# The Water Beetles[1] of a Temporary Pond in Southern Indiana

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It is becoming increasingly difficult to find any natural situation in the Eastern United States which is unmodified by human activity. The whole region is, or is rapidly becoming, one great intermeshing complex of towns and cultivated lands in which only here and there so-called "wilderness areas" are preserved. Even the latter should eventually acquire a different fauna and flora if our general theories of habitat occupancy are correct. That is, in the case of aquatic situations, pond still completely surrounded by forest should be invaded by species from neighbouring ponds, ditches, and empoundments of the "artificial steppes" and the latter should acquire by chance migration some of the "woods pond" species.

It seems, however, that significant interchange of fauna is remarkably slow if it occurs at all either in aquatic or terrestrial habitats. The changes in the fauna of ruderal areas seems largely due to extension of the populations of species already existing in some minor habitats of an area into the artificial extensions of these habitats (1). Migrations into an area from outside seem to be largely restricted to highly modified areas such as cultivated fields although once established in such situations migrants may then establish interrelations with surrounding habitats. These aspects of habitat occupancy have been largely neglected in studying aquatic insects, but considerable evidence is accumulating in regard to some groups such as the grasshoppers and locusts where precise information is of great economic value.

One of the aquatic habitats which seems ideal for studies of population changes is the small, silt-bottomed temporary pond. Ponds of this type are now widely distributed over the Eastern United States. Most of them are man-made being either artificial stock ponds or the result of agricultural practices. Regardless of their origin, however, they now represent a characteristic type of aquatic situation over a wide area and support a rich invertebrate fauna. In permanent ponds, there is a definite succession of water beetle species from the first occupants of a newly formed pool to the species which occur only in situations which are many years old. This succession is not yet fully understood, but in temporary ponds it appears to begin anew each time the pond dries and refills. A temporary pond may thus present an annual succession similar to that which develops in permanent ponds over a period of years, and the study of such situations should allow further analysis of the factors involved in habitat occupancy.

The small pond on which the following observations were made was located on the property of Indiana University in Sec. 35, T-9-S, R-1-W of Monroe County, Indiana. The terrestrial features of the area are described by Cantrall and Young (1), and the general features of the pond as it was in 1908-1910 by Scott (5). At the time of Scott's studies the pond was

[1]Contribution No. 680 from the Zoological Laboratories of Indiana University aided by National Science Foundation grant G-2708 and U. S. Public Health Service grant RG-6411.

apparently permanent, but it was dry during August and through most of September in 1950, 1951, and 1952. The pond was destroyed during building operations in the area in April 1953.

Scott's Pond, as it was called locally, was originally a solution sinkhole enclosed in upland forest. The stoppage of the drainage into the underground strata was probably not begun until after the woodland had been cleared. By 1949, the pond had acquired a marginal rim which was either thrown up by plowing or was produced by erosion of the surrounding field. This rim allowed the pond to extend over a considerably greater area at maximum high water than it would have covered if level with the surrounding field.

The pond in 1908-1910, as described by Scott (5) was roughly oval, about 70 by 57 feet in dimensions at maximum. The greatest depth was about 46 inches, attained during the heavy spring rains. The situation did not seem to have changed significantly by 1949, except that the greatest depth was less, and the pond dried up each year during the late summer and fall droughts. Scott records that in 1887 the pond was about eight or nine feet deep ("deep enough to swim a horse"), and since in 1908-1910 it was less than four feet deep the rate of deposition was calculated to be over two inches per year. This rate, however, must have decreased if it was ever attained because the pond was still over three feet deep at the center at maximum in 1949.

