short distance and in the interior such frosts occur a month or two earlier.

From the collections and lists it appears that the most probable route of migration for these southern forms is along the lake shores, that is along both east and west shores of Lake
Michigan to the vicinity of the Straits of Mackinac and from there along the St. Mary's River to Lake Superior and thence to Whitefish Point. A few local lists along the Michigan shores would assist in testing this hypothesis. It is a well known fact that these southern species are found at least along southern parts of both the east and west shores of Lake Michigan.

Such butterflies as *Colias interior*, *Argynnis atlantis* and *Grapta gracilis* are of distinct northern range and are found also in the White Mountains of New Hampshire, while *Chrysophanus epivante*, *Limenitis arthemis* and *Grapta j-album* are also rather northern in their affinities. These species, with the exception of *Grapta gracilis*, were the only common butterflies at the Point during the period of investigation. This would seem to indicate that conditions at the Point, though attractive to temperate and even more southern species, are in reality most favorable to the boreal species of the fauna, probably because of the severe winters.

A western element in the butterfly fauna is represented by *Chrysophanus helloides* and perhaps *Colias eurytheme*. Regarding the moths of the Point the opinion of specialists in various families is very interesting.

Mr. F. H. Wolley Dod writes that the Noctuidae indicate the fauna of Ontario and Quebec generally. Among the rarer species listed are *Diphthera fallax*, *Mamestra rubefacta* and *M. nevadæ*, *Hadena indocilis* and *H. verbascoides* and *Hormisira bifittata*.

Mr. Louis W. Swett says of the Geometridae that outside of a few species it is a typically New England lot, neither southern nor northern. *Petrophora abrasaria* and *P. convallaria* and *Diastictis bicolorata* are strictly northern species while *Diastictis wanaria* is rather northern, and all are rare. The
western fauna is indicated in *Petrophora convallaria*, *Eois persimilis* and *Alcis sulphuraria* which are also as a rule rare species; the last two named being found very rarely in the east. Among the other more interesting forms are *Caripeta criminosa* and *C. augustiorata*. Another interesting species is *Diastictis inceptaria*. There seems to be some confusion regarding this species and possibly some of the specimens are *Diastictis evagaria*.

Miss Annette F. Brown says of the Microlepidoptera that a number of the species are western and northern.

Another factor which may influence the Whitefish Point fauna to a certain degree is the hardwood belt extending approximately from Point Iroquois to Grand Marais. This belt serves somewhat as a barrier to migration, for certain species at least, as it cuts off direct communication between the central sandy plains region and the Whitefish Point dune areas. Several species of butterflies were seen and captured along the Eckerman-Whitefish Point road between Eckerman and the hardwood belt which were not taken at the Point and which one would naturally expect to find there. To the casual observer the Whitefish Point area seems to support much of the vegetation of the central sandy plains region, which takes in the Manistique River basin and extends towards Eckerman to the hardwood belt, and in addition has the sand dune vegetation. This would lead one to expect to find most of the species common to the central sandy plains region and in addition the southern forms. But from such collections as have been made it is evident that a number of species common on the sandy plains region are not found at Whitefish Point.

Mention may be made here of three butterflies taken on the trip which are new records for Michigan, namely, *Grapta*
gracilis, Pamphila comma (taken at Eckerman), and Catopsilia cubule. Dr. W. W. Newcomb in his check-list of Michigan butterflies records 101 species. Catopsilia cubule is included in his list as reported but not taken.

Acknowledgments

The value of any local list of Lepidoptera depends much upon accuracy in identification. For this reason determinations involving the slightest doubt have been indicated. The writer wishes to express indebtedness to several specialists and general lepidopterists for their kind assistance as follows: to Dr. W. W. Newcomb, of Detroit, for aid in identification of many specimens and for the use of his private collection and library; to Mr. L. W. Swett of West Somerville, Massachusetts, for identification of the difficult Geometridæ; to Mr. F. H. Wolley Dod, of Mednapore, Alberta, for identification of the difficult Noctuidæ; to Miss Annette F. Brown, of Cincinnati, for identification of a number of Microlepidoptera; and to Mr. Alexander Kwiat, of Chicago, for identification of several specimens. Acknowledgments are also due to Mr. A. W. Andrews who made collections in 1913 as previously stated, and to both Mr. and Mrs. Andrews, Mr. Fenton Combs, and Mr. House and family, who kindly assisted in the field and collected many specimens that would not have been obtained otherwise.

List of Species

The following annotated list includes all the Lepidoptera collected on Whitefish Point save the Microlepidoptera. Of the latter, only the more readily determined species are listed, so that much unidentified material remains in the collection awaiting further work.
SKETCH MAP OF WHITEFISH POINT, MICH.

W. S. H. A.

1814
The arabic numerals under each species refer to the date in July, 1914, but when followed by 1913 indicate the day of the same month of the preceding year. The species are numbered separately under the Rhopalocera and Heterocera for ease of reference. The nomenclature of the Heterocera follows Dyar's check-list.

**Rhopalocera**

**Nymphalidae**

1. *Euptychieta claudia* (Cram.)—Old burned area on low sandy ridge extending into a grassy marsh southeast from Clarke's. The single specimen was perfect. The species probably breeds at the Point.


3. *Argynnis atlantis* (Edw.)—A common butterfly on the Point, along paths in open mixed woodland attracted to flowers of spiraea in cultivated areas and near the Post Office. Also found in open grassy meadows and in cranberry marshes, 21-29.

4. *Argynnis myrina* (Cram.)—Open grassy meadows near Long Marsh Lake, 28; cranberry marshes, 6; on clover in cultivated lands, 1913.

5. *Argynnis bellona* (Fabr.)—Open grassy meadows, near Long Marsh Lake, 28.

6. *Phyciodes tharos* (Dru.)—Open grassy meadows near Cranberry Lake and Long Marsh Lake; cranberry marshes near former; along road through open mixed woodland, 24-26.

7. *Grapta comma* var. *dryas* Edw.—Taken by Mr. Andrews in July, 1913.

8. *Grapta fainnus* (Edw.)—Washed up on beach, 23. A single specimen from Emerson.
9. *Grapta gracilis* (Gr. & Rob.).—Open mixed woodland along road to Vermillion about two miles from Post Office, 23.

10. *Grapta j-album* (Bd. & Lec.).—Open mixed woodland along road near Post Office, 21-31; rarely on lower beach.

11. *Vanessa antiopa* (Linn.).—Along road near Post Office in open mixed woodland, 21, 29.

12. *Vanessa milberti* (Godt.).—Taken by Mr. Andrews in 1913.

13. *Pyrameis atalanta* (Linn.).—Cranberry marshes; attracted to flowers of spiraea in open grassy meadows, 26.


15. *Pyrameis cardui* (Linn.).—Attracted to flowers of spiraea in open grassy meadows, 26.

16. *Junonia cania* (Hüb.).—Taken by Mr. Andrews, July 4, 1913, on spiraea flowers on wide upper beach near Post Office.

17. *Limenitis arthemis* (Dru.).—Open mixed woodland near Post Office, 24-27. A number of specimens were seen, most of which were in poor condition.

18. *Limenitis archippus* (Cram.).—Reported by Mr. Andrews.


20. *Satyrus alope* (Fabr.).—Several specimens seen about a mile south of Shelldrake along roadside, August 1, 1914. None were collected.

LYCÆNIDÆ

21. *Thecla edwardsii* (Saund.).—Washed up on beach, 23.

23. *Chrysophanus epirante* (Bd. & Lec.).—Cranberry marsh west of Cranberry Lake, at Doe Lake and near Clarke's, 24-30.

24. *Chrysophanus hypophleas* (Bdv.).—Open mixed woodland on raspberries, 4, 1913; one specimen taken at Emerson, August 1, 1914.

PAPILIONIDAE

25. *Picris protodice* (Bd. & Lec.).—Washed up on beach, 24.


27. *Pieris rapae* (Linn.).—Open mixed woodland on dewberry flowers, 21, 24; in Yeoman's garden, 26.

28. *Catopsilia cubule* (Linn.).—The upper wings and head of a specimen were washed up on the beach July 24.

29. *Colias curytheme* (Bdv.).—On clover in cultivated land, 4, 1913; no specimens seen in 1914.

30. *Colias philodice* (Godt.).—Taken by Mr. Andrews early in July, 1913.

31. *Colias philodice* var. *luteoirtica* (Wolcott).—Data as last.

32. *Colias interior* (Scudd.).—A common species in nearly all habitats during the season.

33. *Terias lisa* (Bdv.).—On flowers of spiraea on wide upper beach near outlet of Cranberry Lake, 26; in same locality, 8, 1913; on clover in cultivated fields, 4, 1913.

34. *Papilio glaucus* (Linn.).—A specimen was seen by Mr. Andrews in a small collection made at Vermillion.
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HESPERID.E

35. *Pamphila hobomok* (Harr.).—On clover in cultivated land, 6, 1913.


37. *Pamphila cernes* (Bd. & Lec.).—On clover and dewberry flowers in meadow west of Post Office, 21, 23; at same place, 6, 1913.

38. *Nisoniades persius* (Scudd.).—Open mixed woodland along road to Vermillion, 12, 1913.

The following species were found along the road between Emerson and Eckerman. It would seem as if some of the species must occur on the Point.

*Danais plexippus* (Linn.).—A single specimen was taken on flowers of iron weed three miles north of Eckerman, August 1, 1914.

*Argynnis cybele* (Fabr.).—Two specimens seen three miles north of Eckerman along the road, August 1, 1914.

*Fenisca tarquinius* (Fabr.).—Along road in hardwood forest four miles north of Eckerman, August 1, 1914.

*Pamphila comma* (Linn.).—A pair in copulo were taken just out of Eckerman, August 1, 1914.

*Pamphila metacomet* (Harr.).—Several specimens seen along road three miles south of Eckerman, August 1, 1914.

HETEROCERA

SPHINGID.E

1. *Hemaris diffinis* (Boisd.).—Open mixed woodland on raspberry flowers, 6, 1913.

2. *Hemaris thysbe* (Fabr.).—Open grassy meadows on flowers of spiraea at Long Marsh Lake, 28; open mixed woodland on flowering shrub, 6, 1913.
Acllopos tantalus (Linn.).—Wash up on beach, picked up alive, 10.

Celerio intermedia (Kir.).—Wide upper beach on log, 10, 1913.

Ceratomia undulosa (Wlk.).—Lower beach on log, 10, 1913.

SATURNIIDÆ

Telca polyphemus (Cr.).—No specimens were taken, but Mr. Andrews saw one in a small collection at Vermillion.

ARCTIIDÆ

Eubapha aurantiaca (var. ferruginosa and var. brevicornis).—Light lures, 21-22; open grassy meadow near Clarke’s, 29; open mixed woodland east of Post Office, 27.

Hyphoraia parthenos (Harris).—Open grassy meadow along Shelldrake River about three miles from Shelldrake, 26; wash up on beach, 10, 1913.

Apantesis virguncula (Kir.).—Wash up on beach, 12, 1913.

Apantesis williamsii (var. determinata) (Neu.).—Light lures, 21-27.

NOCTUIDÆ

Acronycta innotata (Guen.).—Sugar lures, 8, 1913; 30; open mixed woodland, 31.

Acronycta radcliffei (Harv.).—Open mixed woodland, 23.

Acronycta superans (Guen.).—Sugar lures, 24.

Acronycta fragilis (Guen.).—Open mixed woodland on trunk of jack pine, 6-7, 1913.

Diphthera fallax (Herr. & Sch.).—Sugar lures, 21-26, open mixed woodland, 26.
16. Caradrina miranda (Gr.).—Light lures, 21.
17. Hadena indocilis (Wlk.).—Sugar lures, 28.
18. Hadena lateritia (Hüb.).—Sugar lures, 26; 8, 1913.
20. Hadena impulsa (Guen.).—Sugar lures, 22.
21. Hadena devastatrix (Brace.).—Sugar lures, 23-30; 6, 1913.
22. Hadena arctica (Bsvl.).—Sugar lures, 27.
23. Hadena verbascoides (Guen.).—Sugar lures, 23-29.
24. Hyppa xylinoides (Guen.).—Sugar lures, 27; 12, 1913; wash up on beach, 23.
25. Helotropha reniformis (Gr.).—Sugar lures, 23-27.
26. Adelphagrotis prasina (Fabr.).—Log on upper beach, 8, 1913.
27. Platagrotis pressa (Gr.).—Sugar lures, 27.
29. Peridroma occulta (Linn.).—Sugar lures, 30; stone on upper beach, 8, 1913.
31. Noctua smithii (Snell.).—Sugar lures, 27.
32. Noctua normaniana (Gr.).—Sugar lure, 30.
33. Noctua fennica (Faus.).—Stone on upper beach, 8-12, 1913; sugar lure, 12, 1913.
34. Noctua haruspica (Gr.).—Sugar lures, 22-30; stone on lower beach, 8, 1913.
35. Euxoa scandans (Riley).—Sugar lures, 22-30; 7, 1913.
36. Euxoa divergens (Wlk.).—Light lures, 31; lower beach, under board, 12, 1913.
37. Mamestra imbrifera (Guen.).—Sugar lures, 25-30.
38. Mamestra purpurissata (Gr.).—Sugar lures, 22-30.
39. Mamestra detracta (Wlk.).—Sugar lures, 22; 8, 1913.
40. *Mamestra nevadæ* (Gr.).—Wide upper beach, on log, 8, 1913.

41. *Mamestra rubefacta* (Morr.).—Sugar lures, 6, 1913.

42. *Mamestra lorea* (Guen.).—Sugar lures, 22, 30; 8, 1913; light lures, 21, 22; beaten from bushes in open mixed woodland.

43. *Barathra curialis* (Sm.).—1913.

44. *Orthodes cynica* (Guen.).—Cranberry marshes, 26.

45. *Cucullia asteroides* (Guen.).—Sugar lures, 21.

46. *Pyrrhia umbra* (Hüf.).—Sugar lures, 11, 1913; open mixed woodland on trunk of tree, 7, 1913.


50. *Autographa rectangula* (Kir.).—Open mixed woodland, 17, 21, 24, 28; wash up on beach, 21; sugar lures, 7, 1913.

51. *Autographa epigaea* (Gr.).—Cranberry marsh at Doe Lake, 28.

52. *Autographa ampla* (Wlk.).—Wash up on beach, 24.

53. *Autographa simplex* var. *falcigera* (Kir.).—Meadow on cultivated ridge near Post Office.

54. *Eustrotia albidula* (Guen.).—Cranberry marsh at Cranberry Lake, 18, 22; light lures, 26; cultivated meadow near Post Office, 26.

55. *Eustrotia carnea* (Guen.).—Sugar lure, 27; on trunk of jack pine in open mixed woodland, 8, 1913.

56. *Lithacodia bellicula* (Hüb.).—Cranberry marsh at Cranberry Lake, 24; marsh near Clarke’s, 30.


58. *Drasteria crecica* (Cra.).—Cranberry marsh at Doe Lake, 28.

60. *Catacola briscis* (Edw.).—Sugar lures, 25-30.
61. *Epizeuxis americanus* (Guen.).—Sugar lures, 22-30.
63. *Zanclognatha marcidilinca* (Gr.).—Sugar lures, 30.
64. *Hormisa bivittata* (Gr.).—Cranberry marsh at Cranberry Lake, 24.
65. *Chytolita petreais* (Gr.).—Cranberry marsh at Cranberry Lake, 24.
66. *Bleptina caradrinalis* (Guen.).—Sugar lures, 24.
67. *Palthis angulalis* (Hüb.).—Open mixed woodland along road to Vermillion, 23.

**THYATIRIDÆ**

68. *Habrosyne scripta* (Gosse).—Sugar lures, 8, 1913.
69. *Pseudothyatira cymatophoroides* (Guen.). — Sugar lures, 23-28; 8, 1913.

**LASIOCAMPIDÆ**

70. *Malacosma disstria* (Hüb.).—On shrub in open mixed woodland on road to Vermillion about three miles from Post Office, 23.

**GEOMETRIDÆ**

71. *Venusia cambrica* (Curtis).—Open mixed woodland, 27; 12, 1913.
72. *Hydria undulata* (Linn.).—Open mixed woodland, 25-27; light lures, 8, 1913.
73. *Eustroma unigerata* (Wlk.).—Sugar lures, 21-30; open mixed woodland, 27.
74. *Mesoleuca ruficillata* (Guen.).—Open mixed woodland, 7, 1913.
75. *Mesoleuca lacustrata* (Guen.).—Open mixed woodland, 27; 8, 1913; sugar lures, 22 (poor condition).
76. Hydriomena autumnalis (Stro.).—Open mixed woodland, 25.
77. Gypsochroa emendata (Pears.).—Open mixed woodland, 27.
78. Petrophora abrasaria (Herr. and Sch.).—Open mixed woodland, 7, 1913.
79. Petrophora convallaria (Guen.).—Sugar lures, 22.
80. Eois persimilis (Hulst.).—Light lures, 21; 8, 1913.
81. Eois inductata (Guen.)?—Light lures, 21.
82. Synchloera crata (Fab.).—Open mixed woodland, 2-3.
83. Epelis faxonii (Minot).—Cranberry marsh, 30.
84. Enfodonia notataria (Wlk.).—Cranberry marsh, 24; wash up on beach, 24; light lures, 21.
85. Deilimia variolaria (Guen.).—Cranberry marshes, 24; sugar lures, 22; open mixed woodland, 25-26.
86. Sciagraphia granitata (Guen.).—Sugar lures, 8, 1913.
87. Diastictis sulphuria (Pack.).—Cranberry marshes, 24-30.
88. Diastictis brunneata (Thun.).—Light lures, 21; cranberry marshes, 24-30; open mixed woodland, 23-27.
89. Diastictis inceptaria (Wlk.).—There is some question regarding all the specimens according to Mr. Swett. A few are typical as usually understood, that is without markings and of a bluish gray color. The original description by Walker calls for markings on the wings and most of the specimens answer fairly well to his description. It is possible some may be D. evagaria (Hulst.) or even males of D. sulphuria. Light lures, 21-22; open mixed woodland, 23-27; cranberry marsh, 24-30; sugar lures, 21.
90. Diastictis flavaria (Linn.).—Sugar lures, 21.
91. Diastictis bicolorata (Fab.).—A little doubtful. Sugar lure, 29.
92. *Homochlodes fritillaria* (Guen.).—Open mixed woodland, 24.

93. *Caripeta angustiorata* (Wlk.).—On trunk of jack pine in open mixed woodland, 8, 1913.

94. *Caripeta criminosa* (Swett).—Open mixed woodland, 8, 1913.

95. *Acles sulphuraria* (Pkd.).—Sugar lures, 22-23; open mixed woodland, 27; light lures, 22.


98. *Metrocampa perlata* (Guen.).—Open mixed woodland, 24-25.

99. *Xanthotype crocataria* (Fab.).—Sugar lures, 21-29.

100. *Euchlena obtusaria* (Hüb.).—Sugar lures, 22; light lures, 27.

**Cossidae**

101. *Prionoxystus macnurtri* (G. and M.).—Wash up on beach, 12, 1913.

**Sesiidae**

102. *Albuna pyramidalis* var. *coloradensis* (Edw.) and var. *montana* (Edw.).—Specimens correspond well to descriptions. On flowers of dewberry along road to Vermillion about two miles from Post Office in open mixed woodland, 24; lower beach on log, 8, 1913.


106. *Nymphula icciusalis* (Wlk.).—Cranberry marsh at Cranberry Lake, 24; open mixed woodland, 23.

107. *Nymphula maculalis* (Clem.).—On leaves of water lilies at Cranberry Lake, 12, 1913.


110. *Schanobius sordidellus* (Zinck).—Light lures, 27.

111. *Crambus prefectellus* (Zinck).—Light lures, 21.

112. *Crambus hortellus* (Hbr.).—Cranberry marsh near Cranberry Lake, 24.


**PTEROPHORIDÆ**

114. *Oxyptilus periscelidactylus* (Fitch).—Open mixed woodland along road to Vermillion, 26.


**TORTRICIDÆ**

116. *Olethreutes hartmanniana* (Linn.).—Cranberry marsh near Cranberry Lake, 24; sugar lures, 25; on bush in open mixed woodland along road to Vermillion, 23.


118. *Olethreutes instrutana* (Clem.).—Light lures, 21-30; beaten from bushes in open woodland along road to Vermillion, 23.

119. *Olethreutes bipartitana* (Clem.).—Open mixed woodland along road to Vermillion, 28.
120. *Ancyliis subaquana* (Zell.).—Beaten from bushes in open mixed woodland along road to Vermillion, 23.

121. *Alceris minuta* (Rib.).—Cranberry marsh near Cranberry Lake, 24; beaten from bush in open mixed woodland along road to Vermillion, 23.

122. *Epagoge sulphureana* (Clem.).—Light lures, 21-30; beaten from bush in open mixed woodland along road to Vermillion about three miles from Post Office.

123. *Cenopis reticulatana* (Clem.).—Light lures, 30-31.

