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The Natural History of a Nearctic Temporary Pond in Ontario with Remarks on Continental Variation in such Habitats

key words: temporary ponds, seasonal succession, community structure, growth rates, life cycles

Abstract

The seasonal succession of members of the invertebrate community of a temporary vernal pond in southern Ontario is described. Although succession was essentially continuous, 5 faunal groups are suggested, based on time of appearance and duration of active forms in the pond. Some species were found during virtually the entire aquatic phase, while others completed their life cycles in only 2–3 weeks. Analysis of growth rates revealed many different patterns between species and groups. Analysis of community structure in terms of trophic status indicated shifts which coincided with the seasonal occurrence of the pond's potential food resources. Comparison of this fauna with that of a similar pond on Vancouver Island, British Columbia (some 2,400 km to the west) showed many similarities in niche occupancy, including 6 species in common. The biological characteristics leading to the success of these cosmopolitan species in temporary aquatic habitats is discussed.

Contents

1. Introduction .............................................. 239
2. Habitat Description ....................................... 240
3. Material and Methods .................................... 240
4. Results.................................................. 242
   a) Sunfish Pond, physico-chemical data ................. 242
   b) Fauna ............................................. 243
   c) Comparison of Sunfish Pond with Page's Pond ...... 248
5. Discussion ................................................. 250
6. Acknowledgements ....................................... 251
7. Summary.................................................. 252
8. References ............................................... 252

1. Introduction

Canada has an abundance of freshwater habitats. Its lentic bodies range in size from over 77,720 km², as in the case of Lake Superior, to tiny pools only a few metres across. At the lower end of this scale, reduced basin volume frequently results in the habitats losing their free-water for part of each year (either by evaporation in summer or by freezing to the bottom in winter). As Wiggins et al. (1980) have pointed out, information on temporary ponds is primarily concerned with species in particular taxonomic groups (e.g. Thomas, 1963; Cole, 1965; Way et al., 1980) or relatively
local areas (e.g., Dickinson, 1948; Barclay, 1966). Even so, apart from the pioneering study done by Kenk (1949) in Michigan, few detailed studies of entire temporary pond communities have been made in the Nearctic region.

However, Wiggins et al. (1980) attempted a synthesis of existing knowledge in order to identify evolutionary and ecological strategies of animals in annual temporary ponds. They found the taxa from southern Ontario temporary ponds to be relatively consistent and predictable.

The purpose of this paper is two-fold. It presents a detailed account of the animals living in a small vernal pond in southern Ontario including their life histories, seasonal succession and adaptations to the dry phase of their habitat, and compares this community with that found in a very similar pond some 2,400 km to the west, on Vancouver Island. The universality of the model of Wiggins et al. will be examined in both these respects.

2. Habitat Description

Sunfish temporary pond is located near the city of Waterloo, Wilmot County, Ontario, Canada (43° 28' N; 80° 38' W). It has a maximum diameter of 30 m and a depth of 80 cm just after snow-melt in mid April, and usually dries up by mid-July. In exceptionally wet years it may contain a little water for a few days in the fall but essentially it experiences 9 consecutive months of drought annually. It therefore falls under the definition of a temporary vernal pool (Wiggins, 1973). On two adjacent sides it is flanked by a gravel road but otherwise is heavily vegetated (Fig. 1). Cattails (Typha latifolia L.) grow across much of the pond bottom and redstemmed dogwood (Cornus sp.), pussy willows (Salix discolor MÜHL.) and white cedar (Thuja occidentalis) all have their roots in the water. The pond bottom consists of a layer of decaying plant material (mostly Typha L.) several centimeters thick through which grow patches of terrestrial weed species. Clumps of filamentous algae develop in late spring. Throughout the summer, a dense canopy of herbaceous perennials covers the bed resulting in a reasonably moist substrate without standing water. Under winter snow cover, the substrate freezes solid.

