

Seasonal Distribution and Abundance of Odonata at
A Large Pond in Central Pennsylvania

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This report is a compilation of all known Odonata records from Ten Acre Pond, Centre County, Pennsylvania. The author is indebted to G. H. and A. F. Beatty whose encouragement and assistance have made this project possible. Other collectors whose data have been used include Rudolf Raff, Justin Schmidt, Dr. S. W. Frost, and Dr. Thomas Donnelly.

The seasonal distribution of the sixty-one species occurring at Ten Acre Pond has been tabulated along with a rough indication of year to year population fluctuation.

Habitat Description

Ten Acre Pond is located four and one half miles due west of State College in an area of stunted plant growth known as the "Barrens," 1350 feet above sea level.

A railroad, built by Andrew Carnegie in 1881 to remove iron ore, divides the pond east to west. Silt from nearby ore washings probably formed a water-tight layer of clay in the cuts on either side of the railroad thus forming the bed of the pond.

There are no natural inlets or outlets to the pond, but there is a large pipe from an unknown source located at the west end along the railroad bed. During the early spring a continuous flow of clear water from this pipe raises the water level several feet. After the flow stops the water level steadily falls due to evaporation.

Precipitation seems to have only temporary effects. The surface area in the spring may exceed ten acres while near dryness in the late fall is not uncommon (Fig. 1).

In the spring of 1962 the water reached abnormally high levels which enabled the pond to survive the worst drought of its

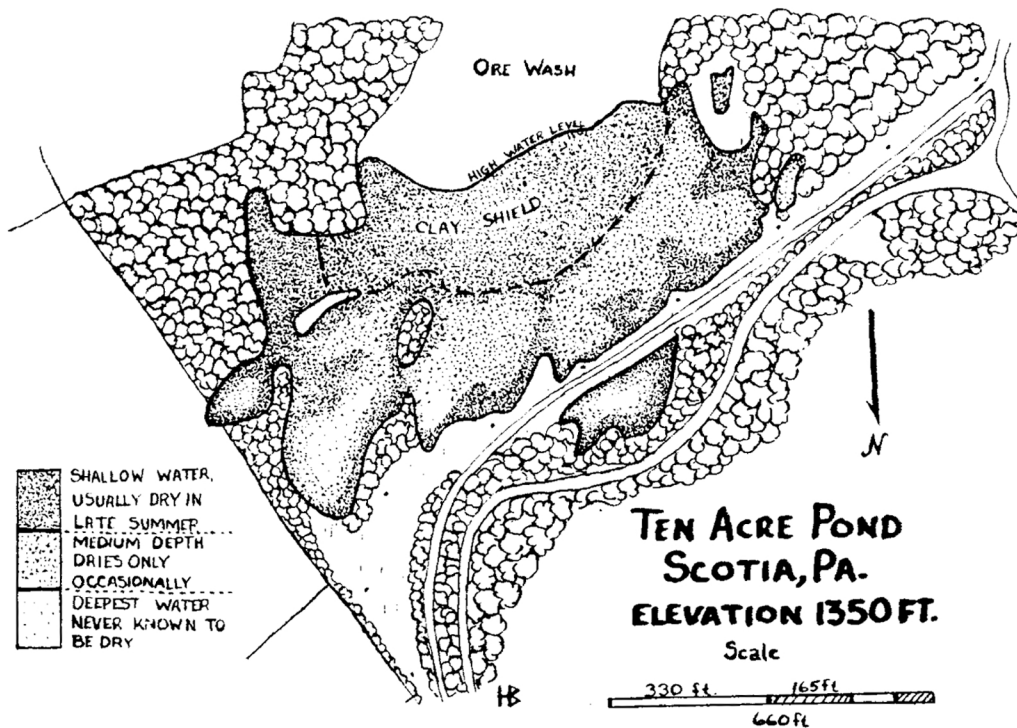


Figure 1. Water fluctuations at Ten Acre Pond.



Figures 2. A view southward of Ten Acre Pond in the late spring. *Aeshna mutata* used to be collected commonly flying over the spatterdocks in the foreground.

existence - six inches of rain from the beginning of May to the end of August. In 1960 with less severe conditions the pond was reduced to a few puddles in which overcrowding of aquatic life was much in evidence.