124. *Archips purpurana* (Clem.).—Light lure, 30.

125. *Archips argyrospila* (Wlk.).—Light lure, 14.

126. *Archips persicana* (Fitch).—Cranberry marsh near Cranberry Lake, 24; beaten from bush in open mixed woodland along road to Vermillion, 23.

127. *Pandemis limitata* (Rob.).—Beaten from bush in open mixed woodland along road to Vermillion, 23.

128. *Tortrix bergmanniana* (Linn.).—Light lures, 21-22; beaten from bush in open mixed woodland along road to Vermillion, 23; open mixed woodland near Post Office, 24, 27.


**TINEIDAE**

130. *Argyresthia goedertella* (Linn.).—Beaten from bush in open mixed woodland on roadside to Vermillion, 23.

131. *Tinea bilaximaculella* (Clem.).—Light lure, 22.


**HEPIALIDAE**

133. *Hepialus gracilis* (Gr.).—Light lures, 22. The specimen corresponds well to descriptions.
A COLLECTION OF TIPULIDÆ FROM SCHOOLCRAFT COUNTY, MICHIGAN

By J. Speed Rogers

The collection upon which the following list is based was made by the writer while he was a member of the Bryant Walker Expedition to Schoolcraft County in the Northern Peninsula of Michigan during July, 1915. While the writer's main interest was centered on the Tipulidæ, yet he attempted to do considerable general collecting of Diptera with the result that a number of species of crane-flies were missed, particularly Limnobinæ. The region was a very favorable one for the family, and would undoubtedly repay further work. As far as known, this is the first paper devoted entirely to the Tipulidæ of the Northern Peninsula of Michigan.

All the field work was done about a locality known as Floodwood, situated on the Manistique River some twenty-six miles northeast of the city of Manistique. The surrounding country was largely the typical cut and burned-over pine land of Michigan, undulating sandy plains bearing a scattered growth
of jack pine, birch and aspen. Considerable swamp areas were present, sometimes open and grassy, again with a heavy growth of black spruce and tamarack. In general the region was bounded north and south by two high moraines which supported a magnificent hardwood forest of maple, beech, basswood and yellow birch with a scattering of hemlock. These ridges were studied. The Manistique River flowed through the region, and on its flood-plain was much hardwood timber. Many excellent habitats for the Tipulidae were found about the numerous ox-bow ponds and sloughs formed by the river meanders on this plain.

All of the species listed were determined by Dr. W. G. Dietz, to whom the writer is indebted for much assistance. In all some twenty-three species are listed, and include, according to Dr. Dietz, four apparently new forms, one of which has been described by him.

List of Species

*Rhipidia maculata* Meigen.—A number of specimens were taken inside the log camp, others were attracted to light lures, and several specimens were found in a clearing on the sand plains.

*Limnobia solitaria* Osten Sacken.—Specimens were taken in the forest on the morainal ridges, from open swamps and sphagnum bogs.

*Elephantomyia westwoodi* Osten Sacken.—This species was collected frequently in marshy thickets along creeks.

*Erioptera armata* Osten Sacken.—Specimens of this species

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were taken from shrubbery along the river, and it also was frequently collected about light lures.

*Erioptera septentrionalis* Osten Sacken.—Two pairs were taken in copulo about a light lure on the river bank.

*Erioptera* sp.—“Probably a new form,” Dr. Dietz.

*Amalopsis inconstans* Osten Sacken.—The species was collected from the forest on the river flood-plain and along brush grown creek banks.

*Phalacrocora tipulina* Osten Sacken.—Four specimens were secured of this species, two from a sphagnum bog, July 20, and on July 29 a pair was found in the same habitat in copulo.

*Pachyrhina brevicornis* Doane.—Several specimens of the species were taken from underbrush along the river.

*Pachyrhina incurva* Loew.—A number of specimens of this species were collected along the river, while a few were found resting on low branches of trees on the sand ridges.

*Pachyrhina macrocera* Say.

*Pachyrhina sodalis* Loew.—This species was taken in large numbers during the month of July, mainly from low moist ground on the river bottoms and among the ostrich ferns. A number of pairs were seen copulating; the breeding seemed to be continuous throughout the month. The species was the most abundant of the family in the region.

*Pachyrhina* sp.—“Seems to be a new form. Manuscript name is caliunta.” Dr. Dietz. A large series of the form were secured from undergrowth on the river flood plain.

*Tipula calva* Doane.—Specimens were taken from low vegetation along the river banks.

*Tipula hebes* Loew.—The species was found on low wooded areas.
Tipula inermis Doane.—This species was of wide occurrence, it extended thru practically all habitats in the region studied.

Tipula speciosa Loew.—Several specimens of this species were collected in the swampy margin of the hardwood forest.

Tipula trivitta Say.—A few specimens of the species were secured from low wooded ground near the high ridges.

Tipula vicina Dietz.—This species was rather rare, a few specimens were taken at the margin of an ox-bow lake on the river flood plain, July 14 and 20.

Tipula sp.—This species is represented by a single undetermined female.

Tipula sp.n.—"Manuscript name is heretica," Dr. Dietz. Several specimens of this form were taken on hazel brush on the high river bank, July 13.

Bittacomorpha clavipes Fabricius.—This species was common in the tamarack and spruce swamps and in sloughs but rare on the sand plains.
A large number of fishes have been examined and studied by the writer while on local trips in the middle Atlantic States and Virginia. in 1917. Where desirable, material was saved, properly prepared and sent or brought to Philadelphia, and placed in the Academy of Natural Sciences of Philadelphia. Many specimens represent new and interesting locality records, some new additions to faunas of the river systems or streams, and a resumé is therefore given, the species grouped under their respective states.

New Jersey

On August 16 a small collection was made at Manasquan. October 5 Mr. S. G. Gordon collected a few fishes in the West Branch of the Popakating Creek of the Walkkill basin in Sussex County. October 20 and 21, with Messrs. E. S. and W. I. Mattern and H. W. Pretz, the writer made an extended trip
through the upper portions of the state and collected in various places as follows: Musconetcong River between Hackettstown and Washington; tributary in Raritan basin over ridge east of German Valley; tributary in Raritan basin east of Chester; Rockaway River at Boonton; tributary of Cranberry Lake; Stanhope Lake at Nectong; tributary of Pequest River at Andover Junction; Stickle Pond, midway between Andover Junction and Newton, in Pequest basin; west shore of Swartswood Lake; lower outlet of Swartswood Lake; Trout Brook, a tributary of the Paulin's Kill; first tributary above Stillwater in the Paulin's Kill; Paulin's Kill mile below Stillwater; Yards Creek, a tributary of the Paulin's Kill at Hainesburg; Paulin's Kill at Hainesburg; Beaver Brook in the Pequest River Basin; Pequest River above Buttsville.

*Entosphenus aepypterus* (Abbott).—On April 28, Mr. S. N. Rhoads secured a number of examples near Haddonfield. The precise locality is 150 feet below a spring head, a tributary of Cooper's Creek in Camden County, in a gravelly ravine half-way between Haddonfield and Ellisburg. These lampreys were spawning at a point in this brook about fifty yards from the creek, and at this point the elevation was about ten feet above the creek's level. The occurrence of this species in the Delaware River basin is of local interest, and these are the first undoubted specimens to be so recorded.

*Carcharias taurus* Rafinesque.—The jaws of a large example taken below Fortescue in the Delaware Bay, in October.

*Mustelus mustelus* (Linnaeus).—Manasquan.

*Raja erinacea* Mitchill.—Manasquan.

*Raja cglanteria* Lacépède.—Manasquan.

*Myliobatis fremincillii* LeSueur.—One at Sea Isle City, August 7, reported by Mr. W. J. Fox.
Pomolobus mediocris (Mitchill).—Longport.
Brevoortia tyrannus (Latrobe).—Manasquan.
Salvelinus fontinalis (Mitchill).—Trout Brook and Paulin's Kill at Hainesburg.
Semotilus bullaris Rafinesque.—Paulin's Kill at Hainesburg.
Semotilus atromaculatus (Mitchill).—West Branch of Popakating Creek; Musconetcong River above Washington; Raritan tributary east of German Valley and another east of Chester; Andover Junction; Paulin's Kill tributary above Stillwater; Yards Creek; Paulin's Kill at Hainesburg.
Abramis crysoleucas (Mitchill).—Stickie Pond.
Notropis cornutus (Mitchill).—Musconetcong River above Washington; Raritan tributary east of Chester; Andover Junction; Trout Brook; Paulin's Kill tributary above Stillwater; Paulin's Kill mile below Stillwater.
Notropis chalybeus (Cope).—Andover Junction.
Rhinichthys cataractae (Valenciennes).—Musconetcong River above Washington.
Rhinichthys atronasiis (Mitchill).—West Branch of Popakating Creek; Musconetcong River above Washington; Raritan tributary east of German Valley and another east of Chester; Trout Brook; Paulin's Kill tributary above Stillwater; Paulin's Kill mile below Stillwater; Yards Creek; Paulin's Kill at Hainesburg.
Catostomus commersonnii (Lacépède).—Boonton; Trout Brook; Paulin's Kill tributary above Stillwater; Paulin's Kill mile below Stillwater; Yards Creek.
Catostomus nigricans LeSueur.—Raritan tributary east of Chester.
Erimyzon suetca oblongus (Mitchill).—West branch of Popakating Creek and Swartswood Lake.

Ameiurus nebulosus (Lesueur).—Swartswood Lake outlet.

Schilbeodes gyrinus (Mitchill).—Tributary of Cranberry Lake; Stickle Pond, and Swartswood Lake outlet.

Esox americanus Gmelin.—Boonton; Nectong; Swartswood Lake outlet.

Esox reticulatus Lesueur.—Nectong.

Umbra pygmaea (DeKay).—Clementon (Dr. P. P. Calvert).

Fundulus heteroclitus macrolepidotus (Walbaum).—Manasquan and Cape May.

Lucania parva (Baird).—Manasquan.

Cyprinodon variegatus Lacépède.—Manasquan.

Menidia menidia notata (Mitchill).—Manasquan.

Mugil curema Valenciennes.—Longport.

Blepharis crinitus (Mitchill).—Adult from Ocean City.

Pomoxis sparoides (Rafinesque).—Nectong.

Enneacanthus gloriosus (Holbrook).—Abundant at Swartswood Lake outlet.

Lepomis auritus (Linnaeus).—Nectong; Andover Junction; Swartswood Lake outlet; Trout Brook; Paulin’s Kill mile below Stillwater.

Pomotis gibbosus (Linnaeus).—Boonton; Nectong; Andover Junction; Stickle Pond; Swartswood Lake outlet; Yards Creek.

Microperus salmoides (Lacépède). — Boonton; Nectong; Swartswood Lake outlet; Paulin’s Kill at Hainesburg; Beaver Brook.

Perca flavescens (Mitchill).—Nectong.
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Boleosoma nigrum olimstedi (Storer). — Musconetcong River above Washington; Raritan tributary east of Chester; Andover Junction; Trout Brook; Paulin's Kill at Hainesburg and below Stillwater; also Yards Creek and Buttsville.

Upeneus phillipsi, new species

Fig. 1

Description: Head 3½; depth 3 2/5; D. VIII-I, 8, 1; A. I, 6, 1; P. II, 14; V. 1, 5; scales 30 in lateral line to caudal base and 3 more on latter; 3 scales above lateral line to spinous dorsal origin, also same to soft dorsal origin; 6 scales below lateral line in vertical series to spinous anal origin; about a dozen predorsal scales; head depth at occiput 1 1/6 its length; head width 2; snout 2⅜; eye 3⅔; maxillary 3 1/3; interorbital 3⅜; mandible 2⅜; second dorsal spine 1 3/5; first ray of second dorsal fin 1⅛; least depth of caudal peduncle 2⅝; caudal along upper lobe 1; first anal ray 2⅝; pectoral 1 2/5; ventral 1 1/3.

Body elongate, compressed, contour rather fusiform, though greatest depth about spinous dorsal origin. Caudal peduncle compressed, elongate, least depth about half its length.

Head well compressed, rather deep, upper profile little more inclined than lower, and flattened sides not constricted above or below. Snout obtuse or convex in profile, and length about ⅗ its width. Eye high, close to upper profile, rounded and hind edge nearly midway in head length. Mouth small, terminal below and upper jaw but slightly protruding. Lower jaw deep, and mandibular rami well elevated inside mouth. Maxillary with posterior half exposed, expansion 2/3 of eye, and nearly reaches opposite front pupil edge. At least a row of very low obscure simple teeth in upper jaw. In lower jaw
row of minute short teeth, and some may be partly biserial. Fine teeth on vomer and palatines. Lips moderate. Two rather stout chin barbels extend back about opposite hind edge of preopercle below. Nostril about midway in snout length. Interorbital depressed, or nearly level. Preorbital moderately broad, its width slightly greater than eye. Preopercle edge entire.


Scales large, mostly uniform, finely ctenoid, rather narrowly imbricate and in nearly even lengthwise series. Head largely scaly, and cheek with 3 rows of scales. Axil of ventral with pointed scale about 1/4 of fin, and rounded scale between fin bases of similar length. Vertical fins largely depressible close to or as if below scales of adjacent regions. Lateral line complete, largely concurrent with dorsal profile. Tubes of lateral line little branched, or simple in most cases, and extend well over scale exposure.

Spinous dorsal origin nearly at first third between snout tip and caudal base, spines rather firm, and second longest, though depressed fin reaches 2/3 to soft dorsal. Latter inserted about midway between hind preopercle edge and caudal base, first ray longest with others graduated down behind, though not extending so far posteriorly as tip of last ray, and depressed fin 1 1/4 to caudal base. Caudal forked, upper lobe slightly longer than lower. Anal inserted about midway between caudal base and pectoral origin, first ray longest and others graduated down behind. Pectoral rather
pointed, reaches \( \frac{3}{5} \) to anal. Ventral origin about opposite that of pectoral and fin reaches nearly \( \frac{2}{3} \) to anal.

Color in alcohol pale brownish with slight yellowish tinge, and dusted with pale dusky largely along each scale edge on upper surface or back. Side of head silvery or whitish, and side of trunk largely rosy pink, especially abdomen. Iris pale or whitish, with pinkish tints. Spinous dorsal pale or grayish-white crossed by three dusky horizontal bands, each made up of variable black dots, first band basal, second medially and third near apex. Soft dorsal similar, only dusky bands oblique, as uppermost along upper edge of fin so that others parallel. Anal whitish, with slight median transverse dusky tint composed of several dark chromatophores on each ray. Pectoral and ventral both pale or gray-white, and caudal of similar tint, except three broad dusky bands across each caudal lobe.

Length 70 mm.

*Type Specimen:* No. 47,448, A. N. S. P., Corson's Inlet, Cape May County, New Jersey, August 11, 1917. Dr. Richard J. Phillips.

*Remarks:* The above example appears to be unique. It was obtained in the bait net on the inside beach. In life Dr. Phillips noted the scales as round, thin and easily detached. Its color at that time was greenish-grey above, and white below. The lateral line was marked by a salmon colored band prolonged through the eye. Coarse flecks of salmon color were on the lower part of the sides. Iris partly of same color, which is best described as a deep salmon shade.

This species appears allied, if not identical with *Upeneus parvus* Poey. It is said to have the maxillary reaching the front of the eye, a yellow longitudinal band along side with similar narrower streaks below, two dusky cross-bands on the
second dorsal and five on each caudal lobe. This species has not been secured since Poey described it.\(^1\)

*U. phillipsi* differs from the next species in the much larger maxillary, and the dark bars on the soft dorsal and caudal.

(For Dr. Richard J. Phillips of Philadelphia, who collected the type.)

*U. pencils maculatus* (Bloch).—On July 12, 1903, I seined an example about 82 mm. long at Stone Harbor, which I wrongly referred\(^2\) to *Mullus auratus* (Jordan and Gilbert). Though now in very poor preservation it seems to belong to the present species. A row of small short teeth are seen along the upper jaw edge, not noticed originally. This record, therefore, adds another species to the New Jersey fish fauna.

*Cynoscion regalis* (Schneider).—Manasquan.

*Bairdiella chrysura* (Lacépède).—Manasquan.

*Prionotus evolans strigatus* (Cuvier).—Manasquan.

*Merluccius bilinearis* (Mitchill).—During early June many were washed ashore, usually at night, at Seaside Heights.

**Pennsylvania**

About thirty-five localities are included below, represented by twelve in Indiana County, where material was gathered by Mr. R. W. Wehrle (North Branch of Brush Run, Little Mahoning Creek, Penn, McKee, Smith, Shafer, Stephen, Laurel, Miller, McDonnell, Brush and Graff Runs). Thirteen lots were sent by Messrs. E. S. and W. I. Mattern, from extended trips in the Delaware River basin in Berks County (stream near Lime Kiln Run in Oley Township and Manatawney Creek), and along the middle Susquehanna River basin in Berks County (Little Swatara Creek and its tributary Stone Creek,


and branch of Cross Kill Creek near Meckville), in Snyder County (Middle Creek and Susquehanna River near Chapman), in Dauphin County (creek near Stone Glen, Beaver Creek, Armstrong Creek above Halifax, Manada Creek near Manadahill, and Powell Creek near Inglenook), and Lebanon County (Little Swatara Creek near Jonestown). June 23 and 24 the writer accompanied Messrs. Mattern through Carbon County (tributary of the Big Lehigh near Hudsondale, and another tributary two miles from White Haven, Lesley's Run which is a tributary of the Big Lehigh between Weatherly and White Haven, and the Pohopoco Creek), Luzerne County (Nescopeck Creek headwaters four miles north of White Haven, Wapwalopin Creek headwaters five miles north of White Haven, Solomon Creek at Solomon Gap, Harvey Creek near West Nanticoke), and Columbia County (Briar Creek, which is a tributary of the Susquehanna below Berwick, and the Susquehanna at Bloomsburg). Though a large number of collections were made nearer Philadelphia, they are omitted as of lesser importance. Also a number of streams were visited and examined which were in part or entirely polluted, and, as no collections were obtained from them, a great amount of work necessary in such cases does not appear in this report.

Salvelinus fontinalis (Mitchill).—Near Hudsondale; Lesley's Run; Nescopeck and Wapwalopin headwaters, and Solomon Creek.

Campostoma anomalum Rafinesque.—Penn Run and Little Mahoning Creek, in Indiana County. Messrs. Mattern seined an example in Briar Creek on June 23, which is the first record for the Susquehanna River basin, thereby also establishing the most eastern point at which this remarkable cyprinoid oc-
curs. Although it was found associated with other small fishes, which were abundant in the water course, and prolonged and careful search was made, no other example could be located. The precise locality was in the lower course of the stream, where shallow and with gentle current and the bottom mostly gravelly or muddy. An examination of the viscera reveals with certainty that it belongs to the present species.

_Pimaphales notatus_ (Rafinesque).—Little Mahoning Creek; Brush, Penn, McKee, Smith, Shafer and Stephen Runs; Stone, Little Swatara, Middle, Beaver and Armstrong Creeks.

_Semotilus bullaris_ (Rafinesque).—Briar Creek; Bloomsburg and tributary of the Susquehanna; Stone Glen; Armstrong Creek; Inglenook, and Jonestown. Also in Pohopoco Creek.

_Semotilus atromaculatus_ (Mitchill). — Little Mahoning Creek; Brush, North Branch of Brush, Laurel, Miller, McDowell, Graff, Penn, McKee, Smith, Shafer and Stephen Runs; Briar Creek; Bloomsburg; Little Swatara; Manatawny Creek; Meckville; Middle Creek; Chapman; Beaver and Armstrong Creeks; Manadahill and Inglenook.

_Leuciscus elongatus_ (Kirtland).—Little Mahoning Creek; Brush, North Branch of Brush, McDonald, Penn and McKee Runs.

_Abramis crysoleucus_ (Mitchill).—Stone, Little Swatara and Middle Creeks, near Lime Kiln.

_Notropis bifrenatus_ (Cope).—Near Lime Kiln Run.

_Notropis procne_ (Cope).—Briar, Stone and Little Swatara Creeks; Meckville; Middle Creek; Chapman; Beaver Creek; Manadahill; Jonestown; near Lime Kiln.

_Notropis hudsonius amarus_ (Girard).—Bloomsburg and
Susquehanna tributary; Stone and Little Swatara Creeks; Meckville; Middle Creek; Chapman; Beaver and Armstrong Creeks; Manadahill, and Jonestown.

*Notropis zhipplii analostanus* (Girard). — Briar, Stone and Little Swatara Creeks; near Lime Kiln Run; Manataweney Creek; Meckville; Middle Creek; Stone Glen; Chapman; Beaver and Armstrong Creeks; Inglenook, and Jonestown.

*Notropis cornutus* (Mitchill). — Little Mahoning Creek; Brush, North Branch of Brush, Smith and Shafer Runs; Briar Creek; Bloomsburg and Susquehanna tributary; Stone and Little Swatara Creeks; near Lime Kiln Run; Manataweney Creek; Meckville; Middle, Beaver and Armstrong Creeks; Manadahill; Inglenook, and Jonestown. Also in Pohopoco Creek.