The decrease in sedimentation rate was probably influenced by the discontinuation of cultivation of the surrounding field and also by decrease in the aquatic vegetation. Scott records *Typha* (cattails) as abundant, covering the shallower two-thirds of the pond. In 1949-1953, *Typha* was restricted to a small area of the east side, and was conspicuous only during the summer. In contrast, however, to Scott's description, during 1949-1953 terrestrial grasses, sedges, and some annual weeds which grew over most of the bottom during the periods in which it was dry, persisted even after the pond refilled in the fall. Scott mentions that the bordering weeds and sedges tended to cause the deposition of much of the silt washed in from the sides before it reached the water, but the weed zone seemed greatly extended by 1949 in comparison with his description. The strictly aquatic vascular plants in 1949-1952 were the same as those recorded by Scott (5): *Alisma plantago* L. and *Veronica* (probably *anagallis* L.), together with the emergent *Typha angustifolia* L.

The pond was visited on numerous occasions between October, 1949, and March, 1953. About 25 collections of water beetles were made using small screen dippers. Of these, 16 were large enough to represent a fairly random sample of the beetles present at the time of collecting. These 16 collections contain approximately 950 specimens representing 40 species in 7 families and are the main basis of the observations and conclusions. The pond was also observed repeatedly during every month of the year for changes in vegetation, but water beetles were not collected on every occasion.

I wish to acknowledge the assistance of Mr. Joseph E. Woodruff in mounting and preparing the specimens for study. Dr. Merle E. Jacobs also assisted with the collecting and made observations on the pond in the summer of 1950 when I was absent.

### Seasonal Aspects

The seasonal aspects of the pond and the correlated changes in the water beetle fauna followed a general pattern as follows:

*Late Summer and Early Fall:* Scott's Pond was completely dry in August in 1950, 1951, and 1952. The bottom had large cracks across the mud by about August 10 in the central depression, and the bordering vegetation had begun to extend toward the center. By September the central depression was covered with a growth of small grasses, sedges, and herbs, apparently of species already present in the bordering zone of annual weeds. The cattails, *Typha*, persisted on one side of the pond and remained green and the annual weeds outside the cattail zone grew quite high during this period. Small shrubs of buttonbush, *Cephalanthus occidentalis* L., and a very few small red maple trees, *Acer rubrum* L., did not seem to be particularly affected by the drying of the pond. No water beetles could be found by digging in the bottom or by pulling up rooted vegetation in August or September. In late September the pond refilled, but as usual, no beetles were found for some time afterwards.

*Fall:* In October, water beetle adults were present in the pond but the number of species was limited. Some of the cattails and emergent grasses were still green at this time and some of the recently submerged terrestrial plants remained green beneath the water into the winter. Algae grew slowly on the submerged vegetation in early October, but were not very evident even in November. *Agabus disintegratus* and *Tropisternus l. nimbatus* were both observed swimming in the water along shore in some numbers. The species of *Laccophilus* were all present at the edges in small numbers. *Agabus punctatus* was found only in one area of the pond where a small stand of buttonbush had produced a partially shaded area with considerable leafy debris and dead wood in the water. This area persisted throughout the period of study and was obviously the main habitat of *Agabus punctatus*, *Hydroporus niger*, *H. rubilabris*, and a number of other species.

*Winter:* The winter aspect of the pond did not differ greatly from the fall except that the dead emergent vegetation in December and January had fallen into the water and begun to decay. Some herbs and grasses remained green on the bottom even beneath ice. Algae were now evident on both the dead and living vegetation in the water. In January the pond reached its maximum and overflowed through an outlet at the northwest corner. *Tropisternus l. nimbatus* remained very common in the winter as did *Agabus disintegratus*. *Laccophilus fasciatus* and *proximus* seemed to increase in abundance in December, possibly due to migration from other habitats, but *L. maculosus* disappeared and did not reappear until late spring. *Hygrotus nubilus* became more abundant in January and could be seen swimming over the bottom. *Agabus punctatus* remained common in December in the buttonwood area, but apparently declined somewhat in January.