3. Materials and Methods

The fauna of Sunfish Pond was sampled intensively at intervals ranging from 1 week to 3 months, depending on the amount of activity observed, during 1974 and 1975. The pond had been kept under preliminary surveillance for 3 years prior to this, during which time the composition of the animal community, as a whole, changed little. During the wet phase a 53 μm mesh dip-net was used to sample both the water column and the bottom in shallow and deep water. In addition, the undersides of submerged leaves, bark and branches were examined for more cryptic forms, and any adult insects flying over the pond were sampled with a sweep-net. On each occasion sampling effort was kept constant so as to allow a semi-quantitative analysis of the fauna to be made. More quantitative samplers were not used because of the problems of diversity of microhabitat, patchiness of animals and small population size of certain species, inherent in small ponds. During the dry phase, bottom samples were dug up to a depth of 30 cm. Care was taken, throughout, not to remove too many animals in order not to alter the community balance. All samples were preserved in either alcohol or formalin and later sorted and the animals identified and measured (to determine growth rates) in the laboratory.

Water level was recorded during both the wet and dry phases. In the latter case this involved digging down to the water table. Temperature was measured in both the deepest and shallowest areas and pH and conductivity were also determined.
Figure 1. Sunfish temporary pond in early spring (upper) and winter (lower).
4. Results

a) Sunfish Pond physico-chemical data

Figure 2 shows various characteristics of Sunfish Pond for the period 1974 to 1975. During mid-summer the groundwater table dropped gradually, reaching a depth of greater than 50 cm for much of the late summer and fall (based on observations over several years). Extremely heavy rainfall, as in late November, 1974, caused a rapid rise in the water table and even some standing water in the pond but this was short-lived.

Pond diameter predictably decreased throughout late spring and summer but the increase in early spring was rapid. Associated with diminution of the water volume was a gradual increase in conductivity, rising from a post-snow melt value of around 170 μmhos to a maximum of around 710 μmhos prior to drying out (values were corrected for temperature changes). pH was variable (6.8–8.7) and probably reflected the rapid changes in carbon dioxide content of the water caused by photosynthetic activity of filamentous algae.

Figure 2. Physical and chemical measurements made on Sunfish Pond during 1974–1975.
Temperature increased from around 8°C, post-snow melt, to a maximum of 27°C in mid-summer. Water in the deeper areas was typically 2–3°C cooler than surface water.

b) Fauna

The 98 taxa identified from Sunfish Pond, together with their seasonal distribution, are shown in Figure 3. Although a seasonal succession amongst the species is plainly evident, several recognisably distinct faunal groups are suggested.

Group 1, comprising 12 taxa, contains animals that were found during virtually the entire aquatic phase. During the dry phase they could be dug up from the pond substrate as semi-torpid adults or immature stages and were capable of movement within minutes of being placed in water. This group includes all the bivalve and gastropod molluscs and the oligochaetes found as well as the two species of Hydroporus, Acanthocyclops bicuspidatus thomasi S. A. Forbes and the very abundant Einfeldia? dorsalis (MEIGEN).

Group 2 consists of 39 taxa present as active forms within a few days of pond filling in the spring. Its members largely completed their life cycles within 4–6 weeks and disappeared (by entering a resting stage, usually as eggs or diapausing immatures, or by leaving the pond as emerged adults) well before (4–6 weeks) the pond dried up. Included here are the limnephitid caddisflies, mosquitoes, mites, anostracans, cladocerans, some chironomids, some beetles, an anisopteran dragonfly and a harpacticoid copepod.

Group 3 contains 19 taxa which appeared some 2–5 weeks after pond formation in the spring. It includes a conchostracan, a zygopteran dragonfly, certain chironomids and coleopterans some of which appeared only as adults and did not breed in this pond. Such species as did, typically completed their life cycles in about 5 weeks.

Group 4 comprises 15 taxa which appeared only 2–3 weeks before the pool dried up (approximately 10 weeks after filling). It includes beetles, mayflies and chironomids.

Group 5 contains 13 taxa which appeared only in the dry phase. These were primarily terrestrial or riparian species and include beetles, myriapods and arachnids.