*Notropis photogenis amanus* (Abbott). — Bloomsburg; Middle Creek; Chapman, and Manadahill. Six interesting males in full nuptial colors were seined in the Little Swatara, July 8. Among the multitudes of individuals I never before noticed this coloration and therefore give the following description: Whole head above and anterior part of body with faint blushes of rosy to blood-red, latter tint bright and deep over whole of muzzle and about gill opening, also at pectoral base. Dorsal base orange red, and similar, though paler, tints at bases of pectoral and anal. Costal region with pale orange tint, lilac in some lights, and all overlaid by the brilliant silvery white sheen so prevalent in this species. Iris blood shot. These males are 46 to 66 mm. in length. Some were more brilliant than others and had the head quite red. Its usual coloration would give no clue to such a livery.

*Notropis rubrifrons* (Cope). — Little Mahoning Creek, where abundant.
Ericynba buccata Cope.—McKee Run.

Rhinichthys cataractae (Valenciennes). — Harvey, Briar. Little Swatara, Middle and Beaver Creeks; Manadahill, and Jonestown. Small ones from Little Mahoning Creek.

Rhinichthys atronatus (Mitchill).—Brush, North Branch of Brush, Laurel, Graff, Penn, McKee, Smith and Stephen Runs, and Little Mahoning Creek; Nescopeck and Wapwallopen headwaters; Solomon, Harvey and Briar Creeks; near Lime Kiln Run; Meckville; Middle Creek; Stone Glen; Beaver Creek; Manadahill; Inglenook; near Hudsondale and White Haven; Lesley's Run; Pohopoco Creek, and near Chestnut Hill.

Hybopsis kentuckiensis (Rafinesque).—Stone, Little Swatara, Middle and Armstrong Creeks; Manadahill; Inglenook, and Jonestown.

Exoglossum maxillingua (LeSueur).—Harvey and Briar Creeks; Susquehanna tributary at Bloomsburg; Stone and Little Swatara Creeks; near Lime Kiln Run; Meckville; Middle, Beaver and Armstrong Creeks; Manadahill; Inglenook, and Jonestown.

Catostomus commersonii (Lacépède). — Brush, North Branch of Brush, Miller, McDonald, Penn, McKee, Smith, Shafer and Stephen Runs; Little Mahoning Creek; Solomon and Briar Creeks; Susquehanna tributary at Bloomsburg; Stone and Little Swatara Creeks; near Lime Kiln Run; Manatawny Creek; Meckville; Middle, Beaver and Armstrong Creeks; Jonestown; Manadahill; Inglenook; Lesley's Run, and Pohopoco Creek.

Catostomus nigricans LeSueur. — Little Mahoning Creek; Briar, Stone and Little Swatara Creeks; Meckville; Middle and Beaver Creeks; Jonestown; Manadahill.
Erimyzon succata oblongus (Mitchill).—Inglenook, and Susquehanna tributary at Bloomsburg.

Moxostoma auriculum (Le Sueur).—Little Mahoning Creek and Shafer Run.

Esox americanus Gmelin. — Susquehanna tributary at Bloomsburg.

Esox reticulatus Le Sueur.—Little Swatara Creek and Jonestown.

Fundulus diaphanus (Le Sueur).—Briar and Little Swatara Creeks; near Lime Kiln Run; Manatawney Creek; Middle and Beaver Creeks.

Ambloplites rupestris (Rafinesque). — Little Mahoning Creek.

Lepomis auritus (Linnaeus).—Stone and Little Swatara Creeks; near Lime Kiln Run; Manatawney Creek; Middle Creek; Chapman; Inglenook, and Jonestown.

Lepomis incisor (Valenciennes).—One from the Hosensack near Allentown, August 16, the first met with.

Pomotis gibbosus (Linnaeus). — Shafer Run in Indiana County; Stone Creek, and Jonestown.

Enneacanthus gloriosus (Holbrook).—Jonestown.

Micropterus dolomieu Lacépède.—Near Lime Kiln Run.

Micropterus salmoides (Lacépède).—Inglenook.

Hadropterus peltatus (Cope).—Little Swatara and Middle Creeks, and Manadahill.

Boleosoma nigrum Rafinesque.—Brush, North Branch of Brush, McDonald, Penn, McKee, Shafer, Smith and Stephen Runs.

Boleosoma nigrum olmstedi (Storer).—Harvey and Briar Creeks; Bloomsburg and Susquehanna tributary; Stone and Little Swatara Creeks; near Lime Kiln Run; Manatawney
Creek; Meckville; Middle Creek; Stone Glen, Beaver and Armstrong Creeks; Pohopoco Creek.

_Pacilichthys flabellaris_ (Rafinesque).—Brush Run and Little Mahoning Creek.

_Cottus ictalops_ (Rafinesque).—Laurel, Penn and McKee Runs.

**Delaware**

During the summer a number of the more common fishes were observed, some in numbers, at Lewes, and reported by Mr. Charles S. Abbott, Jr. They are _Mustelus mustelus_ (Linnaeus), _Eulamia milbertii_ (Müller & Henle), _Sphyra zygaena_ (Linnaeus), _Raja eglanteria_ Lacépède, _Ascipterus striato Linnaeus, Brevoortia tyrannus_ (Latrobe), _Tylosurus marinus_ (Walbaum), _Centropristis striatus_ (Linnaeus), _Cynoscion regalis_ (Schneider), _Micropogon undulatus_ (Linnaeus), _Spheroidees maculatus_ (Schneider), _Paralichthys dentatus_ (Linnaeus), _Lophius piscatorius_ Linnaeus.

**Maryland**

Mr. W. L. Mattern made a small collection at Ocean City in Sinnepuxent Bay, during late August, and sent the following: _Fundulus majalis_ (Walbaum), _Fundulus heteroclitus macrolepidotus_ (Walbaum), _Lucania parva_ (Baird), _Cyprinodon variegatus_ Lacépède, _Gambusia affinis_ (Baird and Girard), _Menidia beryllina_ (Cope).

**Virginia**

May 12 to 16 was spent with Mr. I. N. DeHaven as his guest at Long Point Island in Magothy Bay, Northampton County. Mr. DeHaven assisted me in every way to study and collect fishes in the region. The first day a few species were
noted at Cape Charles City, all of which, however, are mentioned in Mr. Barton A. Bean's list of 1891. About Long Point Island we met with several species Mr. Bean did not have. May 16 Mr. DeHaven and I collected along and on Smith Island.

I include under this caption a small collection of fresh water fishes obtained at Midway Mills of the James River drainage, in Nelson County, November 25-27, 1915, by Mr. E. R. Dunn, also a similar lot of material from Piney Creek, a tributary of the Potomac in Loudoun County, which I visited August 6, 1916. The latter is a rapid rocky stream just below Harpers Ferry.

*Carcharias taurus* Rafinesque.—Smith Island.

*Mustelus mustelus* (Linnaeus).—Fig. 2. Abundant about Smith Island on May 16. Several were caught May 15 with unborn young. We saw ten adult pregnant females, and no males. Some were caught on lines and others were dragged ashore in the hauling-seines. In size these sharks were fully adult, or about three feet long. Of the six we opened all were found with living young, in most cases eight within a female or four in each "uterus."Externally the adult female did not appear swollen, or but slightly more robust than males of the same size observed elsewhere. They took the crab-bait intended for "trout" (*Cynoscion regalis*), with the usual force and held on simply as a dead weight, it being necessary to lift them into the boat with a landing net as they were brought up to the surface on the line. They floundered about the bottom of the boat in the usual fashion, until a well-aimed blow on the top of the head rendered them quiet. Afterwards we cut

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them open and examined the viscera. The "uterus," or membrane containing the young, was well developed as two long sacs nearly a foot in length. Each sac was well supplied with veins and arteries. After cutting a pair of these sacs open the young were found folded about one another, and all moved slightly. Each young shark was found furnished with a long umbilicus, as long, or longer, than the length of the embryo. It was attached to the walls of the sac by a placenta which much resembled a clot of blood and was an inch or more in diameter. The walls of the sac were elastic and of rather thick membrane, also somewhat spongy in texture. The young sharks would all wriggle about and finally break away. When some were thrown overboard they swam slowly away, or sank out of sight. All were perfectly formed and of about uniform size, with characteristic dark blotches about the tips of the dorsals and caudal. In size they were about 225 mm. in length. One female we opened was parasitized with a number of external copepod crustaceans (Pandarus simiatus), which were quite active, moving about over the back and fins of their host. The gestation of this shark I had not noticed previously, although I had reported it from the observations of my friend, Dr. Richard J. Phillips, at Corson's Inlet, N. J.

The accompanying figure shows a view made from life of one of the uterine sacs dissected out, with the young sharks attached.

_Raja eglanteria_ Lacépède.—Magothy Bay and Smith Island.  
_Dasyatis say_ (Le Sueur).—Smith Island.  
_Pteroplatea micrura_ (Schneider).—Several caught in the hauling-seine, the larger ones about 1320 mm. wide, near Smith Island.

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*Science, XXX, December 3, 1909, p. 815.*
Anguilla rostrata Le Sueur.—Long Point Island and Magothy Bay.

Chrosomus orcas Cope.—Abundant at Midway Mills.

Semotilus atromaculatus (Mitchill).—Midway Mills and Piney Creek.

Leuciscus vandoisulus Valenciennes.—Midway Mills.

Rhinichthys atronatus (Mitchill).—Midway Mills and Piney Creek.

Hybopsis kentuckiensis Rafinesque.—Piney Creek.

Fundulus majalis (Walbaum).—Long Point Island, Magothy Bay and Smith Island.

Fundulus heteroclitus macrolepidotus (Walbaum).—Long Point Island and Smith Island.

Lucania parva (Baird).—Long Point Island.

Cyprinodon variegatus Lacépède.—Long Point Island and Magothy Bay.

Menidia menidia notata (Mitchill).—May 12 we found bunches of spawn in the meadow grass, just below high tide, along the shores of Magothy Bay at Long Point Island. Also a number of dead fish were found in the trash and debris washed above tide-mark. These had all spawned several days before, as they were all quite fresh. Mr. George Skidmore, who reported seeing a large school spawning in this locality on May 1, was attracted by the great number of fish congregated, which were apparently to the number of several thousand individuals, all collected at high water over the grass. At this time the water was but several inches deep, and the fish occupied an area of a hundred or more square feet. The water for a still greater area was all white with the expelled milt of the males, so that it had a conspicuous milky appearance. All the fish were greatly agitated, tossing and tumbling about.
As the tide went down they all moved off-shore with it, and the eggs were left attached or screened by the grass on the dampened shore to await the return of high water. Doubtless the greater part of these eggs perish or are devoured by crabs, birds, etc. In color the eggs are pale or somewhat transparent, but mostly become more yellowish with age. In size each egg is about as large as number four shot. We found but few of these fish elsewhere during our stay, and conclude they were all in deeper waters.

*Mugil curema* Valenciennes.—Magothy Bay.

*Hippocampus hudsonius* De Kay.—Smith Island.

*Lepomis auritus* (Linnaeus).—Piney Creek.

*Lepomis incisor* (Valenciennes).—Piney Creek.

*Bolosoma nigrum olmstedi* (Storer).—Piney Creek.

*Bolosoma longimanus* (Jordan).—Midway Mills.

*Orthopristis chrysopterus* (Linnaeus).—Cape Charles City, Magothy Bay and Smith Island.

*Cynoscion regalis* (Schneider).—Cape Charles City, Magothy Bay and Smith Island.

*Cynoscion nebulosus* (Cuvier).—Cape Charles City and Smith Island.

*Bairdiella chrysura* (Lacépède).—Cape Charles City, Magothy Bay and Smith Island.

*Leiostomus xanthurus* Lacépède.—Cape Charles City, Magothy Bay, Smith Island and Long Point Island.

*Microprion undulatus* (Linnaeus).—Cape Charles City, Magothy Bay and Smith Island.

*Menticirrhus americanus* (Linnaeus).—Cape Charles City, Magothy Bay and Smith Island.

*Tautoga onitis* (Linnaeus).—Magothy Bay.
Spheroides maculatus (Schneider).—Magothy Bay and Smith Island.

Paralichthys dentatus (Linnaeus). — Cape Charles City, Magothy Bay and Smith Island.

Opsanus tau (Linnaeus).—Magothy Bay.

Gobiosoma bosc (Lacépède).—Long Point Island, under oyster clusters.
THE PURPLE SANDPIPER AT CLEVELAND, OHIO

By Bradshaw H. Swales

It seems desirable to place on record a specimen of *Arquataella maritima* that is in the collection of the Museum of Zoology, University of Michigan. This bird, No. 47105, was secured at Cleveland, Ohio, on September 11, 1883, by H. E. Chubb and is evidently a bird of the year. Although long attributed to the Great Lakes region, actual records are extremely scarce and known specimens even more so. The above record seems to represent the only Ohio specimen extant. Dr. Wheaton says: "Very rare visitor on Lake Erie. Mr. Winslow informed me that a specimen was taken many years since in the vicinity of Cleveland, which was preserved in the Museum of the Cleveland Academy of Natural Science." (Ohio Geological Survey, Vol. 4, 1882, Birds, p. 476.) Whether this specimen is in existence or not I have been unable to ascertain.

Jones (The Birds of Ohio, Ohio State Acad. of Science,
University of Michigan

1903, p. 69), was able to add no further records to the above, and there is no Michigan record.

In Illinois there seems to be only two records for the species. An adult male was obtained on the Lake Michigan shore, near Chicago, November 7, 1871, which was in the collection of Dr. J. W. Velie (Nelson, Birds of Northeastern Illinois, Bull. Essex Inst., Vol. 8, p. 127), and one taken at South Chicago in June, 1895, is in the possession of Mr. Frank M. Woodruff (Auk, 1896, Vol. 13, p. 180). In Wisconsin Kumlien and Hollister (Birds of Wisconsin, 1893, p. 45) state, “In the collection of the Oshkosh Normal School, is a specimen which was said to have been taken at Bay View, Door County, in May, 1881.”
FOREIGN LAND SNAILS IN MICHIGAN

By Bryant Walker

During the last few years several species of foreign snails have been found in the state, and it seems desirable to have them recorded, although as Dr. Pilsbry has well said: "Until naturalized out of doors, these can hardly be regarded as belonging to our fauna, any more than the animals of zoological gardens."

1. *Arion ater* (L.).—In September, 1912, Mr. I. T. Cowles, then living at No. 148 Seyburn Ave., Detroit, reported to me that he had seen a large slug in his garden. Thinking that it might possibly be *Limax maximus* L., which has not yet been reported from the state, I asked him to bring it to me, in case he saw it again. This he did a few days later, and, to my surprise, it proved to be a specimen of this species. This seems to be the only authentic record of the species for North America. The only reference of its occurrence in this country that I have been able to find is one by Grateloup (Distr. Geog. de
la Famille des Limaciens, 1855, p. 8), who lists *Arion empiricorum* Fer., a synonym, from the "Western States." W. G. Binney (Man. Am. L. Shells, 1885, p. 463) says that Grateloup's quotation is "without authority or description," and Taylor, in his recent Mon. Brit. L. and F. W. Shells, II, 1905, p. 192, states that Grateloup's citation "is not confirmed by more recent authors."

The Detroit specimen was, in life, wholly of an old-rose color and with its yellow and black foot-fringe was a striking and beautiful object. Unfortunately the color has entirely faded out since it was placed in alcohol. It would seem to group under the var. *rufa* L. as defined by Taylor (*l. c.*), but it was far from being of the deep red color figured for the subvar. *rubra*.

Mr. Cowles also informed me that the year before he had seen a dark colored slug of the same size in his garden, which would tend to show that the species had survived at least one winter in that locality. Unfortunately the most strenuous "hunting" failed to discover any additional specimens, and, as he moved away the following year, the specimen remains unique. It is now in the Museum of Zoology of the University of Michigan.

2. *Arion circumscriptus* Johns.—On April 12, 1913, Mr. Harold Cummins, then a student in the University, collected a number of this species under boards and other debris around the "Cat Hole," a well-known sink-hole near Ann Arbor. The specimens then sent to me are now in the Museum of Zoology.

This species seems to be rapidly extending its range westward. Taylor (*l. c.*, p. 239), states that in 1904 it was found abundant at Niagara Falls, New York, by T. D. A. Cockerell. Robertson (Nat. Hist. Toronto Region, 1913, p. 290) records it from Toronto, Ontario. And in October, 1917, specimens
were submitted for identification by Mr. H. F. Wilson of the University of Wisconsin, who wrote that the species was doing considerable damage in the gardens at Madison, Wisconsin.

3. *Subulina octona* (Brug.).—In February last, Mr. W. J. Clench, formerly of Cambridge, Massachusetts, and now at the Michigan Agricultural College, Lansing, Michigan, sent in specimens of this species that he had collected in the conservatory at the College. Pilsbry (Man. Con., XVIII, p. 223), has reported it as "introduced at Miami, Florida, and in hot houses in Philadelphia, etc."

4. *Opeas clavulinum kyotense* Pils.—This species was also sent in by Mr. Clench, who found it associated with the preceding.

It has been recorded by Pilsbry (Man. Con., XVIII, p. 137) from Pittsburgh, Pennsylvania, and I have it from a conservatory at Buffalo, New York.

5. *Vitrea lucida*, (Dr.).—A single dead but full grown and quite fresh specimen of this species was found by Mrs. Calvin Goodrich, of Detroit, in the conservatory at Belle Isle Park on March 17th last.

RESULTS OF THE UNIVERSITY OF MICHIGAN-WILLIAMSON EXPEDITION TO COLOMBIA 1916-1917

II. A NEW SPECIES OF AGRIOGOMPHUS (ODONATA)

BY E. B. WILLIAMSON

The genus Agriogomphus was described by de Selys in 1869. Four years later, in 1873, in describing Cyanogomphus, he took the opportunity of making some corrections and additions to the original description. Since then the genus has been identified but two times, in 1903 by Needham, and

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1 A Collecting Trip to Colombia, South America. Miscellaneous Publications, Museum of Zoology, University of Michigan, No. 3, February, 1918.
2 I. Two New Interesting Colombian Gomphines (Odonata). Occ. Papers, Museum of Zoology, University of Michigan, No. 52, April, 1918.
3 Secondes Additions au Synopsis des Gomphines.
4 Troisiemes Additions au Synopsis des Gomphines.
5 A Geneologic Study of Dragon-fly Wing Venation. Proc. U. S. Nat. Mus., Vol. XXVI, p. 738, fig. 27. Of the specimen which served for the figure, Professor Needham has written me: "Adolph Hempel sent it to me from somewhere in Brazil. It was a fragment of a teneral specimen, rolled up in a ball and unrecognizable. I boiled it and obtained two nearly perfect pairs of wings. The specimen lacked the head and the apex of the abdomen and was in such bad condition that I did not preserve it."
in 1909 by Ris, though, in the latter case, the species was not described and named till 1913. De Selys' specimens were females; Needham had a single imperfect male of which only the wings were preserved; and Ris had two females. De Selys' and Needham's material came from Brazil; Ris's specimens were from Argentina.

The fact that no other material which might be referred to Agriogomphus has come to light, is evidence of a sort for the correctness of the determinations by Needham and Ris. But this evidence is weak because of the scanty material.

Ris's papers do not state that he had studied de Selys' type, and his reference, in 1913, to the type as a male (it is really two or more females) indicates that he had not studied them. Moreover his failure to comment on the differences shown by his specimens from the type females, as described by de Selys, makes it seem possible that his determination was based on Needham's figure. For there is no question that the specimens studied by Needham and Ris are congeneric, though there are differences in the triangles.

Comparing Needham's and Ris's material with de Selys' description of the genus, a striking difference is detected in the stigmas,—long, covering four to five cells (de Selys); moderate, covering two and one-half cells (Needham, Ris). The distinctly four-sided triangle of the front wings (Ris)

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6 Coll. Zool. Selys-Longchamps. Libellulinen. Fasc. IX, p. 10, fig. 1. The wings figured are those of the type described and named in 1913.
8 Under the description of the species, Agriogomphus sylvicola, de Selys says, "la reticulation extrement simple," and under the generic description it is stated that the antenodals of the front wing number twelve. For such an insect to have a stigma covering four to five cells is very remarkable and a misprint might be suspected. But nothing is said of this in his corrections published four years later, and in the specific description he again refers to the long stigma.
and the less distinctly four-sided triangle of both front and hind wings (Needham) are not mentioned by de Selys, and his description of the relative lengths of the sides of the triangles does not correspond with their material, and indicates a narrower winged type. Nor can I see that the sectors of the arculus of their specimens agree well with de Selys' description.