*Early Spring:* The early spring or prevernal changes in the water beetle fauna were particularly striking and interesting. In February and early March a few submerged plants still remained green and the water was at its maximum. Algae was conspicuous on the vegetation and by late March had overgrown all dead vegetation. The *Laccophilus* species

practically disappeared during this period, but three forms appeared for the first time: *Haliplus ohioensis, Berosus fraternus,* and *B. peregrinus. Agabus aeruginosus* of which one specimen had been taken in January also apparently increased in February. *Haliplus ohioensis* was found in February, 1951, and in February, March, and April of 1952, but was not found in February, 1953.

*Spring:* During late March and through April, green algae became more and more conspicuous. Emergent grasses began to appear at the edges of the pond in April and algae grew abundantly on all dead vegetation. The water level receded from the January high during this period so that the pond gradually decreased in area and depth. *Haliplus ohioensis* largely disappeared by the middle of March although a few specimens persisted until later. The species of *Laccophilus* reappeared in April and continued in moderate numbers into the summer. The species of *Agabus* and *Tropisternus* remained about the same. *Dineutus assimilis* appeared in April and extended into June in 1952.

*Late Spring:* In May the cattails began to sprout above the water level, and filamentous algae (*Spirogyra* and others) began to form "greasy" masses in the center of the pond. The water level was now down about two or more feet from the January level and the pond was greatly reduced in size. Most of the water beetles seemed to be present in about the same proportions as before, but *Tropisternus l. nimbatus* was apparently very rare during this period.

*Summer:* By June emergent and floating vascular vegetation (*Typha, Alisma,* and *Veronica* along with some semi-aquatic grasses and others) was abundant around the edges of the water. The mass of algae in the pond was somewhat reduced, but it still formed semi-floating mats in places. By July, *Alisma* was growing over the entire bottom of the central depression in which the water was only about a foot deep. The algae had been greatly reduced by this time, however, probably due to the feeding of various invertebrates. Some beetles were taken in the pond commonly only during the summer period. *Hydrocanthus iricolor, Enochrus ochraceus,* and *Ilybius biguttulus* seem particularly characteristic of these summer conditions. *Agabus disintegratus* and *A. punctatus* along with *Tropisternus l. nimbatus* were correspondingly rare.

### The Water Beetle Fauna

Table I lists the adult water beetles considered characteristic of Scott's Pond. Characteristic is here used in the sense of species likely to be encountered in such a situation and apt to complete their life cycles there. The species listed show a high frequency (regularity of occurrence) and a consistently high abundance (commonness) with some exceptions. The species which do not show a high frequency and high abundance are thought to be poorly represented in the sample because of the techniques used. Three of them (*Bidessus lacustris, B. suburbanus,* and *Hygrotus dispar*) are small and may have been overlooked at times when they were not particularly common. On the other hand, *Coptotomus longulus, Thermonectus basillaris,* and *T. ornaticollis* are medium sized, very active, species usually found in deeper water and may have escaped the collecting net.

TABLE I. Characteristic Adult Water Beetles of a Temporary Silt-Bottomed Pond in Southern Indiana