Figure 4 gives examples of the different types of life cycle shown by some of the more abundant animals in Sunfish Pond and illustrates relative growth rates. In Group 1, the midge Einfeldia? dorsalis appears to have two periods of growth. Larvae in all four instars were present in mid April and the earlier ones grew rapidly until only third and fourth instars and pupae were evident in mid May. Adults were abundant by the end of May. The resulting eggs hatched quickly and the larvae grew rapidly in early June, passing into their second instar. Thereafter, growth slowed and the summer dry period was passed as early instars that could be recovered from the pond substrate. As soon as water reappeared in the spring, the larvae continued their growth. Two of the common molluscs, Sphaerium sp. and Lymnaea humilis SAY showed gradual increases in growth throughout the pond phase with peak growth in the warm water of mid July just before dry-up. Virtually no growth occurred in the dry phase. Species in Group 1 were subject to the temperature range 0–27°C during the aquatic phase of their habitat.

The species assigned to Group 2 showed a variety of life cycles, many, such as Chirocephalopsis, Limnephilus indivisus WALKER, ? Limnephilus sp. and the three species of Aedes, grew very rapidly at the start of the pool phase. Although the life cycles of the Aedes species were very similar, all being univoltine and present as early instars concurrently, some staggering of development through late instars and emergence was evident. A. trichurus DYAR was the first to emerge, followed a week or so
| Date       | 12 Apr 1974 | 24 Apr | 26 Apr | 26 May | 1 Jun | 16 June | 5 Jul | 19 Jul | 28 Jul | 16 Aug | 24 Nov | 17 Dec 1975 | 23 Apr | 20 May |
|------------|-------------|--------|--------|--------|-------|---------|-------|--------|--------|--------|--------|-------------|--------|--------|
| Species    |             |        |        |        |       |         |       |        |        |        |        |             |        |        |
| Einfeldia? dorsalis (Diptera: Chironomidae) | | | | | | | | | | | | | | |
| *Sphaerium* sp. (Bivalvia) | | | | | | | | | | | | | | |
| *Cyclops bicupispidatus thomasi* (Cyclopoida) | | | | | | | | | | | | | | |
| *Lymnaea humilis* (Gastropoda) | | | | | | | | | | | | | | |
| *Hydroporus* sp. A (Coleoptera: Dytiscidae) | | | | | | | | | | | | | | |
| *Cyrtoporus* sp. B | | | | | | | | | | | | | | |
| *Gyraulis parvus* (Gastropoda) | | | | | | | | | | | | | | |
| *Lumbriculus* sp. (Oligochaeta: Lumbriculidae) | | | | | | | | | | | | | | |
| *Nais* sp. (Oligochaeta: Naididae) | | | | | | | | | | | | | | |
| Enchytraeidae (Oligochaeta) | | | | | | | | | | | | | | |
| *Cyclops bicuspidatus thomasi* (Cyclopoida) | | | | | | | | | | | | | | |
| *Lumbriculus* sp. (Oligochaeta: Lumbriculidae) | | | | | | | | | | | | | | |
| *Enchytraeidae* (Oligochaeta) | | | | | | | | | | | | | | |
| *Cyclops bicuspidatus thomasi* (Cyclopoida) | | | | | | | | | | | | | | |
| *Lumbriculus* sp. (Oligochaeta: Lumbriculidae) | | | | | | | | | | | | | | |
| *Enchytraeidae* (Oligochaeta) | | | | | | | | | | | | | | |
| *Cyclops bicuspidatus thomasi* (Cyclopoida) | | | | | | | | | | | | | | |
| *Lumbriculus* sp. (Oligochaeta: Lumbriculidae) | | | | | | | | | | | | | | |
| *Enchytraeidae* (Oligochaeta) | | | | | | | | | | | | | | |
| *Cyclops bicuspidatus thomasi* (Cyclopoida) | | | | | | | | | | | | | | |
| *Lumbriculus* sp. (Oligochaeta: Lumbriculidae) | | | | | | | | | | | | | | |
| *Enchytraeidae* (Oligochaeta) | | | | | | | | | | | | | | |
Figure 3. Seasonal succession of the fauna of Sunfish Pond. (Duration of the dry period is indicated by the horizontal black bar. Circles indicate “abundant, common and rare” in order of decreasing size. Faunal groupings are indicated on the right-hand side of the figure).
later by *A. fitchii* (Felt and Young) and finally *A. sticticus* (Meigen). *Trissocladius* showed a more gradual growth rate spanning a longer period — though it still emerged well before the end of the pool stage. Larval development of the dragonfly *Libellula* took virtually the entire aquatic phase of the pond. Species in Group 2 were generally subject to less of a temperature range (0–17°C) during development.