My specimens, twenty-three in number, representing two species congeneric with Needham's and Ris's material, show that within a species the triangles are variable in form, and therefore probably worthless for generic distinctions. Characters of the sectors of the arculus are easily misinterpreted and are not always correctly represented in figures. The character of the stigma therefore offers the greatest difficulty to referring all this material to Agriogomphus. For I now know the venation of four species and in all the stigma covers two and one-half cells, while in the type, Agriogomphus sylvicola, which I know only from de Selys' description, the stigma covers four to five cells. This is not so remarkable in itself, but in wings with such reduced venation where such a difference exists, other and more significant differences should be expected.

I have written to Dr. Ris asking him to have a photograph made of the venation of de Selys' type. In the chaotic conditions existing a considerable time must elapse before Dr. Ris can have this done, if, fortunately, my letter on the subject ever reaches him.

For the present I am using Agriogomphus in the sense in which all authors since de Selys have used it. Whether we are right or not must be determined by a study of de Selys' material at Bruxelles.
Agriogomphus hamatus, new species

Description: Abdomen, male 23.5-24 mm.; female 23-24 mm.; hind wing, male 17.5 mm.; female 19-20 mm.

Male.—Rear of head pale yellow, dark brown about the foramen; face and frons above olive green, labrum with the anterior edge straight, parallel to the base, the free borders margined with yellow, which shades into the green, and a median brown spot; frons above with a median basal triangular brown spot, the apex of which may reach the angle of the frons or only half this distance. Vertex and occiput dark olive green or brown; the surface posterior to the postocellar ridge relatively flat, the occiput occupying a relatively large part of the area; the occiput rounded off posteriorly, without any ridge or keel, and passing, at either end, into the swollen areas back of the eyes; these areas are similar to those of species of Cyanogomphus and Ischnogomphus, and, like the rear of the occiput, are sparsely covered with bristle-like hairs.

Prothorax pale yellow, the free edges of the front and hind lobes paler; a small median brown spot on the front border; some obscure markings about the suture between the front and middle lobes; similar in shape to that of the female (Pl. I, figs. 7 and 8).

Thorax greenish yellow, marked with black and brown (Pl. I, fig. 1); above and especially towards the median line the pale color on the mesepisternum is pale dull blue; in bright colored specimens the black median area and the black upper part of the dark stripe on either side of it stand out conspicuously in the color pattern; the pale color of the thorax grows brighter and clearer posteriorly; beneath the same shade of greenish yellow, but much paler.

Abdomen with an annulate, and, for a gomphine, intricate color pattern; sides of 1 and 2 same color as metepimeron,
above darker, dorsal markings on 1 obscure and ill defined, 2 with the base pale dull greenish or bluish and a large apical brown spot, covering about three-fourths of the segment, which is more or less distinctly divided longitudinally in the median line; this spot joined on either side by a lateral apical spot, the lower edge of which reaches the upper level of the auricle; auricle high and short, armed on its posterior edge and inner side with a triple or quadruple rowed area of small black spines, numbering about twenty-five; 3 light yellowish brown with a narrow interrupted brown ring at about two-fifths its length and the apical third or less brown; articulations of 4–7 black; 4–6 yellow at base, the apical third of 4, two-fifths of 5 and three-fifths of 6, black, the pale basal area on each with a narrow black ring near its middle; 7 largely yellow or yellowish, a dorsal basal brown spot about one-fourth the length of the segment; the spined apical border black, shading anteriorly into brown which shades out into the pale color of the segment; 8 and 9 black or dark reddish brown with ill-defined lighter brown areas, especially apically; 10 sometimes similar to 8 and 9 but usually lighter, in brighter specimens orange-brown. Base of abdomen of usual form, tapering from the base to about one-fourth the length of 3, from that point of about uniform diameter to about one-fourth the length of 7, from which point the depressed apical segments widen rapidly, the width of 7 at its apex being to the width of the base in the ratio of 9:4; the apex of 8 in the same ratio is 13; this marks the widest point, the abdomen gradually narrowing to the apex of 10 (basal to the long, posteriorly projecting, snout-like dorsum) which in the same ratio is 9. The length of the segments, measured on the side, at mid-height, in terms of the same ratio are as follows: segment 1, 3; segment 2, 9; segment 3, 24; segment 4, 26; seg-
ment 5, 26; segment 6, 24; segment 7, 18; segment 8, 12; segment 9, 8; segment 10, 5 (measured to the apex just at the level of the lower edge of the superior appendage). Height of segment 6 at apex in same ratio, 5; of segments 7, 8, 9 and 10, each 7.

The superior appendages are dull colored, similar to 10. They are small, slightly inflated, flap-like organs. Their attachment by a narrow base to the membrane which encloses the segment within its denticulated posterior margin, proves conclusively their homology with the superior appendages of the Anisoptera. Their form is shown in Pl. I, figs. 3, 4 and 5.

The dorsal surface is convex, the ventral surface is subapically concave, with the larger part of the surface convex, abruptly constricted at the relatively narrow base. The inferior appendage is represented by a low broad tubercle, less developed than the two inferior parts of the anal segment.

Femora light bluish gray; first femora black above, the color widest and most dense at apex; second femora with the dark color paler, the basal two-thirds brown, the apex dark brown; third femora with the apical fourth or fifth dark brown, a narrow stripe of lighter brown the length of the femora on the mid-dorsal surface. First femora with a row of brown bristles on the postero-ventral edge (these "edges" are only positions, indicated by various rows of bristles, as the femora on all legs are practically round) anterior to which, on the ventral surface, is a longitudinal row of very small black spines, anterior to which is a row of larger spines, increasing in size from the base to about the middle of the row, beyond which point they are about uniform in size, except the most apical one which is about two or three times as long as its neighbors; basally this row is in the mid-ventral line but it gradually passes forward toward the
apex so the apical spine is just beneath the antero-ventral edge. The second femora have a row of brown bristles on both the antero-ventral and postero-ventral edges, and on the ventral surface are two rows of spines which start basally from a little patch of spines on the apex of the trochanter; in the posterior row the spines are small; in the anterior row they are larger, the highest spines near the middle of the row, decreasing in size basally and apically, except the extreme apical spine, which is slender and is about as high as the spines at the middle of the row; at the base the two rows of spines are narrowly separated and they diverge slightly apically; between the posterior row and the row of brown bristles are scattered minute black spines. Third femora with a row of brown bristles along the apical half of the antero-ventral edge, and another row of closer set similar bristles on the postero-ventral edge, which become more scattered and disappear basally; between these rows, on the ventral surface, are scattered small spines beginning with a small patch on the apex of the trochanter; in the apical third of the femora the spines become less numerous and resolve themselves into two rows which are carried to the apex in a position homologous to the rows on the second femora; the anterior apical spine higher and more slender than the others. Tibiae bright yellow dorsally, black ventrally, a more or less distinct brown line on the anterior surface just dorsal to the bristles on the antero-ventral edge; tibiae roughly semicircular in cross section. Tarsi black, second joint yellow dorsally, dullest and most restricted on first tarsi and brightest and most extensive on the third tarsi; tooth on claw small (Pl. I, fig. 6).

Accessory genitalia of relatively simple form. The first hamule is the same color and apparently the same composition as the side of the segment adjoining it; its low simple form is
shown in Pl. I, fig. 2; the second hamule is yellowish green, the ventrally directed apex black, shading out basally. The anterior part of the seminal vesicle consists of two wide-spreading, short horns, one on either side. The anterior lamina is straight. Segment 1 has a ventral median tuft of bristles.

Female.—Differing from the male as follows: rear of head very light brown. Face and frons above duller, bluish-green, markings less distinct, the median spot on the labrum brown or yellow. Occiput with a small blunt horn or prominence at either end (Pl. I, figs. 9 and 10). Prothorax (Pl. I, figs. 7 and 8), pale colored, very light brown above, almost white on the sides. Thorax light dull blue, markings paler than in the male, dark brown to paler rusty brown, the middorsal dark area and the dark stripe next adjoining it distinctly to scarcely darker than other dark markings, the median dark area and the next adjoining dark stripe sometimes separated dorsally and the latter stripe usually without any connection with the antehumeral stripe, but continued below with the lower part of the stripe, which, in the male, is separated from the upper part; in some specimens the dark lateral areas, posterior to the humeral suture, scarcely evident. Abdomen more robust than in the male, apparently patterned similarly to the male; 1 and 2 largely dull light blue similar to the metepimeron; auricle wanting; about the apical half of 5 and 6 are dark, 10 is similar to 9, with more or less pale yellowish or light brown areas, especially apically and opposite the superior appendages. Appendages brown and short. Vulvar lamina dark brown or black, nearly reaching the apex of 9, with a broad short base and two long branches (Pl. I, fig. 11), which may lie nearly parallel, as in the figure, or may have the apices separated a distance equal to two-fifths the length of the lamina. Probably the latter condition results from ovipositing. In length
of abdominal segments the female is like the male; the tapering from the base is continued to the apex of 3; the diameter of 4-6 in the female is about one-half greater than in the male; as the four apical segments are about the same in both sexes, the widening of these segments is less abrupt and conspicuous in the female. The ventral median tuft of bristles on 1 in the male is very weakly developed in the female. Legs light dull brown, the tibiae the same color as the femora, or, in bright colored specimens, the tibiae colored as in the male; the femora with the dark areas somewhat reduced and paler as compared with the male. The female has the spines of the anterior row on the second and third femora larger than in the male; the first femora in the two sexes are very similar.

Male and Female.—Stigma black or dark brown, normally covering two and one-half cells. Venation black, wings clear, usually yellow tinged basally and more rarely along the costal border to the nodus; in one female smoky tinged throughout about the veins. Antenodals in the front wings, 11; in the hind wings, 9. Postnodals in the front wings, 5 or 6, in about equal numbers, and 7 in one female wing; in the hind wing usually 6 but in one male both hind wings have 5, and in one female both hind wings have 7. The amount of variability in the postnodals as compared with the antenodals is striking. In the front wings the number of cells on the anterior side of Cu₁, which do not reach M₄, is 1, rarely 2; and in the hind wing it is 2 in the male, and 2 or 3, in equal numbers, in the female. In the hind wing the number of cells posterior to Cu₂ (=the cells distal to the postanal cells) which do not reach the posterior margin is 1, rarely 2 in the male; and 2 or 3, in equal numbers, in the female.

In the venation of this species the most interesting thing of course is the four-sided triangle. Almost equally interesting is
the amount of variation in the form of this triangle due to the shifting about of the cross-vein between $M_4$ and Cu, which in the ordinary triangle forms its anterior side. This however is what might be expected. Prior to the formation of the usual three-sided triangle the cross-vein, which forms its anterior side, would have no particular attachment point on $M_4$. It might be expected to be as variable as any other cross-vein in an enclosed area. Held posteriorly at the angling of Cu, its anterior end would be free to swing about. If it swung far enough distally a three-sided triangle would result in which none of the enclosure would be formed by $M_4$. It might swing basally so that it would be shorter than the portion of $M_4$ forming the distal part of the anterior side of the triangle, which would now be four-sided. Any position the cross-vein might have between these two extremes would result in a four-sided triangle. The more proximal the attachment of the anterior end of this cross-vein with $M_4$, the better developed the four-sided triangle is.

The triangles of the front wings of *hamatus* may be arranged in a series of four groups; I, the distal part of the anterior side ($M_4$) is about one-half the combined lengths of the distal and proximal (the cross-vein from $M_4$ to Cu) parts of the anterior side; II, distal part more than two-fifths the combined lengths; III, distal part about two-fifths; and IV, distal part about one-third. Two males are in I; two males and two females in II; one male in III; one female in IV; and one female with one wing in III and another in IV. Thus, in the front wings, no individual varies in itself more than from one group to another. A very different condition is found in the hind wings. Here five groups may be arranged in a series:

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I, distal part about two-thirds the combined lengths; II, distal part about one-third; III, distal part about one-fourth; IV, distal part about one-fifth; and V, distal part much less than one-fifth. One male belongs in I and II, another in I and IV, and a female in I and III; one male and one female belong in II, one male belongs in II and IV, another in II and V, and one female belongs in II and III; one female belongs in IV.

The following brief color notes were made from recently killed specimens: Male.—Eyes above bright green shading through bluish to blue gray below. Thorax above black, pale color grayish or bluish green, sides brighter, becoming bright yellowish green below and behind. Abdominal segments 1 and 2 olive, broadly grayish blue at their juncture; 3-6 similar to each other, progressively darker posteriorly, bases greenish, apices black, narrow interrupted ring black or dark brown; 7 largely pale bluish green, almost whitish; 8-9 black; 10 brown, translucent. Female.—Eyes dull green above, dull blue beneath. The dark color of thorax and abdomen is brown and the pale color is gray or bluish gray; segment 7 clearer bluish: 8-10 black.

Habitat: Colombia.

Type: Fundacion, Department Magdalena, Colombia; January 10 and 14, 1917; 13 males and 9 females, collected by J. H. and E. B. Williamson; type male and allotype female, January 10, in the collection of E. B. Williamson.

Habits: I have described elsewhere the locality where these specimens were collected. This was a short distance

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39 Note this corresponds with group III in the front wings. In front wings, the four-sided triangle is better developed and is less variable than in the hind wings.

above the town on the left bank of the Rio Fundacion. The spot was reached by following trails through the woods and not by going up the river directly so I can only roughly estimate the distance at one to two miles. The river banks were clothed with a dense impenetrable growth of Heliconias, bamboos and palms. At the place where the specimens were found the river bank was slightly lower for a short distance and across this low area the river had swept, during some recent high water period, into a large jungle-surrounded lagoon only a short distance from the river. The flow of water left the numerous Heliconias and some smaller plants bent down and there were a few dead tree tops scattered about, but the jungle, elsewhere present, was largely wanting, admitting both light and air, and making it possible for the collector to move about freely. Knowing how productive such locations often prove, we examined it just before noon as we were going up the river, but without detecting any gomphines, though it is not impossible they may have been present. As we returned in the afternoon, we caught our first male along the jungle path near the overflow area. Finding no more along the path, we spent the next hour, from three-thirty to four-thirty p. m., collecting in the open area and succeeded in taking ten more specimens. The afternoon was cloudy without any sunshine. The place was visited a second time four days later at about the same time of day, and the same number of specimens was secured. During our second visit, the day was bright and sunny, but the jungle surrounding the open area threw much of it in shade.

The gomphines were usually resting on twig tips or similar perches from six inches to two and one-half feet high, lower locations being preferred. No difference was detected in the actions of the sexes. They were not wary, but once flushed,
the flight was followed with difficulty and the individual was usually lost. An Anatya was flying at the same place and several times in our search one of these libellulines was mistaken for the gomphine, but the error was detected in every case before the Anatya was netted. On the other hand no gomphines were ever mistaken for libellulines. Years ago I had a similar experience in Ohio the day I first saw Celithemis elisa alive. It was flying among a large number of Celithemis eponina. In my anxiety to get a number of the more beautiful and rarer species, I netted by mistake a considerable number of the commoner species. But when a specimen of elisa really appeared it was "spotted" at once beyond all question. Today, when I no longer care to catch either, they are readily distinguishable even at a distance.

The proximity of the river and lagoon to the area where we found the adult gomphines left the habitat of the larvae in doubt. In fact we have no assurance that the larvae lived in either, though this was assumed, as careful search at both places yielded no exuviae. Our failure to find them may be explained, however, on other grounds than their absence.

The absence of the male inferior abdominal appendage and the apparently functionless character of the superior appendages, at least as grasping organs, raise the question of the manner of the grasping of the female by the male during copulation. The unusual form of the tenth abdominal segment of the male, and the absence of peculiar modifications of the head and prothorax of the female show at once that this grasping is accomplished in some manner hitherto unknown among Odonata. Dr. Walker has kindly studied a male and female specimen and I quote from his letter: "I soon decided that the hooks of the tenth segment of the male engage either the posterior margin of the prothorax or of the occiput, and I finally
decided the latter was the more probable. In trying to fit the hooks on the hind margin of the prothorax it did not occur to me that the apex of 10 would rest on the dorsum of the head (an opinion I had expressed to Dr. Walker in a letter); I thought it would have to lie behind the head, and I found it was too long for this. If the dorsum of 10 is placed on the prothorax of the female with the hooks behind the posterior margin, the apex of 10 is too low to rest on the head. If the apex is elevated sufficiently to rest on the female's occiput, the dorsum of 10 and the prothorax are widely separated, and the apical dorsum of segment 9 may possibly be closely against the middorsal thorax carina of the female. My idea is that the hooks of 10 engage the occiput of the female, the dorsum of the segment resting on top of the head. This position involves no difficulties in regard to contact between parts of the male abdomen and the thorax of the female, but has the disadvantage that the parts of the female grasped by the male are as fixed as those of the latter. An attempt by the female to free herself by a forward and downward movement of the head could however be resisted by a forward and upward pull of the male abdomen. The occiput of the female is for the most part rounded but at each postero-lateral angle there is a short projecting tooth, separated from the rear of the eye by a notch. These teeth or notches are the right distance apart to be grasped by the hooks of the male, and they are wholly absent in the male. This is the chief reason why I incline towards this theory rather than the other one. It does not however account for the snout-like projection of the apex of 10 which seems unnecessarily long for either method, though, according to your plan the long apex might allow a little play of the female's head beneath it without permitting the latter to escape."
My idea as to the method of grasping is indicated in the above quotation. Dr. Walker thinks it more probable that the hooks engage the rear of the occiput. I thought it more probable that they engage the rear border of the prothorax. We arrived at our opinions independently. I think greater weight should be given Dr. Walker's opinion than my own, as he has studied the matter carefully and his experience in the subject is greater than mine. However, it should be noticed that the teeth or projections on the occiput of the female would serve as lateral guards for the snout-like apex of 10 in my plan. If, therefore, as Dr. Walker assumes, their presence in one sex, and not in the other, implies a function, my plan is not weakened by this. As to males of other species in the genus we know nothing, but similar modifications of the tenth segment of the male should be expected. Yet the female of *infans* has no such occipital projections. It is not impossible, however, that the male of *infans*, when discovered, will be found to have some structures developed on the dorsum of the tenth segment for engaging the depressions in the rear of the head of the female.

It seems to me, however, that the weakest point in Dr. Walker's plan is one to which he calls attention—the immobility of the parts involved. The retention of the female by the male under such circumstances would be almost impossible. Moreover the plan leaves the snout-like apex of 10 without any function. My idea was that, in seizing the female, the male would place this apex on the dorsum of her head, pushing the rear of the head down, so the occiput would be brought more in line with the prothorax, and, this accomplished, the hooks would be snapped behind the hind border of the prothorax. The push upward, by the female's head, on the apex of 10 would, I think, securely bind the two sexes together. But
against my plan is the unmodified character of the prothorax, and the fact that such a coupling involves a greater departure from the usual gomphine method than Dr. Walker's plan necessitates.

One female specimen has the head of a bee attached to the left hind tibia. The apex of the tibia is broken off, the mandibles of the bee gripping the tibia firmly near its base. Through the kindness of Mr. Currie this specimen was submitted to Mr. J. C. Crawford of the United States National Museum who reports that "the head is that of one of the stingless honeybees, Trigona sp. These bees, of which there are many species in the tropics, are social in their habits, and build nests, combs, etc., and store honey. It is possible that the dragonfly was attacked by the bee when in the vicinity of its nest, but more probably the dragonfly captured the bee which seized its captor by the leg before being dispatched."

Remarks: Two species of Agriogomphus, based on female specimens only, are known: sylvicola de Selys, and infans Ris. The male figured by Needham, referred to in a footnote above, was never named and only the wings are preserved. It is fortunate, in view of the fact that colors and even color patterns become obscure in dried specimens of these gomphines, and that only females have been described, that good venational characters are available for their recognition. Hamatus is separated at once from sylvicola by the short stigma and the well-developed four-sided triangles. It is also a smaller species than sylvicola. In the hind wing the number of cells posterior to Cu₂ which do not reach the posterior margin is one, rarely two, in the male, and two or three in the female of hamatus; in Needham's figure (male) there are four, and in Ris's figure (female) there are six. The triangles of hamatus are more
conspicuously four-sided; and *infans* and *hamatus* differ in the thoracic color pattern.

*Agriogomphus hamatus* is the smallest gomphine known; in no other gomphine is the triangle so distinctly four-sided; and it is the only dragonfly in which the male abdominal appendages have become functionless as grasping organs, this function being taken over by unique modifications of the tenth abdominal segment.

**Agriogomphus** species

*Description*: Abdomen, female 24 mm.; hind wing, female 20 mm.

Female.—Similar to *hamatus* but separated at once by the form of the occiput. Thoracic dark colors brighter, a rusty brown; the dark stripe on either side of the median dark area joined above to that area, and, a short distance below, broadly joined to the dark antehumeral stripe. Abdominal patterns apparently the same, the dark apices of the segments possibly darker, noticeable especially on 6, where the apex and the base of 7 are black. Vulvar lamina similar to that of *hamatus* but specifically distinct, the branches slenderer, slightly longer, with their outer edges more nearly parallel, meeting the posterior edge of the base at nearly a right angle instead of in a long curve.