| Species | S | O | N | D | J | F | M | A | M | J | J | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DYTISCIDAE: | | | | | | | | | | | | |
| *Agabus disintegratus* (Cr.) | — | 5/1* | 7/1 | 9/1 | 4/2 | 19/3 | 6/2 | 5/3 | 4/2 | 3/1 | — | —** |
| " *punctatus Melsh.* | — | 7/1 | — | 48/1 | 9/2 | 64/3 | 13/2 | 20/3 | 30/2 | 16/1 | — | — |
| *Bidessus lacustris* (Say) | — | — | — | 6/1 | — | — | — | — | 6/2 | 1/1 | — | — |
| " *suburbanus* Fall | — | — | — | 9/1 | — | — | — | 17/3 | 1/2 | — | — | — |
| *Coptotomus longulus* LeC. | — | — | — | — | — | 1/3 | 4/2 | — | — | — | — | — |
| *Hygrotus dispar* (LeC.) | — | — | 2/1 | — | — | — | — | — | 1/2 | — | — | — |
| " *nubilus* (LeC.) | — | — | 1/1 | 1/1 | 5/2 | 2/3 | 1/2 | — | — | 3/1 | — | — |
| *Hydroporus niger* Say | — | 1/1 | — | — | 2/2 | 6/3 | 2/2 | 1/3 | 8/1 | — | — | — |
| " *rufilabris* Shp. | — | 1/1 | — | — | 1/2 | 19/3 | 5/2 | 3/3 | 1/2 | 5/1 | 4/1 | — |
| *Laccophilus fasciatus* Aubé | — | 3/1 | 1/1 | 27/1 | 3/2 | — | 2/2 | 5/3 | 10/2 | 2/1 | 6/1 | — |
| " *proximus* Say | — | 5/1 | 1/1 | 21/1 | 5/2 | — | — | 4/3 | 1/2 | 1/1 | 5/1 | — |
| *Thermonectus basillaris* (Harris) | — | — | — | 1/1 | 1/2 | — | — | — | — | — | — | — |
| " *ornaticollis* Aubé | — | 1/1 | — | 4/1 | — | — | — | — | — | — | — | — |
| HYDROPHILIDAE: | | | | | | | | | | | | |
| *Tropisternus l. nimbatus* Say | — | 11/1 | 1/1 | 38/1 | 19/2 | 1/3 | 13/2 | 6/3 | — | 1/1 | — | — |

* First number under month is total specimens taken; second number is number of collections made in that month from September 1949 to February 1953.

**Pond was completely dry in August and through most of September during both 1950 and 1951.

The species represented in Table I can be subdivided into at least three groups on the basis of known habitat preferences. One group is composed of the pioneer species which invade any newly formed body of fresh water during its early stages and then gradually decrease as the biota develops. These include *Bidessus lacustris*, *Hygrotus nubilus*, *Laccophilus fasciatus*, *L. proximus*, *Thermonectus basillaris*, and *Tropisternus l. nimbatus*. Since the pond dried up each year and thus essentially started over again, the presence and abundance of these forms is to be expected. This group represents derivatives of the western desert fauna, but none of the species are now found in the deserts. They may have evolved in connection with the prairie plains. All of them are certainly now more abundant than they were before the clearing of the forests, but there is no indication that their ranges have actually changed.

A second group of species is characteristic of silt-bottomed ponds, but does not occur regularly in new situations as pioneers. *Agabus disintegratus*, *Thermonectus ornaticollis*, and some of the seasonal or sporadic species are examples. These again may be relicts of the old prairie pond fauna. *Coptotomus longulus* may belong to this group although it is often found in more permanent ponds.

A third group, possibly a subdivision of the second, includes the remainder of the species in Table I. These are characteristically associated with silt-bottomed ponds, but only where there is some accumulation of organic debris: *Agabus punctatus*, *Bidessus suburbanus*, *Hygrotus dispar*, *Hydroporus niger* and *H. rufilabris*. In Scott's Pond these species were obviously associated with the fallen leaves and other debris beneath the small buttonbushes.

Some characteristic species of true detritus ponds also occurred in Scott's Pond, but they were mostly seasonal or erratic. Some of them, such as *Hydrocanthus iricolor* and *Hydrovatus c. pustulatus* were represented in Scott's original list (5) and were probably then characteristic. More recently, the detritus pond species increased as the vegetation in the pond increased in the spring while the pioneer species correspondingly declined.

Only a few unidentified larvae of *Hydroporus* and *Agabus* were taken in Scott's Pond in 1949-1953. In consequence, it is impossible to say whether all of the species thought to be characteristic actually completed their life cycles in the pond. The absence of larvae of *Laccophilus* in the collections is surprising.

Table II lists the species of adult water beetles taken in Scott's Pond on more than one occasion but only infrequently or during a restricted season of the year. Some of these seem to occur only at the season in which they were taken, for example *Haliplus ohioensis* and *Berosus fraternus*. Other species probably migrate into the pond during periods of maximum abundance in other situations, for example *Laccophilus maculosus* which is characteristic of more permanent ponds. Within this group of seasonal or sporadic occupants some species probably completed their life cycles in the pond. *Hydrocanthus iricolor*, for example, may have been a permanent inhabitant surviving from a period when the pond was permanent. The apparent absence of the species during most of the year, however, suggests a replacement of the population by migration.