Group 3 species again showed variable growth rates. The dragonfly *Lestes* grew gradually throughout much of the pond phase, while *Lynceus? brachyurus* O. F. Müller and *Rhantus* grew more quickly, but at different times. These species grew in the temperature range 12–22°C.

Among the Group 4 taxa, the mayfly *Cloeon* showed extremely rapid growth, completing its life cycle in 2–3 weeks. *Cricotopus* grew quickly also, taking about 4 weeks and completing its larval development in the moist pond substrate in mid July. The hydrophilid beetle *Helophorus orientalis* Motsch showed slower growth and passed much of its larval development in the moist bottom material. Water temperatures prevailing at the time of Group 4 development were in the range 17–27°C.

Suggested life cycles and growth patterns of the species of Group 5 are largely speculative as these primarily terrestrial animals were not sampled at other times of the year. It is suggested that they grew at a reasonable pace given the warm temperature and plentiful food supply of the moist pond basin.
Figure 5. A. Seasonal variation in total numbers of taxa (●—●) seen in Sunfish Pond, together with an estimate of relative numbers of individuals present (—). B. and C. Seasonal changes in the percentage composition of the 4 main trophic categories in the community.

Figure 5A shows the seasonal variation in the total number of taxa seen in the pond. Diversity was greatest during the wet phase of the habitat, but the drying basin by no means lacked a fauna.

Due to the semi-quantitative sampling method used, an accurate picture of the population dynamics of the pond community (other than the approximation given in Figure 5A) is not possible. One can, however, analyse, community structure in terms of trophic status. Using information in the general literature, each taxon was ascribed to a trophic category. It is acknowledged that the trophic status of a limited number of taxa may be uncertain, and that of some others may change during their life cycle, nevertheless, preliminary analysis of the community in this manner seems justified. The percentage composition of the 4 main categories is shown in Figures 5B and C. The percentage of suspension-feeders generally declined throughout the aquatic phase, correlating with decreasing pond diameter, and hence water volume ($r = 0.806$). The few suspension-feeding taxa present in the bottom mud of the dry phase were obviously non-functional. At spring thaw, the detritivore-herbivores predominated. Many were found to be eating the decaying plant material left over from the terrestrial phase. Numbers of species in this category fluctuated throughout
the aquatic phase. Although they dropped during the dry phase, they increased in
importance in terms of percentage composition of the community—reflecting the move-
mant of species into the drying basin to feed on decaying vegetation. The relative im-
portance of omnivorous scavengers also increased at this time for similar reasons. The
percentage of predatory taxa was relatively low at spring thaw but increased rapidly
thereafter, primarily due to the immigration of species capable of flight—particularly
aquatic beetles, and remained high for most of the aquatic phase. Their importance
declined significantly shortly after dry-up.

c) Comparison of Sunfish Pond with Page’s Pond

Page’s Pond is located near Cedar (49° 05’ N; 123° 50’ W) on Vancouver Island,
British Columbia. It reaches a maximum diameter of 15 m and is very similar in appear-
ance and setting to Sunfish Pond. According to local information it holds water for
about 5 months of the year, December—May. It was sampled thoroughly once, in
early April, 1977, when the water temperature was about 8°C. In Table 1, the fauna
is compared with that of Sunfish Pond for approximately the same time of year and
water temperature. On those occasions, 50 and 41 taxa were recorded from Sunfish
Pond and Page’s Pond, respectively.

The number of species in each major taxon (i.e., Class, Order and, in many instances,
Family) was frequently identical or very similar in the two ponds, for example, dytis-
cid beetles, 5 species each; chironomids, 5 species each; culicids, 3 species each; tri-
chopterans, 3 species each; mites, Sunfish 4 species, Page’s 3 species; copepods,
Sunfish 4 species, Page’s 3 species. In addition, the faunas included 23 (25.3 %) genera in common and 6 (6.0 %) identical species. Interestingly, of the latter, only
one was an insect capable of flight; (Limnephilus indivisus) the others were micro-
crustaceans (Cladocera, Copepoda, Ostracoda) and a mite.