Stigma black, covering two and one-half cells (two in one front wing). Venation black, wings clear, yellow tinged basally and anteriorly as far as the nodus. Antenodals in front wings, 10 or 11, in hind wings, 9; postnodals in front wings, 5 or 6; in hind wings, 5. In the front wing the number of cells on the anterior side of Cu₁, which do not reach M₁, is 1; and in the hind wing it is 1 or 2 (2 or 3 in females of *hamatus*). In the hind wing the number of cells posterior to Cu₂, which
do not reach the posterior margin, is 4 (2 or 3 in females of *hamatus*). In the front wings the distal part of the anterior side of the triangle is two-fifths, or a little more, of the combined lengths of the distal and basal parts of the anterior side; in the hind wing it is about one-third (see under *hamatus* for variations of this character in that species).

**Habitat:** Colombia.

**Type Specimen:** One female; Cristalina, Department Antioquia, Colombia; February 14, 1917; J. H. and E. B. Williamson, collectors; in the collection of E. B. Williamson.

**Remarks:** It is certain this female belongs to an undescribed species but to give it a name now is more likely to prove a hindrance than a help to future students. It was captured along the Quebrada Sabaleticus and was supposed at the time to be the same as the species collected a month earlier at Fundacion. A male also was seen along the Rio Diez-y-ses on February 13, but escaped. A hasty search was made at both the Cristalina locations, but no more were seen, and, as we thought it the same as the Fundacion species, and other interesting things were demanding attention, we did not take the time and energy necessary to collect more specimens. Our mistake was detected only during the preparation of this paper.
PLATE I

Figure 1, diagramatic; 9 and 10, magnification; 2-5, 8, and 11-13, more magnified; 7, still more magnified; and 6, the greatest magnification.

Figures 1-6. *Agriogomphus hamatus*, all of the type male. Fig. 1, diagram of thoracic color pattern; 2, abdominal segment 2, with accessory genitalia, left side, in profile; 3, dorsal view of segment 10 and apex of 9; 4, profile of segments 9 and 10; 5, posterior view of segment 10, the inferior appendage partially concealed by the dorsal apex of 10; 6, third tarsal claw.

Figures 7-12. *Agriogomphus hamatus*, female. Fig. 7, left profile of prothorax; 8, dorsal view of prothorax; specimen taken January 14; 9, rear of head; 10, dorsum of head, same specimen; 11, ventral view of abdominal segments 9 and 10 and apex of 8 of allotype female, showing vulvar lamina; 12, dorsal view of same segments as 11; note the normal tenth segment of the female as compared with the male, 3.

Figure 13. *Agriogomphus* species, female, Cristalina, Colombia, February 14, 1917; dorsal view of the occiput and part of the vertex; compare with 10.
PLATE II

Figure 14. *Agriogomphus hamatus*, male, Fundacion, Colombia, January 10, 1917.

Figure 15. *Agriogomphus hamatus*, female, Fundacion, Colombia, January 10, 1917.

From wing photographs by Mr. C. H. Kennedy, Cornell University.
A REVIEW OF THE FISHES DESCRIBED IN COPE'S PARTIAL CATALOGUE OF THE COLD-BLOODED VERTEBRATA OF MICHIGAN

By Henry W. Fowler

In 1864 Professor E. D. Cope published the first part of his article included under the above title, and the second part was concluded in the following year. Since Agassiz's account of the fishes in his work on Lake Superior, little was known of the Michigan fauna until Cope's work appeared. Though treating mainly of Michigan, various new forms from elsewhere in the United States are described in foot-notes, and the work is thus expanded to a wider scope. The Michigan material was obtained from the Flint Scientific Institute, the State Agricultural College and the State Collection through Prof. Manly Miles. While many of the specimens were ob-

2 L. c., 1865, pp. 78-88.
tained for the collection of the Academy of Natural Sciences of Philadelphia years ago, some others were more recently received with Cope’s collections shortly after his death.

In 1917 Dr. Alexander G. Ruthven suggested that I study over our Michigan material and furnish him a report, as it would be desiderata in connection with the local ichthyological explorations now being carried on. Accordingly I searched our collections and have been able to present details concerning types or specimens of sufficient importance. The entire list of Cope’s fishes is the basis of this paper, and such references as pertain to his materials are included. In cases where his species are no longer represented by specimens no comment is made. A small collection made about 1901 at Pequaming, Lake Superior, in Baraga County, by Mr. Morgan Hebard, is also included.

PETROMYZONIDÆ

Ichthyomyzon concolor (Kirtland)


Entosphenus epypterus (Abbott)


Two examples in poor preservation, both received from Cope, and the Grosse Isle one, a nearly metamorphosed larva, obtained by Prof. Charles Fox. They agree with other material from New Jersey, Pennsylvania and Iowa.

Two small lampreys without data and belonging to the preceding species may have come from Michigan. Mr. H. Cummins informs me that the example I recorded in 1907 as the present species is also the preceding species.
Occasional Papers of the Museum of Zoology

LEPI50STEID.E

*Lepisosteus osseus* (Linnaeus)

*Lepidosteus huronensis* Cope, l. c., p. 276. Saginaw Bay.

Possibly some of the examples without data I recorded in 1910 as *L. huronensis* may be Cope's Saginaw Bay material.

*Cyliindrostenus platostomus* (Rafinesque)


*Lepidosteus oculatus*, Cope, l. c. (on type).

AMIATID.E

*Amia calva* (Linnaeus)

*Amia calva*, Cope, l. c.

A number of examples without data doubtless in part refer to Michigan examples.

SALMONID.E

*Cristichom* *namaycush* (Walbaum)

*Trutta namaycush* Cope, l. c., 1865, p. 80. Saginaw Bay.

An undetermined species of *Coregonus* is also listed by Cope, but no examples are in the Academy.

THYMALLID.E

*Thymallus tricolor* Cope


Head 4 1/2; depth 4 3/5; D. viii, 14; A. iv, 9, 1; P. 1, 15; V. 1, 9; scales in lateral line 80 to caudal base and 3 more on
latter; 10 scales above 1, 1, 8 below; 31 predorsal scales; head width 2 2/5 its length; head depth at occiput 1 4/7; snout 3 3/4; eye 3 3/4; maxillary 2 1/2; interorbital 3 4/5; mandible 2; first branched dorsal ray 1 3/4; first branched anal ray 2; least depth of caudal peduncle 2 3/4; pectoral fin 1 4/7; ventral 1 3/4; lower caudal lobe about 1 1/6.

Body elongated, compressed, profiles similarly convex, apparently deepest at ventral origins and edges convex. Caudal peduncle compressed, least depth about 1 3/4 its length.

Head compressed, profiles similar, flattened sides not converging above or below. Snout slightly convex over surface, its profile a trifle convex and basal width about 1 1/4 its length. Eye a little ellipsoid, high or close to upper profile, at first 2/5 in head. Mouth moderate, gape short and horizontal. Maxillary well inclined, reaches back opposite front pupil edge, its greatest distal expansion 2 2/3 in eye. Teeth in jaws small, conic, of about uniform size, curved inward, series separated in front of jaws and all more or less concealed within thickened lips. Series of about 6 teeth in each premaxillary edge inside in front. Also a series similarly along each anterior maxillary edge. Small patch of small teeth on front of vomer and each palatine roughened with similar teeth, these most developed anteriorly on bones. Tongue smooth, depressed, edge free in front and along sides, rather broad front rounded. Mandible shallow in front, rami well elevated inside mouth anteriorly and equal with snout tip in front. Front of each jaw entire, mouth transversely horizontal as viewed from before. Nostrils about midway in snout. Interorbital broadly depressed. Upper maxillary edge slips below narrow, straight and oblique preorbital edge. Postorbital width half
of eye diameter. Hind preopercle edge evenly convex, free. Opercle width 1 1/5 its depth.


Scales rather small, disposed in even longitudinal series parallel with lateral line, mostly of about uniform size, cycloid and each scale well exposed. Preventral and front predorsal regions finely scaled though breast anteriorly naked. Ventral with scaly axillary flap. L. 1. complete, about midway along side and each scale with a simple tube extending about first half over each exposure.

Dorsal origin about first third in space between snout tip and caudal base, graduated up to first branched or longest ray, other branched rays but slightly shorter. Adipose fin origin about midway between depressed dorsal tip and caudal base, fin 4 to caudal base. Caudal forked, lobes pointed, about equal. Anal origin a little nearer last branched dorsal ray than caudal base, first branched ray longest and falling a little short of last when depressed, fin 1 2/3 to caudal base. Upper pectoral rays longest, fin about half way to ventral. Latter inserted about opposite middle of dorsal base, fin half way to anal origin. Vent?

Color in alcohol faded, largely dull or pale brownish, silvered or whitish below. Fins all pale brownish and all medianly and terminally with somewhat dusky shades. Iris brownish.

Length about 179 mm.?

No. 7,796. A. N. S. P., type of Thymallus tricolor Cope. Au Sable River, Michigan. E. D. Cope. This example in very poor preservation several years ago, when the above description was made.
Another from the same locality (Smithsonian Inst. No. 11,088) also in poor preservation. Head about 4 3/5; depth about 4 3/5; D. VIII, 14; A. IV, 9; scales in 1. l. 80 to caudal base and 5 more in latter; 9? scales above 1. l., 8 below; 28 predorsal scales; length about 242 mm.

Head 5 1/6; depth 4 2/5; D. VIII, 14; A. V, 10, 1; scales 86 in 1. l. to caudal base and 5 more in latter; 9 scales above 1. l., 9 below; 25 predorsal scales; snout 4 in head measured from upper jaw tip; eye 4; maxillary 2 3/5; interorbital 4 1/8; last dorsal ray 1 2, 5; pectoral 1 2/5; ventral 1 2, 5; least depth of caudal peduncle 2 2/5; length 318 mm. Dried skin from Michigan (J. A. Shultz). It shows a few small dusky spots at the front costal region, all well separated.

ICTALURIDÆ

Ictalurus punctatus (Rafinesque)

Ictalurus gracilis Cope, l. c., 1864, p. 276.

Anceirurus natalis (Le Sueur)

Anceirurus natalis Fowler, l. c., 1915, p. 207. Oakland County.

Anceirurus cupreus Cope, l. c., (same material).

One example in the collection.

Anceirurus vulgaris (Thompson)

PLATE I

Head 3 1/3; depth 4; D. I, 5, 1; A. VI. 14, 1; snout 2 4/5 in head measured from upper jaw tip; eye 9; maxillary 3; interorbital 2 1/8.

Body long, well compressed, deepest at dorsal origin. Head well depressed, much wider than deep. Snout broadly de-
pressed and its length about $\frac{3}{5}$ its width at front of eye. Eye small, largely lateral, ellipsoid, and hind edge well before center in head length. Mouth broad, lower jaw well protruding in front. Teeth fine, in villiform bands in jaws. Maxillary barbel reaches pectoral origin, nasal barbel $2 \frac{1}{2}$ times eye length, outer mental barbel $1 \frac{3}{4}$ to pectoral origin and inner $2 \frac{1}{2}$ in same space. Upper surface of head and interorbital rather convexly elevated. Space unossified between end of occipital process and front of dorsal plate slightly greater than horizontal eye-diameter. Gill-rakers $5 + 8$, short points, longest about $\frac{3}{4}$ of eye. Humeral process finely and rather obsolescently rugose. Skin smooth. Dorsal inserted midway between tip of lower jaw and first fourth in adipose fin length, and depressed fin about half way to adipose fin. Dorsal spine slender, edges smooth, about as long as snout. Adipose fin very slightly shorter than dorsal spine. Anal inserted a little nearer caudal base than pectoral origin. Caudal truncate. Pectoral reaches $1 \frac{3}{4}$ to ventral, spine short, smooth and but a trifle longer than snout. Ventral inserted about midway between caudal base and snout tip, fin reaches anal.

Color in alcohol largely uniform brownish, belly and under surface of head faded whitish. Iris grayish. Barbels all more or less brownish. Fins also brownish.

Length 272 mm.

Only one example, obtained April, 1859, in Saginaw Bay, E. D. Cope.

_Noturus flavus_ Rafinesque


Two examples now in the collection with above data.
University of Michigan

Catostomidae

Carpiodes thompsoni Agassiz

*Carpiodes thompsoni* Cope, l. c., p. 285. Saginaw Bay.

*Carpiodes thompsoni* Fowler, l. c., 1913, p. 46 (above material).


One Saginaw Bay example in the collection.

*Carpiodes selene* Cope

PLATE 2


*Carpiodes selene* Fowler, l. c., p. 47 (types?).

Head 4; depth 2 1/3; D. V, 21, 1; A. IV, 7; P. 1, 14; V. 1, 8; scales 33 in lateral line to caudal base and 4 more on latter; 8 scales above l. l., and 5 below to ventral origin (6 to anal origin); 15 predorsal scales; head width 1 3/4 its length; head depth at occiput 1 1/8; snout 3 1/3; eye 4; mouth width 4 2/5; snout tip to hind maxillary end 3 3/4; interorbital 2 1/6; fourth simple dorsal ray 1 2/3; fourth simple anal ray 1 1/6; pectoral 1 2/7; ventral 1 1/10; least depth of caudal peduncle 1 2/3.

Body deep, compressed, back elevated, so that predorsal well convex but after dorsal origin sloping gradually down. Predorsal edge constricted, not sharply trenchant, and other edges all rounded convexly. Lower profile but slightly convex, much less so than upper. Greatest depth at dorsal origin. Caudal peduncle well compressed, length about 3/4 its least depth.

Head moderately small, broad, sides slightly convex, but very slightly convergent below, and upper profile much more inclined than lower. Snout very obtuse, with slight anterior
depression, its front profile nearly evenly semicircular, surface generally convex, and length from middle of front snout extremity to eye about 3/5 its width. Eye a little ellipsoid, rather high, and center falls about first third in head. Mouth small, transversely crescentic, opens down and forward. Maxillary small, reaches back trifle beyond front pupil edge though not quite to eye center. Lips rather thick and fleshy, moderately broad, with small papillae and obsolete plications. Jaw edges obtuse, broad. Mandible shallow in front, rami well elevated inside mouth. Tongue adnate, thick, fleshy, depressed. Nostrils together, close before and about opposite eye center, anterior large pore and posterior larger and with slight cutaneous flap in front. Interorbital broad, rather unevenly convex, depressed in front. Cranial bones somewhat cavernous. First suborbital nearly of equilateral triangular form, length 1 1/4 in eye. Second suborbital much smaller and narrower, and third equally narrow, though its length nearly equals eye. Last also with very obsolete striae. Opercle and subopercle strongly striate, former with width about half its length.

Gill-opening forward about last fourth in head length. Gill-rakers about 30 + 17, slender, 1 4/5 in eye. Filaments 1 1/2 in eye. Pseudobranchiae obsolete, less than filaments. Branchiostegals 3, robust, median a little more enlarged or bulky than others. Isthmus width 1 1/10 in eye.

Scales large, moderately imbricated, of mostly uniform size, disposed in series parallel with 1. 1., and each with many radiating striae. Scales on breast but little smaller than others, though those along bases of dorsal and anal smallest. Scales on base of caudal rather small. Axillary ventral scaly flap scarcely developed. L. 1. complete, median along side, inclined little below middle of caudal peduncle side. Tubes simple, extend horizontally to hind scale edges. No tubercles.
Dorsal origin nearer snout tip than caudal base, fifth simple ray longest, prolonged back far as tips of median caudal rays. Simple dorsal rays not especially osseous. Anal inserted little nearer ventral base than caudal base, fourth simple and first branched rays subequally longest, and fin depresses back slightly beyond caudal base. Caudal well forked, upper lobe longer or 2 1/3 in head and trunk, both lobes sharply pointed. Pectoral broad, slightly over half way to ventral. Ventral origin about opposite second branched dorsal ray base, fin reaches vent close before anal.

Color in alcohol dull or uniform brassy-brown. Iris brownish.

Length 293 mm.

No. 6,647, A. N. S. P., cotype (type) of Carpiodes selene Cope. Probably Root River, Michigan. E. D. Cope.

Another cotype. No. 6,648, A. N. S. P., same data, shows: head 4; depth 2 2/7; D. v. 25, 1: A. iv. 7, 1; scales 33 in lateral line to caudal base and 4 more on latter; 8 scales above l. l., 6 below to anal origin; 16 predorsal scales; snout 4 1/5 in head; eye 3 5/6; mouth width 4; interorbital 2 1/3; length 236 mm.

Catostomus nigricans Le Sueur


Moxostoma aureolum (Le Sueur)


One from Saginaw Bay in the Cope collection.
Occasional Papers of the Museum of Zoology

Cyprinide

Campostoma anomulum (Rafinesque)

PLATES 3 AND 4


Campostoma mormyrus Cope, l. c., p. 284. Bruce, Macomb County.

Campostoma gobionium Cope, l. c., p. 284. Bruce, Macomb County, and Grosse Isle.

Head 4; depth 3 1/8; D. III, 7, 1; A. III, 6, 1; scales 46 in lateral line to caudal base and 3 more on latter; 8 scales above l. l., and 7 below; snout 2 4/5 in head; eye 4 1/2; maxillary 3 7/8; interorbital 2 9/10; first branched dorsal ray 1 1/3; anal ray 1 1/2; least depth of caudal peduncle 2 1/8; pectoral 1 1/4; ventral 1 3/7; teeth 4 - 4. Body well compressed, upper profile more evenly convex than lower, deepest at dorsal origin, edges rounded. Caudal peduncle compressed, least depth about 1 5/7 its length. Head compressed, upper profile little more convex and inclined. Snout about as long as broad, convex, protruding a little. Eye little longer than deep, about first 3/7 in head. Mouth inferior. Mandible flattened below, horny edge depressed or flaring out. Maxillary not quite reaching eye, reaches hind nostril. Tongue obsolete. Nostrils close, near eye. Interorbital broadly convex. Rakers about 10 + 22?, short weak fleshy points. Pseudobranchia equal filaments, latter about 4/5 of eye. Predorsal scales 18, scarcely reduced. L. l. complete. Dorsal inserted midway between snout tip and caudal base. Anal inserted opposite depressed dorsal tip, nearer ventral origin than caudal base. Pectoral 4/5 to ventral, latter inserted before dorsal or nearer snout tip than caudal base, about 2/3 to anal.

Color in alcohol brownish above, faded paler, especially be-
low. Fins pale. Body overshot with brassy or light reflections.

Length 78 mm. (caudal damaged).

No. 5,989, A. N. S. P., type ? of C. mormyrus Cope. Bruce, Macomb County, Michigan. Though this example is a little larger than the one described by Cope, which is said to be about 2 1/2 inches long, possibly his statement is a slip for 3 1/2 ? It agrees in almost every respect with his short diagnosis, and his label states that it is from the Miles collection.

Head 4; depth 3 1/4; D. iii, 7, 1; A. iii, 6, 1; scales 50 in lateral line to caudal base and 3 more on latter; 8 scales above l. l. and 7 below; snout 3 1/10 in head; eye 4; maxillary 3 3/5; interorbital 2 1/3; least depth of caudal peduncle 2 1/5; teeth 4-4? Body and head compressed, back a trifle convexly elevated. Snout little broader than long. Eye little longer than deep, about first 3/7 in head. Mouth inferior, horny edges of jaws depressed. Predorsal scales 22. L. 1. complete. Dorsal inserted about midway between front nostril and caudal base. Anal inserted nearer ventral base than caudal by space equal to interorbital, falls well behind dorsal base. Ventral inserted but trifle before dorsal origin.

Color in alcohol faded brownish, paler below, without markings. Fins plain pale brown.

Length 48 mm. (caudal damaged).

No. 5,986, A. N. S. P., cotype? of C. gobioninum Cope, Grosse Isle, Michigan. This specimen is marked as type but Cope says “one specimen is three inches long.” It largely agrees, especially in squamation, etc.

Campostoma brevis Haseman has been described as a distinct species.3 It is said to differ from C. anomalum in the

shorter alimentary canal, which in a specimen 82 mm. long (without caudal) had the intestines 150 mm. long. In C. anomalum 81.5 mm. long (without caudal) the intestines were 360 mm., while in another 72 mm. long they were 530. A breeding male from western Pennsylvania 145 mm. long shows the intestines 515 mm. That the length of the intestines is quite variable is unquestionable. In C. anomalum it is claimed that the intestines are always dark and break quite easily, while those of C. brevis are white and not so fragile. My examples of C. anomalum certainly show both conditions, and also many were more or less wrapped in fatty tissue. Also in C. anomalum the alimentary canal wraps around the air-bladder many times, though my material shows it variable in this respect. Sometimes half the number of folds, or a half dozen or more may encircle the air-bladder. In no case could only one or two coils about the air vessel be detected. Possibly an examination of a large amount of material may disclose such a condition. It is also claimed for C. brevis that the other folds are not spiral but longitudinal, and in this both conditions were noticed, though the lengthwise folds variable. Further, my material often showed the anterior folds variable, as several were even noticed encircling the hind portions of the liver, and others showed them loose or inclined. Some dissections revealed the alimentary canal like a continuous even coil, even posteriorly or where the air-bladder did not extend. Often the coils were between a dozen and eighteen to twenty in number.