TABLE II. Seasonal or Sporadic Adult Water Beetles of a Temporary Silt-Bottomed Pond in Southern Indiana

| Species | S | O | N | D | J | F | M | A | M | J | J | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DYTISCIDAE | | | | | | | | | | | | |
| *Agabus aeruginosus* Aubé | — | — | — | — | 1/2* | 6/3 | — | — | — | — | — | — |
| *Copelatus glyphicus* (Say) | — | — | — | 4/1 | — | 3/3 | 3/2 | — | — | — | — | — |
| *Laccophilus maculosus* Say | — | 1/1 | — | — | — | — | — | 5/3 | 4/2 | 2/1 | 1/1 | — |
| NOTERIDAE | | | | | | | | | | | | |
| *Hydrocanthus iricolor* Say | — | — | — | 1/1 | — | — | — | — | — | — | 10/1 | — |
| HALIPLIDAE | | | | | | | | | | | | |
| *Haliplus ohioensis* Wallis | — | — | — | — | — | 52/3 | 12/2 | 1/3 | — | — | — | — |
| GYRINIDAE | | | | | | | | | | | | |
| *Dineutus assimilis* Kirby | — | — | — | — | — | — | — | 1/3 | 2/2 | 2/1 | — | — |
| HYDROCHIDAE | | | | | | | | | | | | |
| *Hydrochus rufipes* Melsh? | — | — | — | 1/1 | — | — | — | — | 24/2 | 2/1 | — | — |
| HELOPHORIDAE | | | | | | | | | | | | |
| *Helophorus tuberculatus* Gyll. | — | — | — | — | — | — | 1/2 | 2/3 | 6/2 | — | — | — |
| " *lineatus* (Say) | — | — | — | — | — | — | 1/3 | — | — | 1/1 | — | — |
| HYDROPHILIDAE | | | | | | | | | | | | |
| *Berosus fraternus* LeC.? | — | — | — | — | — | 6/3 | 3/2 | 3/3 | 1/2 | — | — | — |
| " *peregrinus* (Hbst.) | — | 1/1 | — | — | — | 7/3 | 3/2 | — | — | — | — | — |
| " *striatus* (Say) | — | — | — | — | — | — | 1/2 | 1/3 | — | — | — | — |
| *Enochrus cinctus* (Say) | — | — | — | — | — | — | 16/2 | — | 8/2 | — | — | — |
| " *ochraceus* Melsh. | — | — | — | — | — | — | — | 1/3 | 1/2 | — | 3/1 | — |
| " *pygmaeus* (Fabr.) | | | | | | | | | | | | |
| " *horni* Leech | — | — | — | — | — | — | — | 2/3 | 3/2 | — | — | — |
| " *perplexus* LeC. | | | | | | | | | | | | |
| *Hydrophilus triangularis* Say | — | — | — | — | — | — | — | 1/3 | — | — | 1/1 | — |

* See notes accompanying Table I.

Three of the species listed in Table II may represent part of a group of desert-prairie pond species. These are *Haliplus ohioensis*, *Agabus aeruginosus*, and *Berosus fraternus*. It is possible that these species have specialized life histories which allow them to pass over periods of drought. The appearance of teneral adults in the prevernal and vernal periods and the abundance of adults only at those times suggests that the larvae, pupae, or eggs must somehow pass over the period of drying in the late summer and early fall.

A similar correlation of the life cycle has been surmised in *Desmopachria mutchleri* Blatchley in Florida by Young (7). It is difficult, however, to make any positive statement as to the larval habitat of such species because like other drought-adapted forms they are so highly vagile that the habitats in which they appear as adults may be merely coincidental. However, the great abundance of *Haliplus ohioensis* in Scott's Pond in February and March during two of three springs and at no other time strongly suggests that the species completed its life cycle in the pond.