The prevailing winds are from the west; consequently, floating debris has deposited nearly a foot of organic material at the eastern end of the pond. This is in marked contrast to much of the rest of the pond where clay predominates. As a result of these varying bottom compositions several plant communities have formed, each in its preferred environment. Spatterdock, *Nymphaea advena*, is widespread in deeper water particularly where organic debris is present. Cattails, *Typha latifolia*, are located in one cove along the railroad bed with only a few isolated plants elsewhere. Rushes, *Eleocharis obtusa*, predominates one area of shallow water. These microhabitats undoubtedly are a contributing factor to the wide variety of Odonata found here.

Air and water temperatures are also variable. There is a large frost pocket near Ten Acre Pond where temperatures on still nights are commonly twenty and more degrees below the State College temperature. Frosts have been recorded in every month except July. These extreme air temperatures probably have little effect on the larval Odonata but it could conceivably diminish a flying population enough to show its effect in the next generation. As for the water, it may well be that temperatures at the other extreme would be ecologically limiting. Due to the lack of circulation and to the shallowness in the late summer, pronounced surface heating is often observed.

Sampling

After George Beatty discovered *Aeshna mutata* in abundance in mid-June of

1955, he made eleven more collecting trips to the pond in the next five weeks. The information gathered during this intense period of study has been very useful in determining seasonal distribution and population changes.

In 1960 the author made twenty-five weekly trips from late May through October. In 1961 less extensive, yet rather thorough collecting was done at irregular intervals over the same period. A less than adequate, yet still informative, four trips from July through October in 1962 produced additions to the species list and seasonal distribution.

The emphasis on all of these samples was to collect as many species as possible which were present. Since this is often an impossible undertaking, sight records of many species identifiable on the wing were included in the data. In this effort to collect a large number of species, all sections of the pond were visited.

Seasonal Distribution and Population Fluctuation

Table 1 shows the seasonal distribution of sixty-one species of Odonata at Ten Acre Pond. Each month has been divided into four periods of approximately one week.

The yearly population fluctuations of the chart may lead to invalid conclusions if taken to be absolute. For instance a small inconspicuous species like *Nehalennia irene* may be very common yet go almost unnoticed while one or two individuals of a larger species make themselves conspicuous. This produces difficulties in determining the actual population. Also, as frequently happens, a peak population does not occur simultaneously with a collecting trip. Based on these considerations the 1960 and 1961 ratings would be most accurate, whereas the other years may only be valid for a portion of the population.

Table 1. Seasonal and yearly distribution of Odonata at Ten Acre pond, Scotia, Pennsylvania.^{a/}

Species	Time of observations ^{b/}												Year ^{c/}										
	May			June			July			Aug.			Sept.			Oct.			1955	1959	1960	1961	1962
	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3					
<i>Aeshna canadensis</i>										X								0	0	1	0	0	
<i>A. constricta</i>																	X	0	0	1	0	0	
<i>A. mutata</i>				X	X	X	X	X	X	X	X							4	3	3	1	0	
<i>A. tuberculifera</i>										X	X	X	X	X	X	X	- X	0	0	3	3	3	
<i>A. umbrosa</i>										X								0	0	1	0	0	
<i>A. verticalis</i>														X				0	0	1	0	0	
<i>Anax junius</i>	X - X			X	X	X	X	X	X	X	X	X	X	X	X			3	4	3	3	3	
<i>A. longipes</i>				X	X	X	X	X	- X	X								0	2	2	2	2	
<i>Protogomphurus exilis</i>				X		X												0	1	1	1	0	
<i>P. spicatus</i>						X	X											0	1	0	0	1	
<i>Arigomphus villosipes</i>				X	X	X	X	X	- X									4	2	3	3	1	
<i>Tetragoneuria canis</i>					X													0	0	0	1	0	
<i>T. cynosura</i>				X	X	X												1	0	2	2	0	
<i>Cordulia shurtleffi</i>				X	X	X	X	X	X									3	P	2	3	3	
<i>Dorocordulia libera</i>					X	X	X	X	X	- X	X	- X						3	P	1	3	2	

Table 1. (cont.) Seasonal and yearly distribution of Odonata at Ten Acre pond, Scotia, Pennsylvania.^{a/}