An examination of the above typical nominal species described by Cope shows that they fall within the limits of C. anomalum in the arrangement of their alimentary canals, which have a dozen or more coils and half at least around the air-
bladder. Granting *C. brevis* is distinct on the basis of the modified alimentary canal, it is certainly covered in all other characters by my series of *C. anomalum*.

**Hybognathus muchalis** Agassiz


**Pimephales promelas** Rafinesque


*Pimephales milesii* Cope, l. c. Grosse Isle, Detroit River.

Head 3 3/5; depth 3 2/3; D. III, 7, i; A. III, 6, 1; scales 40 in median lateral series to caudal base and 2 more on latter; about 14 scales transversely between dorsal and anal origins; 22 predorsal scales; head width 1 4/7 its length; head depth 1 1/3; snout 3; eye 3 7/8; maxillary 3 2/3; interorbital 2 1/3; second branched dorsal ray 1 3/4; second branched anal ray 2 1/4; least depth of caudal peduncle 2 1/8; upper caudal lobe about 1; pectoral 1 2/5; ventral 1 3/4.

Body rather fusiform or with similar profiles. Least depth of caudal peduncle 1 3/4 in its length. Head rather broadly conic, sides somewhat compressed or flattened though not constricted below. Snout broadly convex, length 2/3 its width. Eye circular, high and about first 2/5 in head. Maxillary inclined, reaches about opposite hind nostril. Lips fleshy and mandible rather broad, not very convex. Nostrils together on snout, above and just before eye. Interorbital broadly convex, depressed medianly. Preopercle with rather abrupt angle. Preorbital about as long as eye. Teeth 4 - 4, slender, scarcely hooked, tips pointed, with well developed concave grinding surfaces. L. I. present only as several tubes anteriorly and extending about half way to dorsal. Dorsal origin nearer caudal base than snout tip by length of latter. Anal origin inserted
just behind last anal ray base, fin small. Pectorals reach about 2 3/4 to ventrals. Latter inserted trifle before dorsal origin or about midway between front nostril and caudal base.

Color in alcohol brownish, becoming paler on sides and still more so below. Iris brassy. Fins all pale brownish white.

Length 52 mm. (caudal damaged).

Lansing, Michigan (Prof. Manley Miles), E. D. Cope.

The type of *Pimephales milesii* Cope I have not located.

**Pimephales notatus** (Rafinesque)


Eight examples from Grosse Isle (Prof. Fox) and one from Ann Arbor. These all agree with large series of examples from the Middle Atlantic States, and the intestine appears to average 1 1/2 times the length of the fish. *Pimephales anuli* Kendall also agrees in its similar intestine but differs in its deeper body and incomplete lateral line, characters in which it approaches *Pimephales promelas*.

**Semotilus atromaculatus** (Mitchill)

_Semotilus corporalis_ Cope, l. c., p. 277. Near New Hudson, Oakland County; Swartz Creek, Genesee County; Grosse Isle.

Nineteen examples from Swartz Creek, Genesee County; Grosse Isle and Houghton Lake.

**Leuciscus elongatus** (Kirtland)

**PLATE 5**

*Squalius proriger* Cope, l. c., p. 280. _Exact locality in Michigan not stated._

Head 3 3/4; depth 4 2/5; D. III, 7, 1; A. III, 8, 1; scales 62 in lateral line to caudal base and 3 more on latter; 25 predorsal scales; 10 scales above 1. l. to dorsal origin, 7 below to

anal origin; snout about 3 in head measured from upper jaw tip; eye 3 3/5; maxillary 1 4/5; interorbital about 3 1/2.

Body elongate, well compressed and greatest depth apparently at dorsal origin. Caudal peduncle compressed, least depth about half its length. Head conic, pointed, rather broadly convex above and becomes scarcely constricted below convexly. Snout long, convex and its length about 7/8 its width. Eye circular, high and a trifle anterior in head. Mouth large, well inclined so that profile more oblique than that of snout above. Mandible large, protruding. Maxillary long, slender, more or less concealed and reaches a little beyond front edge of pupil though not quite to middle. Nostrils superiorly lateral on snout, posterior larger and in crescent. Interorbital space rather broadly convex. Preorbital large, its width but a trifle less than its length, and latter 1 1/5 in eye. Gill-rakers few weak short points. Teeth ? ? - 4, 1?, hooked, slender, without grinding-surfaces. Scales moderately small, disposed in lengthwise rows parallel with l. l. and not crowded before dorsal. L. l. of simple tubes, continuous and a little decurved at first. Dorsal origin little nearer caudal base than snout tip. Anal inserted just behind last dorsal ray base.

Color faded uniform brownish in alcohol. Fins pale. Iris slightly silvery.

Length 73 mm. (caudal damaged).

No. 22,316, A. N. S. P., cotype of Squalius proriger Cope. Exact locality in Michigan not stated. E. D. Cope. This specimen is greatly damaged.

Leuciscus neogaeus (Cope)

PLATE 6


Head 3 3/5; depth 4; D. III, 8, i; A. III, 7, i; scales about 76 in lateral line to caudal base and 4 more on latter; tubes in l. l. about 28; 45 predorsal scales; 18 scales from near end of l. l. obliquely up to dorsal origin; 10 scales obliquely from ventral origin to l. l.; head width 1 7/8 its length; head depth at occiput 1 2/7; snout 4; eye 3 1/3; maxillary 2 3/5; interorbital 2 3/4; first branched dorsal ray 1 1/2; anal ray 1 7/8; least depth of caudal peduncle 2 1/3; lower caudal lobe about 1 2/7; pectoral 1 3/5; ventral 1 4/5.

Body rather robust anteriorly, predorsal profile well convex. Caudal peduncle rather stout, well compressed, its least depth about half its length. Head robust, more especially broad and convex above. Snout broadly convex, length about 3/5 its width. Maxillary reaches front pupil rim. Tongue scarcely free. Preorbital small, its length about 1 1/2 in eye, and other suborbitals narrow. Gill-rakers 2 + 6. Teeth 2,5 - 4,2, without grinding surfaces. Scales a little smaller along dorsal and ventral edges of body. L. l. only extending to opposite dorsal origin. Anal inserted just behind base of last dorsal ray. Pectoral reaches 3/5 to ventral and latter not quite to anal.

Color in alcohol brownish on back, sides and lower surface a dull leaden or silvery-gray. A brown lengthwise band about equal to orbit in width and of shade of back, extends to caudal where it forms a small black spot, in size little smaller than pupil. Iris dull slaty. Fins all pale brown.

Length 67 mm.

No. 4,548, A. N. S. P., cotype (type) of Phoxinus neogonus Cope. New Hudson, Livingston County, from streams flowing into Lake Erie, Michigan.

Also 37 examples, small and in poor preservation.
Abramis crysoleucas (Mitchell)


Seven examples from Grosse Isle, Michigan, and Lake Michigan. Mr. Morgan Hebard also obtained it at Pequaming in Lake Superior, Baraga County.

Ceratichthys vigilax Baird and Girard

PLATE 7


Head 4; depth 4 1/2; D. iii, 7, 1; A. iii, 6, 1; P. 1, 15; V. 1, 7; scales 42 in lateral line to caudal base and 2 more on latter; 7 scales above 1. 1. to dorsal origin, 4 below to ventral origin, and 5 below to anal; 23 predorsal scales; head width 1 7/8 its length; head depth 1 1/2; snout 3 1/8; eye 3 1/2; maxillary 3 3/4; mandible 3 1/10; interorbital 2 4/5; first branched dorsal ray 1 2/3; anal ray 2; least depth of caudal peduncle 2 1/4; upper caudal lobe 1 1/10; pectoral 1 1/2; ventral 1 3/5.

Body oblong, rather well compressed though with heavy or somewhat stout appearance, deepest at dorsal origin, edges all more or less convexly rounded, and profiles alike. Caudal peduncle stout, rather well compressed and least depth about 2 2/5 its length.

Head moderate, broad, robust, obtuse, width about 4/5 its least depth, sides flattened to slightly converging below where also flattened convexly. Head broadly convex above and profiles alike, though lower slightly more convex. Snout obtuse, convex, length 2/3 its width. Eye elongate, ellipsoidal, large, high, placed at first 2/5 in head. Mouth small, inferior, terminal, upper jaw very slightly protruding. Maxillary con-

Gill-opening extending forward about opposite hind edge of preopercle, and width of isthmus at that point 1 1/3 in eye. Gill-rakers about 3 + 7?, short weak rudimentary points. Gill-filaments large, 1 1/4 in eye. Pseudobranchiae about 2 3 of largest gill-filaments. Isthmus broad, its surface nearly level or only very slightly convex. Teeth 4-4, compressed, rather lanceolate or with tips but slightly curved over and grinding-surfaces well developed, broader below.

Scales large, rhomboidal vertically, well exposed, of more or less equal size except along median predorsal region where smaller and crowded, and disposed in rows parallel lengthwise with I. I. Rather broad adnate scale in ventral axilla. Each scale on body usually with very fine radiating striæ. I., I. continuous, of simple tubes with each one extending to edge of scale, and its course nearly straight or about midway along side, but very slightly decurved at first.

Dorsal origin about midway between hind nostril and caudal base, and graduated down from first branched ray, which highest. Second simple dorsal ray separated from third by membrane of rather broad space. Anal origin inserted just behind last dorsal ray base, and first branched ray highest
with others graduated down. Caudal deeply emarginate, broad lobes rounded, and upper trifle longer than lower. Pectoral rather long, uppermost rays longest, reaches \( \frac{3}{5} \) space to ventral. Latter inserted trifle before dorsal, reaches about \( \frac{3}{4} \) to anal. Vent close before anal.

Color in alcohol faded dull brownish, trunk more or less unicolor or back scarcely darker. Pale gray, leaden streak from level with eye below shoulder to middle of caudal base, and in this course traces of dull olive-brown band beginning on side of snout coursing through eye along upper side of head and back to caudal, at bases of median rays of which jet-black spot size of pupil. Side of head and under surface whitish with silvery reflections. Also silvery reflections on lower side of trunk. Iris silvery to whitish, except where dark lateral band crosses. Fins all plain pale brownish. Traces of a dusky blotch at tip of second simple dorsal ray which extends on two following rays at this point. Also outer ends of dorsal rays pale brownish.

Length 70 mm.

No. 5,019, A. N. S. P., cotype of *Hybopsis tuditans* Cope, in the Detroit River. E. D. Cope. Also Nos. 5,020 and 5,021, same data, and 41 examples from Grosse Isle.

*Notropis heterodon* (Cope)


Although the types are now lost Mr. Hebard procured it at Pequaming, Baraga County.

*Notropis fretensis* (Cope)


Head 4; depth 4; D. III, 7, 1; A. III, 7, 1; P. I, II; V. I, 7; scales 36 (damaged) in lateral series to caudal base and 2 more on latter; 7 scales above l. l. to dorsal origin, 4 below to anal origin; 17 predorsal scales; head width 2 in its length; head depth 1 2/5; snout 3 1/3; eye 3 1/3; maxillary 3 1/10; interorbital 2 2/5; first branched dorsal ray 1 1/10; first branched anal ray 1 2/5; least depth of caudal peduncle 2 1/5; upper caudal lobe (damaged) 1; pectoral 1 1/5; ventral 1 2/5.

Body elongate, compressed, profiles similar with contour fusiform, deepest at dorsal origin and edges all convexly rounded. Caudal peduncle compressed, least depth 1 4/5 its length.

Head moderately compressed, lower profile little more inclined, sides flattened and slightly converge below. Snout short, convexly rounded over surface and in profile near tip, and its length about 3/5 its width. Eye circular, little above midway in depth of head, and center falls about first 2/5 in head length. Mouth well inclined, moderate in size, and lower jaw slightly protrudes when closed. Premaxillaries protractile. Maxillary long, slightly curved, rather slender, more or less concealed above, and reaches front edge of eye. Lower jaw moderately convex, with very slight knob at symphysis and rami well elevated inside mouth. Lips little developed, jaw edges rather horny and trenchant, though upper more so. Tongue thick, fleshy, little free. Nostrils large, together, posterior much larger and placed close to upper front edge of eye. Interorbitals rather broad and convexly depressed. Preorbital large, its width about 2/3 its length and latter 1 2/7 in eye, other suborbitals all narrower. Hind preopercle edge nearly straight, and inclined a little anteriorly. Gill-opening extending forward about opposite last 2/5 in

Scales large, cycloid, with numerous concentric striae, of mostly uniform size, and placed in lengthwise rows parallel with 1. 1. Predorsal scales now crowded, though those on base of caudal and breast little smaller than elsewhere. No scaly axillary ventral flap. L. l. complete, decurved little at first, low along side of caudal peduncle and reaches middle of caudal base; tubes simple, extend well over each scale, though not quite to its edge.

Dorsal origin nearer caudal base than snout tip by space equal to snout length, graduated down from first branched ray, which highest, and depressed fin reaches half way to caudal base. Anal inserted just behind last dorsal ray base, first branched ray longest with others graduated down and depressed fin reaches about 3/5 to caudal base. Caudal well emarginated, lobes (damaged) apparently of about equal length. Pectoral long, slender, pointed, uppermost rays longest and fin reaches 3/4 to ventral. Last inserted slightly before dorsal origin, fin rather long and pointed, and reaches anal origin. Vent close before anal.

Color in alcohol pale brownish, more or less uniform, scarcely more pale below than above. Sides of head, especially cheek and opercle, with brassy and silvery reflections. Upper surface of head darker than lower. Iris dull brassy, also pupil. Fins all pale or dull uniform brownish.

Length 58 mm. (caudal damaged).

Cope states that the maxillary does not attain the line of the orbit, which is only true when the mouth is closed, as the distal portion seen when the mouth is closed is not the end, though even then it is very close. The pharyngeal teeth are said to be more or less crenate and the inference according to his key is that they would be 4-4. The external angle of the pharyngeal bone is said to be scarcely projecting.

_Notropis deliciosus_ (Girard)


Head 3 7/8; depth 4 1/5; D. III, 7, 1; A. III, 6, 1; scales 34 in lateral line to caudal base and 3 more on latter; 5 scales above l. l. to dorsal origin, 4 below to ventral and 4 below to anal; 14 predorsal scales; snout 3 2/5 in head; eye 2 4/5; maxillary 3 1/5; interorbital 3; first branched dorsal ray 1 1/8; first branched anal ray about 2; least depth of caudal peduncle 2 2/3; pectoral 1 1/3; ventral 1 3/4.

Body moderately elongate, well compressed, profiles similar and greatest depth at dorsal origin. Caudal peduncle compressed, least depth about 2 1/5 its length. Head moderate, muzzle obtuse. Snout convex over surface, length 2/3 its width, very slightly protrudes beyond lower jaw. Eye large, deeply ellipsoidal, high, its center about first 3/8 in head length. Mouth little inclined, moderately large. Lower jaw slightly included in upper jaw and with slight prominence at symphysis below. Premaxillaries protractile downward. Maxillary reaches very slightly beyond front of eye, though when closed appears to barely attain to it. Jaw edges tough, firm, little trenchant. Tongue adnate, fleshy. Nostrils near upper front of eye, hind one crescentic. Interorbital broad, very
depressed and but slightly convex. Preorbital trapezoidal, greatest width 4/5 its length and latter 2 in eye. Suborbitals all narrow. Hind preopercle edge slopes little forward. Gill-opening extends forward trifle before hind edge of eye. Gill-rakers 2 + 4 short weak points. Pseudobranchiae large, but little shorter than longest gill-filaments. Teeth 4-?, curved little at tips and with slight grinding-surfaces. Scales cycloid, mostly uniform or but little smaller on caudal base, predorsal region and breast, and each with number of radiating striae. Ventral axillary scale small, adnate. L. 1. continuous, but very little decurved on costal region, and midway along side of caudal peduncle. Tubes simple and each one extends well over exposure of scale for about first 2/3 its space. Dorsal origin midway between front nostril and caudal base; first branched ray longest and depressed fin reaches half way to caudal base. Anal inserted well behind last dorsal ray base, first branched ray longest and depressed fin reaches half way to caudal base. Caudal (damaged) evidently well forked. Pectoral pointed, upper rays longest and reach 3/4 to ventral origin. Ventral inserted trifle before dorsal origin, reaches 2/3 to anal. Vent close before anal.

Color faded in alcohol to pale brownish, and under surface scarcely paler. Side and lower surface of head, and broad band along side to caudal base silvery-white. Lower surface of body tinted here and there with silvery. Fins all uniform pale brownish. Iris pale creamy.

Length 63 mm. (caudal damaged).

No. 4,131, A. N. S. P., cotype (type) of Hybognathus stramineus Cope. Grosse Isle, Detroit River, Michigan. (Prof. Manly Miles) E. D. Cope. Also Nos. 4,132 to 4,136, A. N. S. P., cotypes, same data.
The specimen selected as the type differs a little from Cope's account. Head said to enter length to caudal a little over 4 times; depth 3/4; eye 3; dorsal inserted nearer end of muzzle than caudal base. A small label, evidently in Cope's handwriting, says "one specimen P. notatus". Also a large number of young examples, evidently the present species, from Grosse Isle and Houghton Lake.

Notropis volucellus (Cope)


Notropis hudsonius (Clinton)

Hybopsis hudsonius Cope, l. c., p. 279. Lake.


Fifty-six examples from the above localities.

Notropis whippii (Girard)

Notropis whippii Fowler, l. c., p. 282, Pl. 18, fig. 28 (cotype of Photogenis spilopterus Cope).


Head 3 7/8; depth 4 1/4; D. III, 7, I; A. III, 7, I; scales 32? (damaged) in lateral line to caudal base; 6 scales above l. l., 4? below; 16? predorsal scales; head width 2 in its length; head depth 1 2/5; snout 3 1/8; eye 3 4/5; maxillary 3 1/5; interorbital 3; first branched dorsal ray 1 1/8; anal ray 1 2/5; least depth of caudal peduncle 2 4/5; median caudal rays 1 7/8?; pectoral 1 1/3; ventral 1 9/10.

Body elongate, compressed, profiles apparently alike, deep-

Color in alcohol faded mostly uniform dark brownish. Sides of trunk leaden. Head sides silvery tinted. Iris dull leaden. Fins pale brownish, upper hind part of dorsal with slightly dusky tint.

Length 57 mm. (caudal damaged).


Cope gives eye 3 1/2 in head. He also says "median part of caudal fin, a spot on the upper hinder portions of the dorsal, and a narrow vertebral line black", all of which cannot be satisfactorily determined in my example. Otherwise his account agrees.
Occasional Papers of the Museum of Zoology

Notropis cornutus (Mitchill)


Hypsilopis frontalis Cope, i. c., p. 279. Grosse Isle, Detroit River; Three Mile Lake and Waterford, Oakland County; Swartz Creek, Genesee County; Monroe County.

Alburnopus plumbeolus Cope, i. c., p. 282. Flint.

Head 3 3/4; depth 4 1/4; D. III, 7, 1; A. III, 7, 1; P. 1, 12; V. 1, 7; scales 35 in lateral line to caudal base and 2 more on latter; 6 scales above l. l., 3? below; 14 predorsal scales; head width 2 in its length; head depth 1 3/5; mandible 2 1/2; first branched dorsal ray 1 1/10; third simple anal ray 1 1/3; least depth of caudal peduncle 2 1/4; pectoral 1 1/3; ventral 1 1/5; snout 3 2/3 in head measured from upper jaw tip; eye 2 3/4; maxillary 3 2/5; interorbital 2 7/8.

Body elongate, well compressed, rather slenderly fusiform, greatest depth at dorsal origin, profiles similarly convex and edges evenly so. Caudal peduncle compressed, least depth about 1 3/4 in its length.

Head compressed, sides flattened somewhat and converging a little below, and upper profile little more convex than lower. Snout convex over surface, its length 3/4 its width. Eye large, ellipsoid, its width about 4/5 its length, and center falls near first 2/5 in head. Mouth terminal, rather small, inclined, and lower jaw well protrudes in front. Premaxillaries protrac tile down anteriorly. Maxillary slender, more or less concealed, and reaches front edge of eye. Jaw edges thin, tough. Lips thin. Tongue thick, fleshy, not free. Mandible depressed, rami scarcely elevated inside mouth. Nostrils together on upper side of snout close in front of eye,
posterior much larger and anterior with cutaneous rim. Interorbital broadly depressed and very slightly convex. Preorbital a little long, width 3/4 its length and latter 2 in eye horizontally. Postorbital width about 1 1/4 in pupil, other suborbitals all narrow. Hind preopercle edge slightly convex and inclined anteriorly.


Scales in lengthwise rows parallel with l. l., mostly uniform or all rather broadly exposed, and those on chest slightly smaller. Predorsal scales not crowded. L. l. complete, decurved nearly to lower third in greatest depth and ascends a little low at first along side of caudal peduncle. Tubes simple, extend well over exposures of scales or for first 3/4 at least.