In addition to the species listed in Tables I and II, eight others were taken only once during the period of study and are considered erratic or accidental. Some of them are characteristic of situations with heavy accumulations of organic debris or detritus ponds: *Bidessus affinis* (Say), *Desmopachria convexa* (Aubé), *Hydrovatus c. pustulatus* (Melsh.), *Ilybius biguttulus* (Germ.), *Tropisternus b. blatchleyi* D'Orchymont, and *Tropisternus natator* D'Orchymont. The habitat correlations of the remaining two is not known: *Hydrochus subcupreus* Randall and *Helophorus lineatus* Say.

### Comparison with Other Lists

A comparison of Scott's list of water beetles with the 1949-52 list indicates the change from relatively permanent to temporary. The species listed by Scott, with nomenclature revised, and a summary of his comments follows:

| | |
|---|---|
| *HALIPLIDAE:* | *Peltodytes 12-punctatus* (Say)—always present, abundant. |
| | *Peltodytes muticus* (LeC.)—always present, abundant. |
| *NOTERIDAE:* | *Hydrocanthus iricolor* (Say)—throughout the year in considerable numbers. |
| *DYTISCIDAE:* | *Laccophilus maculosus* Say |
| | *Laccophilus fasciatus* Aubé—present in about equal numbers to preceding. |
| | *Hydrovatus c. pustulatus* (Melsh.) — present throughout the year. |
| | *Coptotomus interrogatus* (Fabr.) — taken in numbers at any season. |
| | *Graphoderus liberus* (Say) — one specimen June 6, 1910—probably just immigrated. |
| *GYRINIDAE:* | *Dineutus assimilis* Kirby—present from April to October. |

*HYDROPHILIDAE:* *Tropisternus mixtus* (LeConte) — the commonest beetle in the pond, seen even beneath the ice in winter.

*Berosus peregrinus* (Herbst.)—not common.

The only notable species lacking from this list but present in the 1949-1953 period are: *Agabus disintegratus*, *Tropisternus l. nimbatus*, and *Laccophilus proximus*. It is possible that Scott confused the first with *Coptotomus* and the last with *L. maculosus*, but he could hardly have missed *nimbatus* if it had been present. Notably lacking in our list, however, is any species of *Peltodytes (=Cnemidotus)* which are relatively good indicators of permanent water. Also the rarity of *Coptotomus* in our collections probably reflects the fact that the water had become shallower and less permanent, since the species of this genus are normally bottom feeders in fairly deep water out beyond the marginal vegetated zone. *Tropisternus mixtus*, another permanent pond species, is not represented in our list, although it may be considered replaced by *T. blatchleyi blatchleyi* or *T. natator* which were not at that time separable. The decline in occupancy of the pond by *Dineutus assimilis* was probably due to the decrease in size of the area of open water during much of the year.

The examination of a number of lists of aquatic beetles from small ponds in other regions shows some interesting parallels to Scott's Pond.