Species	Time of observations ^{b/}												Year ^{c/}															
	May			June			July			Aug.			Sept.			Oct.			1955	1959	1960	1961	1962					
	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3						4				
Libellula																												
cyanea																												
L. julia																												
L. luctuosa																												
L. lydia																												
L. pulchella																												
L. semifasciata																												
L. quadrimaculata																												
Perithemis tenera																												
Erythemis																												
simplicicollis																												
Sympetrum obtrusum																												
S. rubicundulum																												
S. semicinctum																												
S. vicinum																												
Pachydiplax																												
longipennis																												
Leucorrhinia																												
frigida																												
L. glacialis																												
L. hudsonica																												
L. intacta																												
Celethemis elisa																												
Pantala flavescens																												
Tramea carolina																												
T. lacerata																												
Calopteryx maculata																												
Lestes congener																												
L. disjunctus																												
australis																												
L. eurinus																												
L. forcipatus																												
L. inequalis																												
L. rectangularis																												
L. unguiculatus																												
L. vigilax																												
Nehalennia gracilis																												
N. irene																												
Chromagrion conditum																												
Enallagma aspersum																												
E. boreale																												
E. civile																												
E. cyathigerum																												
E. ebrium																												
E. geminatum																												
E. hageni																												
E. signatum																												
E. vesperum																												
Ischnura posita																												
I. verticalis																												
Anomalagrion																												
hastatum																												
Collections (No.)	1	0	5	4	5	9	9	4	5	5	3	3	2	2	1	3	2	1	1	1	3	3	1	12	5	29	10	4
Species (No.)	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	2	2	3	4	3	4	3	3	

^{a/} X - species collected or observed; - indicates gaps in data do not see sufficient to warrant exclusion of the species for the quarter.

^{b/} Numerals under each month indicate quarters. Duration of each quarter was : 1 - 1st to 7th; 2 - 8th to 15th; 3 - 16th to 23rd; and 4 - 24th to end of month.

^{c/} Figures for years indicate population fluctuations:

0 - not reported, seen or collected.

1 - Scarce, one or two were most seen during any collecting trip.

2 - Frequent, never seen in large numbers but could be found with some regularity during its flying season.

3 - Common, found with ease during its flying season.

4 - Abundant, occurring in hundreds or even thousands some time during its flying season.

P - Present, no indication of relative abundance given in the records.

Three species recorded by sight only are included in the chart - Libellula cyanea, Pantala flavescens, and Calopteryx maculata. Epi-aeshna heros was reported seen in June of 1961. Since its identification was not positive, it was not included on the chart. (Years in which one or two minor trips were made have not been included in this last section.)

The Effect of Drought on Year to Year Population Fluctuations

As was indicated earlier, Ten Acre Pond has a yearly cycle where high water in the spring gives way to low water in the late summer and fall. The receding water leaves many nymph habitats on dry ground. In addition to the loss of habitats, overcrowding occurs. The combination of these two factors I think, played an important role in changing the abundance of several species from 1960 to 1961.

Dredging in the late fall of 1960 produced many Anax longipes and Aeshna mutata larvae along with large numbers Libellulid and Cordulina larvae. In 1961 only two imago Aeshna mutata were seen, Anax longipes remained fairly stable over the previous year, and Cordulia shurtleffi and Dorocordulia libera showed significant increases. The seasonal distribution for D. libera was almost exclusively determined by this one year's collecting.

Among the group of species which did not show significant change over the previous year was Aeshna tuberculifera. It is of particular interest since it and A. mutata occurred in about equal numbers in 1960. Why did A. mutata become nearly extinct in one year while A. tuberculifera remain unchanged? Perhaps the explanation lies in their life cycle. A. mutata is an early summer flier, while A. tuberculifera begins flying in early August

and continues to the first hard frost. A. mutata overwinters in the nymph stage whereas it is quite likely that A. tuberculifera is in the egg stage. Females of A. tuberculifera were often seen ovipositing in clumps of grass far from the water but below the springtime water levels. A life cycle of this type would be advantageous to a habitat experiencing drought conditions, whereas the life cycle of A. mutata would not. If this analysis is not correct, the only other alternative would be that the A. tuberculifera larvae are more fit to withstand overcrowding.

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