Dorsal origin about midway between front nostril and caudal base, graduated down from first branched ray which longest, depressed fin reaching 1 4/5 to caudal base. Anal origin behind last dorsal ray, graduated down from third simple ray which highest and depressed fin reaching 1 1/2 to caudal base. Caudal (damaged) apparently emarginate. Pectoral reaches 3/4 to ventral origin, which opposite dorsal origin, and ventral reaches anal. Vent close before anal.

Color in alcohol faded dull brownish generally, fins and under surface paler. Lower side of head and trunk with dull silvery tints. Iris with slaty tinge, otherwise with silvery.

Length 53 mm.
No. 2,055, A. N. S. P., cotype (type) of *Alburnops plumbeolus* Cope. From Flint, a branch of the Saginaw, Michigan. E. D. Cope. Also Nos. 2,056 to 2,061, A. N. S. P., cotypes, with same data.

Cope's account differs from the above as follows: head a little over 4 to base of tail; greatest depth 4 2/3; anterior base of dorsal half way between base of caudal and end of muzzle; height of dorsal less than half length from its anterior base to base of caudal; ventrals extending 2/3 way to vent; scales 39 in lateral line; length 3 inches; a brownish caudal spot. Most of the other examples, however, more or less agree.

*Notropis cornutus cyaneus* (Cope)


Head 4 1/8; depth 3 2/5; D. III, 7, 1; A. III, 8, 1; P. I, 15; V. I, 7; scales 38 in lateral line to caudal base and 3 more on latter; 9 scales above l. l., 5 below to anal; 28 predorsal scales; head width 2 in its length; head depth 1 1/4; snout 3; eye 4 4/5; maxillary 3 1/8; interorbital 3; pectoral 1 2/5; ventral 1 3/5; first branched dorsal ray 1 1/3; first branched anal ray 1 5/6; least depth of caudal peduncle 2 1/2; lower caudal lobe 1.

Body elongate, compressed, deepest at depressed ventral tip, profiles similarly convex, edges all convexly rounded, and trunk tapers rather conspicuously from after dorsal origin. Caudal peduncle little long, compressed, least depth 2 1/4 its length.
Head compressed, rather deep, obtuse, upper profile more inclined than lower or with slight angle over front nostrils and lower more inclined and evenly convex. Sides of head flattened, not constricted below. Snout obtusely convex both in profile and over surface, width but trifle greater than its length. Eye small, rounded, high, about first $2/5$ in length of head. Mouth moderate, oblique, jaws nearly even or mandible but slightly protruding. Premaxillaries little protruded down. Maxillary narrow, concealed along its upper portion, reaches opposite hind nostril or not quite to front rim of eye. Lips thin. Mandible depressed, rather shallow, broad, and rami but little elevated inside mouth. Jaw edges rather thin, trenchant and tough. Tongue thick, fleshy and little free. Nostrils together on upper side of snout, posterior larger and exposed in crescent, and anterior with well developed cutaneous edge, placed about last third in snout length. Interorbital evenly convex. Preorbital rather rounded, its width $7/8$ its length. Postorbital width $1\,1/4$ in eye, other suborbitals but little narrower. Hind edge of preopercle nearly straight, inclined forward.

Gill-opening extends forward to middle of head, isthmus width $1\,4/5$ in eye horizontally. Gill-rakers $2+9$, slender firm points, longest about 7 in longest gill filaments. Last nearly equal eye. Pseudobranchiae $1\,1/2$ in eye. Teeth $2.4 - 4.2$, hooked, each with well developed grinding-surfaces.

Scales very small, crowded over predorsal region of back, also on breast. Preventral scales and postventral scales next in size, those on caudal peduncle, postdorsal and postanal regions rather broadly exposed. Scales on costal region very narrowly imbricated, those on caudal base not much smaller than others. Short pointed adnate scale in ventral axil. L. l.
continuous, ascends to middle of caudal base and descends to lowest 2/5 of greatest depth. Tubes simple, extend over first half to 3/4 of exposure of scale at least. Pectoral axil with deep pit. Head above, muzzle, including preorbital and sides of mandible, furnished with numerous small tubercles, though those on muzzle largest and most pronounced.

Dorsal origin about midway between snout tip and caudal base, first branched ray longest with others graduated down, and depressed fin reaches 2/3 to caudal base. Anal origin well behind that of last dorsal ray, first branched ray longest with others graduated down, edge of fin nearly straight and depressed fin reaches 3/4 to caudal base. Caudal well forked, lobes pointed, about equal. Pectoral broad, expanded, reaches 5/6 to ventral origin, uppermost rays a little longer. Ventral inserted a little before dorsal origin, broadly expanded, edge rounded and fin reaches 7/8 to anal. Vent close before anal.

Color in alcohol faded dull dusky brown generally, sides and lower part paler, scales on sides with dusky pockets showing at their bases. Dorsal and caudal with dusky rays, bases of fins paler. Opercles and flanks with brassy brown tinges. Other fins pale brownish basally, and largely dusky on outer portions with narrow pale milky colored edges. Iris brassy gray. A dark median stripe down back.

Length 153 mm.

No. 3.950, A. N. S. P., cotype (type) of *Hypsilepis cornutus cyanus* Cope. Montreal Run, Keeweenaw Point on Lake Superior. Dr. J. H. Slack. Also Nos. 3.951 to 3.959, cotypes, same data.

Cope gives the scales before the dorsal as 31 to 40 and as 10/4 transversely; eye 4 1/2 (evidently above example) in head.
Notropis atherinoides Rafinesque


No. 2,577, A. N. S. P., cotype of A. jaculus Cope, St. Joseph River, and its tributary the Dowagiac; these streams debouch into the head of Lake Michigan from the east. This example is 51 mm. long. Head compressed, flattened sides slightly converge below. Snout about broad as long. Mouth rather large. Mandible depressed, rami scarcely elevated inside mouth, symphysis included within upper jaw. Interorbital convex, about 3 in head. Gill-rakers 2+5 short points, 1/3 or less than filaments, latter about equal pupil. Pseudobranchiae trifle less than filaments. Teeth 2,4-4,2, hooked, grinding-surfaces slight. Vent close before anal. Color in alcohol faded dull brownish, fins paler, caudal base medianly with obscure brown spot.

Notropis umbratilis lythrurus (Jordan)

Notropis umbratilis lythrurus Fowler, l. c., p. 282. Lansing.


Hypsilopis diplaminia Cope, l. c., 1867, p. 662 (same).

Two from Lansing, E. D. Cope.

Rhinichthys atronatus (Mitchill)

Rhinichthys lunatus Cope, l. c., 1864, p. 278. Grosse Isle.

Hybopsis storcerianus (Kirtland)

Hybopsis storcerianus Cope, l. c., p. 279. Flint River at Flushing, Genesee County.
Hybopsis kentuckiensis (Rafinesque)

PLATE 8

Ceratichthys cyclotis Cope, l. c., p. 277. Grosse Isle; Waterford, Oakland County; Clinton River and Bruce, Macomb County.

Ceratichthys stigmaticus Cope, l. c., p. 278. Michigan.

Head 3 7/8; depth 4 1/8; D. III, 7, 1; A. III, 6, 1; scales 40 in lateral line to caudal base and 3 more on latter; 7 scales above 1, 1, 6 below; 21 predorsal scales; head width 2 in its length; snout 2 4/5; eye 6; maxillary 6; interorbital 3 1/10; first branched dorsal ray 1 1/2; anal ray 1 7/8; least depth caudal peduncle 2 1/3; upper caudal lobe 1 1/8; pectoral 1 1/2; ventral 1 3/5.

Body compressed, profiles alike, deepest at dorsal origin. Caudal peduncle compressed, least depth 2 in its length. Head compressed, not especially convergent above or below. Snout surface convex, also profile long as broad, slightly protruding beyond mandible. Eye trifle longer than deep, slightly before center in head length. Mouth large, low, horizontally inclined, broad. Premaxillaries protractile downward. Maxillary reaches little beyond hind nostril, not quite to eye. Jaws heavy, powerful. Lips thick, fleshy. At lower maxillary end thin pointed barbel equal to pupil. Tongue large, thick, fleshy, adnate. Mandible broad, depressed, rami scarcely elevated inside mouth. Nostrils together, posterior little larger, with cutaneous edge forming flap over posterior one. Interorbital broadly depressed, slightly convex. Preorbital ovate, width 3/4 its length, latter 1 4/5 in snout. Other suborbitals all narrow. Gill-opening forward last 2/5 in head, isthmus width 2 1/5 in snout. Rakers 3 + 7 short blunt denticles, ends mostly pectinated, length 1/4 of filaments. Pseudobranchia large, 4/5 of filaments, latter equal eye. Teeth 4-4, large.
rather obsoletely hooked, several upper with slight grinding-surfaces. Scales large, little smaller on median predorsal and breast. L. l. continuous, midway along side. Tubes simple, extending well over scales about first half of exposed length. Dorsal origin trifle nearer hind nostril than caudal base, fin reaches half way to latter. Anal origin little behind dorsal base, fin 1 3/4 to caudal base. Caudal emarginate, lobes pointed, similar. Pectoral 2/3 to ventral, latter inserted opposite dorsal origin, fin 4/5 to anal, not to vent which is close before anal.

Color in alcohol dull brownish, back a little darker than lower surface. Fins dull brownish, all marked with slightly darker shades of brownish on outer portions. Iris brassy.

Length 165 mm.


Besides the above 13 examples from Belle Isle, Detroit, from C. Rutter, and Grosse Isle from E. D. Cope.

Cocesius plumbeus (Agassiz)

PLATE 9


Head 4 1/4; depth 4 1/8; D. III, 7, 1; A. III, 7, 1; scales 57 in lateral line to caudal base and 3 more on latter; 11 scales above l. l. and 8 below; 33 predorsal scales; head width 1 3/4 its length; snout 3 1/6; eye 3 7/8; maxillary 3 1/3; inter-orbital 3; least depth of caudal peduncle 2 3/5; pectoral 1 1/5; ventral 1 1/2.

Body elongate, compressed, deepest at dorsal origin, profiles alike, edges convexly rounded. Caudal peduncle com-

Color in alcohol dull brownish generally, below paler or more brassy. Dorsal, caudal and pectoral brownish, other fins paler. Iris pale brassy.

Length 146 mm. (caudal damaged).

Also Nos. 2,153 to 2,156, same data. Head 3 1/2 to 4 1/2; depth 4 to 4 3/4; D. 111, 7, 1; A. usually 111, 7, 1, seldom 111, 6, 1; scales in lateral line to caudal base often 62 or 65, seldom 54, 56, 58, 63 or 64, and usually 3 more on caudal base, rarely 4; usually 11 or 12 scales above l. l., seldom 10; 7, 8 or 9 scales below l. l.; usually 34 predorsal scales, vary 28, 30, 32, 33, 35 or 36; snout 3 1/5 to 3 1/2 in head; eye 3 7/8 to 4 1/3; maxillary 2 3/4 to 3 1/3; interorbital 2 4/5 to 3 1/4; teeth usually 2.4-4,2, rarely 1.4-4,1 or 1.4-4,2; length 54 to 140 ? mm.

*Platygobio gracilis* (Richardson)


Head about 3 3/4 ? (caudal peduncle damaged); depth 4 3/4 ?; scales 40 + ? in lateral line; 6 scales above l. l., 5 below; 22 predorsal scales; head width 1 4/5 in its length; snout 3; eye 6 1/2; maxillary 2 4/5; interorbital 2 1/4.

Body elongate, compressed, back slightly elevated, and caudal peduncle rather long. Head broad as deep, sides not converging below. Snout broad, depressed, length about 2/3 its width. Eye small, lateral, hind edge slightly before middle in head length. Mouth large, nearly horizontal, lower jaw included within upper and snout tip slightly protrudes. Maxillary barbel terminal, nearly as long as diameter of pupil. Lips rather firm. Tongue broad, thick, adnate. Mandible shallow, rami little elevated inside mouth. Nostrils large, together, close before eye, hind one crescentic. Preorbital elongate crescent, long as 1 1/2 eye diameters. Other suborbitals all narrow. Preopercle edge free. Interorbital broadly convex, depressed medianly. Gill-rakers 1 + 5 short weak points. Gill-filaments nearly long as eye, pseudobranchiae little smaller. Scales rather large, cycloid, all well exposed.
mostly of uniform size, or smaller on median predorsal line and breast. L. l. extends only as far as last anal ray, slightly decurved at first, median. Tubes simple, about over first half of scale exposure. Axillary scaly flap of ventral 1/4 its length. Dorsal (damaged) elevated in front. Anal inserted just behind last dorsal ray tip when depressed. Pectoral trifle longer than head, reaches 7/8 to ventral. Latter inserted slightly behind dorsal origin, 1 3/5 in head, and reaches vent which close before anal.

Color in alcohol pale brownish on back, sides and under surface paler. Fins all pale. Iris brassy.

Length 111 mm. (without caudal).
Bruce, Macomb County, E. D. Cope.

Esocidæ

Esox vermiculatus Valenciennes

PLATE 10


Head 2 7/8; depth 4 3/4; D. vii, 12; A. v, 11; scales about 110 in lateral series to caudal base; 27 scales from middle of back to ventral origin, and about same between dorsal and anal origins; about 78 scales before dorsal; head width 3 1/3 in its length; mandible 1 2/3; snout 2 2/3 in head measured from upper jaw tip; eye 7; maxillary 2 1/4; interorbital 5 1/8.

Body well compressed, back elevated and much broader than ventral region, profile also more convex. Caudal ped-
uncle compressed, least depth trifle less than half its length. Head well compressed, flattened sides approximated below. Snout broad, profile concave, width \( \frac{3}{5} \) its length. Eye elevated, close to upper profile, slightly before middle in head length. Mouth large, mandible well protruded. Maxillary reaches about first third in eye, not to center. Outer front upper teeth very small. Lateral mandibular teeth large, erect, well-spaced. Tongue depressed, free at tip which slightly emarginate. Mandible shallow in front. Interorbital slightly concave. Gill-rakers numerous minute denticles or asperities. Gill-filaments about \( \frac{2}{3} \) in eye. Branchiostegals 12. Scales smaller and more crowded on lower portion of abdomen between pectorals and ventrals. Scales in 10 rows on cheek, little larger on opercles. L. l. as about 43 spaced notches or gashes in course of scales from shoulder to caudal base medianly. Dorsal origin little nearer ventral origin than caudal base, depressed fin \( \frac{2}{5} \) to latter. Anal origin slightly before that of dorsal, fin similar. Caudal emarginate, small. Pectoral \( \frac{1}{5} \) in head, \( \frac{1}{3} \) to ventral. Last inserted nearer anal origin than that of pectoral, fin \( \frac{3}{5} \) in head and reaches \( \frac{2}{3} \) to anal. Vent close before anal.

Color in alcohol largely faded uniform brownish, under surface paler or whitish. Fins brownish. Iris brassy.

Length 183 mm. (caudal tips damaged).

No. 7, 681, A. N. S. P., cotype (type) of *Esox cypho* Cope. Waterford, Oakland County. (Prof. Manly Miles) E. D. Cope.

Although “several specimens” are mentioned by Cope, the above is the only one I have examined.

*Esox lucius* Linnaeus

Head 3 1/6; depth 5 1/2; D. IX, 14; A. VI, 12; scales about 105 along course of lateral line to caudal base; 13 scales above l. l., 12 below; about 90 predorsal scales; head width 3 7/8 in its length; snout 2 1/3 in head measured from upper jaw tip; eye 8 1/2; maxillary 2 1/8; interorbital 4 3/4.

Body well compressed, also caudal peduncle. Head compressed, with flattened sides not approximating below. Snout broadly depressed, profile concave, width about 1 1/2 its length. Eye high, about midway in center of head length. Lower jaw well protruded. Tongue depressed, rounded and free in front. Maxillary reaches about first third in pupil. Interorbital concave, depressed medianly. Branchiostegals 14. Scales smaller along caudal base and breast. Median l. l. of about 45 gashes on hind edges of scales. Also 4 or more similar parallel irregular l. lines above and below main median course, variously complete, most prominent on side of abdomen over ventral and on caudal peduncle. Dorsal inserted slightly in advance of anal origin, fins alike. Caudal moderately emarginate. Pectoral 2 in head, 1 2/3 to ventral. Latter inserted little nearer anal than pectoral origin, fin 2 3/5 in head, or 1 3/4 to anal. Vent close before anal.

Color in alcohol deep brownish on back, under surfaces paler. Sides with about 8 lengthwise rows of rather elongate leaden-gray spots. Also sides of head spotted with leaden gray. Iris yellowish-brown. Fins all tinged with brownish, unpaired with deep brownish to dusky blotches or obscure streaks.

Length 439 mm.

Keeweenaw Point. Dr. J. H. Slack.

The head of a much larger example with same data shows: snout 2 1/3 in head measured from upper jaw tip; eye 9; maxillary 2; interorbital 4 3/5.
Esox masquinongy Mitchell


Head 3 2/5; depth 5 3/5; D. vii, 15; A. vi, 13, 1; scales about 152 along course of lateral line to caudal base; 16 scales above l. l., 16 below; 120 predorsal scales; head width 3 1/4 its length; snout 2 1/6 in head measured from upper jaw tip; eye 11 1/4; maxillary 2 1/8; interorbital 5 1/3.

Body, including caudal peduncle, well compressed. Head compressed, flattened sides not approximating below. Snout rather depressed, width about 2/3 its length. Eye high, midway in length measured from upper jaw tip. Lower jaw well protruded. Tongue depressed, free, and rather obtuse in front, also slight notch medianly on front edge. Maxillary nearly reaches front pupil edge. Branchiostegals 18. Scales smaller on caudal base, scarcely so on breast. Median l. l. of about 60 gashes on hind edges of scales. Also 7 or more similar parallel irregular l. lines below main median course, fewer above, variously complete, most prominent on abdomen over ventral. Dorsal inserted slightly before anal origin, fins alike. Caudal well forked, lower lobe a little longer. Pectoral 2 1/4 in head, half way to ventral. Latter inserted little nearer anal than pectoral origin, fin 2 1/4 in head and slightly over half way to anal. Vent close before anal.

Color in alcohol brown on back, lower surfaces paler to whitish. Fins all with obscure darker cloudings.

Length 675 mm.

Saginaw Bay. E. D. Cope. This specimen was in poor condition.
I have not located the Grosse Isle specimen Cope lists simply as Esox?, a which he says is "not far from the E. affinis (?) of Holbrook", but with "the branchiostegal and fin radial formula of fasciatus". Probably it was simply E. vermiculatus.

**Umbriide**

*Umbra limi* (Kirtland)


The few Oakland County examples are in bad condition.

**Poeiciliide**

*Fundulus diaphanus* (Le Sueur)

*Fundulus multifasciatus* Cope, l. c., p. 78. Frederick, Macomb County; Grosse Isle, Oakland County.

*Fundulus diaphanus menona* Fowler, l. c., p. 422 (Grosse Isle material).

Eleven from Grosse Isle.

**Fundulus notatus** (Rafinesque)

**PLATE II**

*Fundulus notatus* Fowler, l. c., p. 425 (type of *F. aureus* Cope).

*Fundulus aureus* Cope, l. c., p. 78. Grosse Isle.

Head 3 2/3; depth 4 1/5; D. 11, 7; A. 1, 11; P. 11, 12; V. 1, 5; scales 35 in median lateral series to caudal base and 3 more on latter; 11 scales between dorsal and anal origins; 28 scales before dorsal; head width 1 3/4 its length; head depth 1 4/5; snout 1 1/3 in head measured from upper jaw tip; eye 3 2/3; maxillary 3 3/5; interorbital 2.

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Body fusiform, compressed, especially behind. Caudal peduncle well compressed, its least depth about $3/5$ its length. Head broadly depressed above, its least depth about $3/5$ its length. Head broadly depressed above, upper profile nearly straight from snout tip to occiput, lower convex. Sides of head but slightly approximate below. Snout depressed, upper surface nearly level, length about $3/5$ its width. Eye rounded, high, close to upper profile, and slightly anterior to center in length of head. Mouth moderate, transverse, lateral cleft slight and little inclined. Premaxillaries greatly protractile. Maxillary not quite reaching opposite front eye edge. Lips rather thin. Teeth simple, conic, in bands in jaws, and some in outer row enlarged and slightly curved. Upper and lower inner buccal folds moderately wide, entire. Tongue depressed, elongate, end rounded and free in front. Lower jaw robust, protruded slightly beyond upper, rather depressed. Nostrils simple, close above front edge of eye. Hind preopercle edge inclined slightly backward.

Gill-opening extends forward slightly beyond hind eye edge, not quite to hind pupil edge. Gill-rakers 7, lanceolate, very short, firm, less than half of gill-filaments, which about $2/3$ diameter of eye. Isthmus narrowly constricted.