Dickinson (2) lists 33 aquatic beetles from a small field pond in Alachua County, Florida. This pond, also studied by the present writer, was somewhat similar to Scott's Pond, probably having arisen from a small sinkhole originally in forest. It was, however, considerably richer in vegetation and at times may have connected with other ponds in the vicinity. Unlike Scott's Pond, fairy shrimp were present at times during the year. Considering the separation in space and the very different faunas of the surrounding areas, the similarity of the water beetles of the two ponds is remarkable. The following species are identical in the two lists: *Agabus punctatus*, *Laccophilus fasciatus*, *L. proximus*, *Thermonectus basillaris*, *Tropisternus b. blatchleyi*, and *T. l. nimbatus*. Three of these were present in high frequency and abundance in both the Florida and Indiana ponds: *A. punctatus*, *L. proximus*, and *T. l. nimbatus*. Considering ecological equivalents or subspecies the following additional correspondences are evident: *Coptotomus i. obscurus* Sharp, *Copelatus c. chevrolati* Aubé (equivalent of *glyphicus*), *Hydroporus falli* Blatchley (equivalent of *niger*), *Hydrocanthus regius* Young, *Haliplus annulatus* Roberts (equivalent of *ohioensis* and also abundant only in prevernal period), *Dineutus c. carolinus* LeC. (equivalent of *assimilis*), *Hydrochus foveatus* Hald. and *H. simplex* LeC. (equivalent of *rufipes*), *Berosus infuscatus* LeC. (equivalent of *fraternus*), and *Tropisternus natator* subsp.? (the *glaber* of Dickinson's list). Considering the species listed by Scott (1910), *Graphoderus liberus* also occurred in both ponds, and *Peltodytes floridensis* Matheson of the Florida list is equivalent to *P. 12-punctatus*. Thus the total Scott's Pond list contains 7 identical, 2 only subspecifically different, and 8 ecologically equivalent species of the Florida list.

Kenk (3) lists the aquatic beetles from a number of small ponds near Ann Arbor, Michigan. The ponds considered are not as similar to Scott's

Pond in history or general features as the one in Florida studied by Dickinson. They are also near the northern limits or outside the ranges of some of the species found in Scott's Pond, but of 32 species listed from temporary ponds, the following also occurred in Scott's Pond: *Bidessus affinis, Desmopachria convexa, Hydroporus niger, Hydrovatus c. pustulatus, Helophorus lineata, Berosus striatus, Hydrophilus* (prob. *triangularis*), *and Enochrus ochraceus.* In more permanent ponds Kenk also found *Graphoderus liberus, Laccophilus maculosus, Dineutus assimilis,* and *Hydrocanthus iricolor.*

Needham and Williamson (4) list 28 species of Dytiscidae collected in a small permanent pond at Lake Forest, Illinois. Their list contains the following species also found in Scott's Pond: *Agabus disintegratus, Bidessus affinis, B. lacustris, Coptotomus interrogatus, Hydrovatus c. pustulatus, Hygrotus dispar, H. nubilus, Laccophilus fasciatus, L. maculosus, L. proximus,* and *Thermonectus basillaris.*

Sherman (6) says that almost exactly the same species as those in the Needham and Williamson list occur in meadow ponds in New York, along with *Desmopachria convexa* and *Hydrocanthus iricolor.*

## Summary and Conclusions

Forty species of water beetles (Coleoptera) were collected in a small, silt-bottomed temporary pond in southern Indiana at various times between 1949 and 1953. Eight species occurred in nearly every month except August and September when the pond was dry. These, and six other species, are considered *characteristic.* The characteristic species include (1) pioneer forms which migrate into any body of water and are characteristic of newly formed situations, (2) some possible relicts of prairie pond situations, and (3) a few species characteristically associated with organic debris in silt ponds but not detritus pond species. Of the remaining species, 18 are either *seasonal* or *sporadic.* The strikingly seasonal species may include specialized desert-prairie pond forms which can survive even during periods of complete drying. *Haliplus ohioensis* Wallis may be such a drought-adapted species. Adults of this species appeared in the pond in February in two successive years but were absent the next year. Sporadic species apparently entered the pond during periods when they were abundant in other habitats. The eight species taken only once in the pond are considered *erratic* or accidental.

It is concluded from the data presented and from a consideration of other studies that the characteristic species of water beetles in temporary ponds are the adventitious pioneer forms. These form a remarkably constant nucleus over a very wide area and are generally the major predators and scavengers. The greater part of the list of species of any temporary pond, however, is largely composed of species which migrate in from habitats in the surrounding area and are often characteristic of other habitats in the region. Some of these migrants are present only as adults and perhaps only fortuitously; others which find suitable breeding places in the pond persist for longer periods.

There is no clear evidence of the extension of any of the species into new regions, but all of the species considered characteristic must have increased in number at least with the increase in temporary ponds.

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