Scales moderate, with concentric strike, enlarged on top of head, and smaller on breast, prepectoral region and caudal base. Cheek with 2 rows of scales. Lateral line obscure, complete, developed as single pore on each exposure of scale, frequently absent from a scale of its course.

Dorsal origin at last third in space between front eye edge and caudal base. Anal inserted well in advance of dorsal origin, or little nearer caudal base than pectoral origin. Caudal (damaged) apparently rounded. Pectoral moderately
high in depth, or about midway in its insertion. Ventral inserted slightly nearer snout tip than caudal base, fin about 3/5 to anal origin. Vent close before anal.

Color in alcohol largely dull uniform brownish, paler below. A dark brown band extends from snout tip, through eye, along side to caudal base, and below dorsal broader, also below median line of depth. Fins and under surface of head all pale brownish. Iris brownish.

Length 50 mm.

No. 7.142, A. N. S. P., type of Fundulus aureus Cope. Detroit River, Grosse Isle.  E. D. Cope.

**Atherinidæ**

*Labidesthes sicculus* (Cope)


The type is apparently lost as it cannot now be found.

**Gasterosteidæ**

*Eucalia inconstans* (Kirtland)

*Gasterosteus inconstans* Cope, l. c., p. 81.  Grosse Isle.

**Centrarchidæ**

*Pomoxis sparoides* (Lacépède)

*Hyperistius hexacontus* Cope, l. c., p. 84.  Saginaw Bay.

This example as listed by Cope cannot be located in the collection. There is, however, one received from him labeled from Lake Huron.
Ambleplites rupestris (Rafinesque)

Ambleplites rupestris Cope, l. c., p. 84. Algoma [doubtless Algonac], St. Clair County; Long Lake; Flint River.


A number in the collection from the localities mentioned in 1906.

Chenobryttus gulosus (Cuvier)

Chenobryttus gulosus Cope, l. c., p. 84. No locality given.

Chenobryttus melanops Cope, l. c. No locality.

Lepomis megalotis (Rafinesque)

PLATE 12

Lepomis megalotis Fowler, l. c., p. 516 (cotypes of Lepomis peltastes Cope). Detroit, Michigan.


Head 2 1/2; depth 2; D. X, 10, 1; A. III, 10, 1; P., 11, 1 1; V. I, 5; scales 36 in lateral line to caudal base; 5 scales above l. l. to spinous dorsal origin, and 12 below to spinous anal origin; head width 2 1/8 in its length; head depth over front eye edge 2; mandible 2 2/3; fourth dorsal spine 3; fourth dorsal ray 2 1/3; third anal spine 2 5/6; third anal ray 2 1/3; upper caudal lobe 1 2/3; least depth of caudal peduncle 2 1/3; pectoral length 1 1/2; ventral 1 3/4; snout 4 in head measured from upper jaw tip; eye 3 3/4; maxillary 3; interorbital 3 3/5.

Body rather deep, compressed, and profiles similarly convex. Caudal peduncle compressed, least depth trifle less than its length and about 1 1/3 its greatest depth.

Head rather large, compressed, more or less broadly triangular in profile. Snout broad, short, convex. Eye rather
large, circular, its hind edge about midway in head. Preorbital narrow, about equals 2/5 of orbit or a little less than horizontal diameter of pupil. Mouth steeply inclined, curved slightly in gape, and lower jaw projecting a little. Maxillary reaches about opposite hind nostril, and its terminal expanded end about 2/5 of orbit. Lips rather thick and fleshy. Teeth fine, sharp pointed, in bands, outer series slightly enlarged, especially in front of upper jaw. Patch of fine teeth on vomer. No teeth on palatines or tongue. Tongue rather thick, somewhat pointed and free. Each ramus of mandible well elevated inside mouth. Nostrils separated, front one about midway in snout, hind one little larger and close to upper front orbital rim. Interorbital space broad, trifle wider than eye, more or less flattened. Suprascapula and edge of preopercle entire. Opercular flap large, about 3/4 of eye-diameter, and osseous portion not differentiated from cutaneous.

Gill-opening extends forward about opposite front edge of orbit. Rakers i, i + 6, iv, small tubercle-like rudiments, asperous, and longest about 2/5 of longest filaments, which about equal terminal expansion of maxillary. Isthmus constricted. Pharyngeal teeth fine, pointed, of usual type in genus.

Scales large, broadly exposed, finely ciliated, though those of head more or less entire. Cheek with 5 rows of scales, similar to occipital scales, and both smaller than opercular. Head otherwise naked and more or less porous. Scales on chest small, also those along bases of vertical fins. Along spinous dorsal and anal bases they form low scaly sheaths, though on soft portions of these fins they extend further out with those between rays becoming much smaller. Lateral line of simple tubes, more or less concurrent with upper profile,
extending a little high along side of caudal peduncle at first and not reaching on base of caudal fin.

Spinous dorsal inserted much nearer snout tip than base of last dorsal ray, edge of fin notched, spines graduated to fourth, after which mostly subequal. Soft dorsal higher, inserted nearly midway between pectoral origin and caudal base. Anal spines graduated to third, which longest, edge of fin notched, and its origin much nearer that of pectoral than caudal base. Soft anal like soft dorsal, inserted a little posteriorly. Caudal small, emarginate, so that rounded lobes distinct. Pectoral pointed, not quite reaching spinous anal origin, and upper rays longest. Ventral inserted entirely behind pectoral base, or little before spinous dorsal origin, pointed, not quite reaching spinous anal origin, spine scarcely trifle over half of space. Vent about first third of space between tip of ventral spine and spinous anal origin.

Color in alcohol dull brown, darker above, each scale also with slightly darker edges. Fins plain pale brownish, somewhat obscurely mottled. Opercular flap blackish-brown with narrow white rim. Iris pale brownish.

Length 95 mm.

No. 12,978. A. N. S. P., cotype (type) of Lepomis pelastes Cope. Huron River. Prof. Alexander Winchell.

Also Nos. 12,978 to 12,981, A. N. S. P., cotypes, with same data. These vary as follows: Head 2 1/3 to 2 4/5; depth 2 to 2 1/8; D. IX or X, 11, 1 or 12, 1; A. III, 9, 1 or 10, 1; scales 31 to 36 in lateral line to caudal base; snout 4 to 4 1/2 in head, measured from upper jaw tip; eye 3 3/4 to 4 1/5. One example with dusky ventrals.

Of the present species also one from Michigan obtained by Dr. Pitcher and three from Detroit? presented by Prof. Cope.
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*Lepomis incisor* (Valenciennes)


Five Michigan examples.

*Pomotis gibbosus* (Linnaeus)


*Pomotis maculatus* Cope, l. c. Waterford, Clinton River, Long Lake, Copenaconic Lake and Grosse Isle.

Five Michigan examples.

*Micropterus dolomieu* Lacépède

*Micropterus fasciatus* Cope, l. c. Swartz Creek, Saginaw Bay and Grosse Isle.

*Micropterus salmoides* (Lacépède)


*Micropterus nigricans* Cope, l. c. Orchard Lake, Strait's Lake, Bald Eagle Lake and Copenaconic Lake.

Three Michigan examples received from Cope.

**Percidae**

*Stizostedion vitreum* (Mitchill)

*Stizostedion vitreum* Fowler, l. c. Michigan.

*Stizostedion americanum* Cope, l. c., p. 82. Saginaw Bay.

One Michigan example received from Cope.

*Percia flavescens* (Mitchill)

*Percia flavescens* Cope, l. c. Saginaw Bay.

Two young examples were obtained at Pequaming in Lake Superior, by Mr. Morgan Hebard. These are the only Michigan examples I have examined.
Percina caprodes (Rafinesque)

Percina caprodes Cope, l. c. Grosse Isle.

Hadropterus aspro (Jordan)


Crystallaria asprulla (non Jordan) Fowler, l. c., p. 524. Grosse Isle.

Head 3 2/5 to 3 3/4; depth 5 1/4 to 5 3/4; D. XIII or XIV-11, 12; A. 11, 10; scales 60 to 65 in l. l. to caudal base and 3 to 5 more on latter; 7 or 8 scales above l. l., 8 to 10 below; about 12 predorsal scales; snout 4 to 4 1/8 in head; eye 3 to 4; maxillary 3 to 3 1/5; interorbital 5 to 6.


Color in alcohol faded brownish generally. Indistinct traces on median row of seven large dark blotches along l. l. Fins plain brownish barred with darker, and dark spot smaller than pupil at caudal base medianly quite distinct. Lower surface paler than upper.

Larger example 55 mm.
Two examples in poor preservation and long in alcohol. These were wrongly determined, as indicated above, as the young of widely different forms. A careful and detailed examination recently shows that they are evidently young of the present species.

_Etheostoma blennioides_ Rafinesque


_Bolcosoma nigrum_ (Rafinesque)

Many examples from Michigan, St. Joseph and Grosse Isle.

_Pacilichthys caruleus_ (Storer)

_Pacilichthys caruleus_ Cope, l. c., p. 82. Grosse Isle.
_Etheostoma caruleum_ Fowler, l. c., p. 525. Ann Arbor.

Seven examples from Ann Arbor.

_Pacilichthys flabellaris_ (Rafinesque)

_Catonotus flabellatus_ Cope, l. c., p. 82. Grosse Isle.
_Etheostoma flabellare_ Fowler, l. c. Grosse Isle.

One from Grosse Isle.

_Serranid.e_

_Roccus chrysops_ (Rafinesque)

_Roccus chrysops_ Cope, l. c., p. 83. Saginaw Bay.

_Cottid.e_

_Cottus ictalops_ (Rafinesque)

PLATE 13

_Potamocottus alvordii_ Cope, l. c., p. 81. Dexter, Washtenaw County.
_Uranidea spilota_ Cope, l. c., p. 82. _Grand Rapids, on the Grand River which flows into Lake Michigan._
Head 3; depth (distorted?) 3 7/8; D. VIII, 17; A. 12; head width 1 2/5 in its length; head depth at occiput 1 4/5; lower jaw 2; fifth dorsal ray 2 1/6; fifth anal ray 2 1/4; least depth of caudal peduncle 4 4/5; caudal 1 1/4; pectoral 1 1/6; ventral 1 3/4; snout 3 3/4 in head measured from upper jaw tip; eye 4; maxillary 2 1/2; interorbital 2 in snout.

Body elongate, rather depressed anteriorly, well compressed from vent back. Caudal peduncle rather slender, its least depth twice its length. Head rather robust, depth about 7/8 its width. Snout not especially depressed, length about half its width at front edge of eyes. Eyes large, rather close together, hind edge near middle of head length. Mouth moderate, lower jaw slightly projecting. Narrow band of fine teeth in each jaw and row of small ones transversely on vomer, but none on palatines or tongue. Maxillary small, reaches back opposite middle of eye. Interorbital concave. Preopercle with a spine nearly as long as pupil curving up backward. Gill-rakers tubercular, only about 5, obsolete, on lower branch of first gill-arch. Branchiostegals 7. Skin largely smooth. L. 1. high at shoulder, slopes down till median above anal, and front tubes somewhat enlarged. Mandible and preopercle rather cavernous. Spinal dorsal begins close behind head, fin apparently low (damaged). Second dorsal begins slightly before anal origin, fins alike. Caudal apparently truncate or slightly rounded behind. Pectoral rays 13, all simple and lowermost a little stronger, reaches back nearly opposite vent. Ventral inserted about opposite base of lowermost pectoral ray, with one spine and four rays which reach 2/3 to vent. Latter close before anal.

Color in alcohol faded brownish, paler on belly and under surfaces. Back with obsolete scattered darker cloudings.
Traces of indistinct dark bars on dorsal and caudal. Iris pale slaty.

Length 60 mm.

No. 11,061, A. N. S. P., cotype (type) of Uranidea spilota Cope, Grand Rapids, E. D. Cope.

Also No. 11,061, same data. A smaller example, and like the above both females gravid with ova and in poor preservation. These specimens agree with our other Michigan material, from Dexter in Washtenaw County, Grosse Isle, and Ann Arbor, 5 in all. There seems little doubt to my mind that they are all identical, and for this reason I allow U. spilota Cope as only a synonym of the present species. Also obtained in Lake Pequaming by Mr. Hebard.
CAMPOSTOMUM ANOMALUM (RAFINESQUE)

Plate III

(Type of Campostoma browningi Cope)
CAMPOSTOMA ANOMALUM (RAFINESQUE)

(\# Colype of Campostoma gobioinum Cope)
Leuciscus elongatus (Kirtland)

(Cotype of Squallus proriger Cope)
Plate VII

Ceratichthys vigilax Baird and Girard

(Cotype of Hybophis italicus Cope)
Hybopsis kentuckiensis (Rafinesque)

Plate VIII

(Cotype of Ceratichthys cyclotis Cope)
Cottus plumbeus (Agassiz)

(Cotype of Cottus plumbeus plumbeus Cope)
The material considered in this paper consists of some 130 specimens collected fortuitously by Mr. F. M. Gaige on the Bryant Walker Expedition from the Museum of Zoology, University of Michigan, in the Trans-Pecos region of Texas in 1916. Eighteen species are represented in the collection, which taken as a whole is characterized by the large size of the majority of the specimens. It is seldom that a small collection contains so many species of special interest. Mr. Gaige's statement regarding the locality which the expedition visited will give an understanding of the conditions under which the collection was made.

"The region worked is situated some forty miles south and slightly west of Pecos, the nearest town being Toyahvale.
Most of the region is drained by Toyah Creek, which in turn empties into the Pecos River. Part of the work was done in the arid sage lands, the typical west Texas country, and a part in the edge of the Davis Mountains which bound the region studied on the south and west. The vegetation of course is scanty, and as the expedition encountered a very severe drouth, this condition was strongly emphasized. The all prevalent bush is the catclaw acacia, while greasewood, devil thorn and sage, with a few willows and cottonwoods along the larger arroyas and about the few springs, furnish most of the balance. In the mountains small oaks and a few other trees occur at low elevations. Much of the land is quite bare, there are large outcrops of limestone and some igneous rocks, while everywhere, save in a few of the wider valley bottoms, the soil is shallow and stony.

"The collection of robber flies was made very casually. I was in the region primarily for the Formicidae, and incidentally collected a considerable number of other Hymenoptera. This led to a more or less careful search for bees, and the continual harassing which they received at the hands of these predaceous Diptera led to the making of the very informal collection of the latter."

List of Species

*Microstylum morosum* Loew.—This species is variable in color from black to light brown. Some authors use the specific name *pallens* for the brown specimens. Both extremes and intermediate specimens are represented in the collection, so there appears to be no satisfactory way of placing them in two species. It seems advisable to consider all specimens as belonging to one variable species. The large size, nearly 50 millimeters in total length, the uniformly dark colored wings and closed first posterior cell characterize the species, which
is an important enemy of the various insects upon which it preys.

*Microstylum galactodes* Loew.—This species is somewhat smaller than the preceding, with the abdomen black and the wings white. The type locality is Pecos River, Texas; it has also been taken in several places in Kansas.

*Saropogon dispar* Coquillett.—Three specimens. This species closely resembles some members of the genus Deromyia, but the fourth posterior cell is open and each antenna has a short style. Length about 30 millimeters.

*Deromyia ternata* Loew.—Three specimens. The fourth posterior cell is closed and petiolate; thorax with prominent black stripes separated by gray stripes and abbreviated anteriorly. The specimens are larger than usual, having a total length of 26 to 28 millimeters.

*Proctacanthus arno* Townsend.—One female specimen appears to be of this species, but the specimen is teneral and therefore not fully colored.

*Erax anomalus* Bellardi.—One male and three females. All have three submarginal cells and clearly belong to this species.

*Erax argyrosoma* Hine.—The species of *Erax* that belong to the group in which the male has long white hair on some of the abdominal segments parted in the middle and directed outward are common in arid regions. This species is represented by numerous specimens of both sexes. The wing has only two submarginal cells, of which the second is much more than half the length of the first.

*Erax albibarbis* Macquart.—Numerous specimens of both sexes. Considered in the light of recent synonomy, this is the most abundant and widely distributed species of *Erax* in this country, for its range is from the Atlantic to the Pacific and
from Guatemala and even further south to Canada. The specimens in this collection are above average size.

_Eraxe tuberculata_ Coquillett.—The male of this species has three prominent tooth-like extensions on the ventor of the abdomen; size rather small and slender; second submarginal cell of wing much less than half as long as the first. The female is like the male but without the ventral extensions on the abdomen. Three specimens. The type material of the species was procured at San Diego and Brownsville, Texas. Coquillett's description was published in the Journal of the New York Entomological Society, 1904, Volume XII, page 34.

_Eraxe armatus_, new species.

_Description_: This is a rather robust, dark colored species, in large part covered with gray pollen; the legs are generally black, but all the tibiae are red on basal two-thirds to three-fourths. Mystax pale yellow, wings hyaline, second submarginal cell short, much less than half as long as the first. Thorax gray, with some narrow longitudinal markings. Length including genitalia, male 30 millimeters, female 32 millimeters.

**Male.**—Costa slightly thickened at about two-thirds of the distance from the base to the apex of the wing. Hind tibia with a triangular enlargement posteriorly near its middle. First abdominal segment gray, second gray at the sides and behind, leaving a large black triangular spot with its base on the black spots are smaller and more rounded; sixth segment like second, except that the black spot on the sixth is much reduced; seventh segment uniformly gray. Hypopygium large, black and clothed with black hair.

**Female.**—Costa not thickened. Hind tibia not modified. First five abdominal segments colored much as in male, but the black spots are smaller and more rounded; sixth segment
almost entirely black above, seventh black. Ovipositor black, rather slender and about equal in length to abdominal segments five, six and seven combined.

_Type Specimen:_ Male from Phantom Lake, Fort Davis Quadrangle, Davis Mountains, Texas; F. M. Gaige, collector; Museum of Zoology, University of Michigan. Several other specimens of both sexes from the same locality are in the collection. A male from Costula, Texas, collected by the late F. C. Pratt and belonging to U. S. National Museum is referable to this species.

_Remarks:_ Specimens of _Erax_ easily become discolored and greasy, and are therefore sometimes hard to place with descriptions, especially when these are based on color. The color of this species is taken from good specimens, which appear somewhat different from others that are discolored, but there will be no trouble in locating the male of _Erax armatus_ by the peculiar structure of the hind tibia. There are three species of _Erax_ known from North America with modified hind tibiae; in _Erax tagax_ and _Erax sagar_ the modifications are at the distal thirds of their respective hind tibiae, while in _Erax armatus_ the modification is of different appearance and near the middle. This character is not present in any case in any of the females of the various species.

_Erax interruptus_ Macquart.—Numerous specimens of this very common southern species are included in the collection. The male has the hypopygium, from side view, plainly divided at the apex by a deep incision, furnishing a definite character for identification.

_Mallophora fautrix_ Osten Sacken.—More than a dozen specimens of both sexes. The species is quite bee-like in appearance on account of its furry body. I have taken this
insect in Arizona and know it to be an active robber fly which catches a variety of insects for food. It has a wide distribution in arid regions.

*Mallophora guildiana* Williston.—This is a much smaller species than the preceding, but has similar habits. It flies from one perch to another when disturbed, and catches many small insects. The yellowish gray color is more or less protective on the sandy areas where it is usually found.

*Promachus magnus* Bellardi.—The genus *Promachus* contains several species of large active flies which are often abundant and are known to have an influence in materially reducing the numbers of insects upon which they prey. Their large size makes it possible for them to dispose of most other insects, and on account of their abundance much food is required. In my treatment of *Promachus* in a former paper, I had to omit the present species because material was not available. In this collection there are more than twenty fine specimens of both sexes, and from this material the following short description is formulated. Bellardi had only the female, so the male is here described for the first time.

Male.—Length 27-35 millimeters. General color dark; mystax and beard white; antennae and proboscis black; palpi with black bristly hairs; all bristles of the whole body black; legs very dark reddish; thorax of the same color with narrow gray stripes dorsally; wings reddish hyaline, slightly darker at the apex; abdomen black above with gray posterior borders to the segments. There is no great marking in the first posterior cell as in *Promachus vertebratus*, but the darker area at the apex of the wing crosses this cell. The male and female are easily associated; the former has the genitalia densely silvery pilose above. The most apparent variation in the
specimens studied is a noticeable difference in the width of the wings. This is not a sexual characteristic, for it is shared by both males and females.

*Promachus gigantulus* Hine.—This is one of the largest American species of its family. Specimens at hand range from 35 to 47 millimeters in total length. Judging from the size, it must be an important predaceous enemy of other insects in regions where it abounds. The type was collected at El Paso, Texas.

*Asilus gracilis* Wiedemann.—This species is distinguished from all other described species of *Asilus* in this country by the long antennal bristle, which is fully twice as long as the third antennal segment. It is a pale slender species, well adapted to hiding on the gray sand.

*Asilus leucopogon* Williston.—The species is a common one on sand in arid regions, and is difficult to capture because of its protective coloration. It resembles the preceding species, but the antennal bristle is much shorter and the genitalia are very different.
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