Table 1. Comparison of the faunas of Sunfish and Page’s ponds based on extensive
sampling in early spring. (Taxa in brackets are known to occur in Sunfish Pond but
were not caught at that time of year).

| Sunfish Pond, Ontario | Page’s Pond, B.C. |
|-----------------------|-------------------|
| (12 April, 1974; 8 °C) | (2 April, 1977; 8 °C) |
| Tricladida | [Hymanella retenuova CASTLE] | unidentified |
| Nematoda | unidentified | unidentified |
| Oligochaeta | Lumbriculidae (unident.) | Lumbricus variegatus (O. F. MÜLLER) |
| Oligochaeta | [Nais sp.] | Nais sp. |
| Hirudinea | Helobdella stagnalis (L.) | — |
| Anostraca | Chirocephalopsis bundyi (FORBES) | *Eubranchipus oregonus (CHEAUSER) |
| Cladocera | *Daphnia pulex LEYDIG | Daphnia pulex |
| | Acanthocyclops bicuspidatus thomasi S. A. FORBES | Acanthocyclops sp. |
| | *Acanthocyclops vernalis FISCHER | Acanthocyclops vernalis |
| | Cyclops (Diacyclops) sp. | Cyclops (Diacyclops) sp. |
| | *Canthocamptus staphylinoides PEARSE | Canthocamptus staphylinoides |
| Ostracoda | *Cypria ophthalmica (JURINE) | †Diaptomus caducus LIGHT |
| | | Cypria ophthalmica |
| | | Herpetocypris replans (BAIRD) |
Table 1. Continued

| Sunfish Pond, Ontario (12 April, 1974; 8°C) | Page's Pond, B. C. (2 April, 1977; 8°C) |
|------------------------------------------|---------------------------------------|
| Isopoda                                  | Cypricerus reticulatus (ZADDACH)      |
|                                          | Cyclocypris ovum (JURINE)             |
| Candonina decora FURTOS                   |                                       |
| Gastropoda                               | †Caecidotea occidentalis (WILLIAMS)   |
| Lymnaea humilis SAY                      |                                       |
| Lymnaea columnella SAY                    |                                       |
| Gyraulus parvus (SAY)                    |                                       |
|                                          | †Menetus opercularis (GOULD)          |
| Bivalvia                                 | Sphaerium sp.                         |
|                                          | Pisidium sp.                          |
| Acari                                    |                                        |
| Hydryphantes sp.                         |                                        |
| *Thyas barbigera (VIETS)                 | Thyas barbigera                       |
| Thyas brunellii LUNDBLAD                 | Thyas stolli KOENIKE                  |
|                                          | Eulais sp.                            |
| Oribatidae (unident.)                    |                                        |
| Collombola                               | Isotomidae (unident.)                 |
| Libellula sp.                            | Isotomidae (unident.)                 |
| [Lestes sp.]                              | Lestes sp.                            |
| Hemiptera                                | Sigara grossolineata HUNGERFORD       |
| Trichoptera                              | Sigara sp.                            |
| *Limnephilus indivisus WALKER            | Limnephilus indivisus                 |
| ?Limnephilus sp. A.                      | ?Limnephilus sp. B.                   |
| ?Limnephilus indivisus Walker            |                                        |
| ?Menetus opercularis (GOULD)             |                                        |
| Coleoptera                               |                                        |
| Hydroporus spp. (2)                      | Hydroporus sp. (1)                    |
| [Dytiscus sp.]                            | Dytiscus sp.                          |
| Agabus sp.                               | Agabus sp.                            |
| [Rhantus sp.]                             | Rhantus sp.                           |
| Anacaena limbata FABRICIUS               |                                        |
| ?Chelonariidae (unident.)                |                                        |
| Tipula spp. (2)                          |                                        |
| Aedes siicticus (MEIGEN)                 | Aedes ?flavescens                     |
| [Chaoborus sp.]                          | Chaoborus sp.                         |
| [Mochlonyx cinetipes Coq].               | Mochlonyx sp.                         |
| Anthomyiidae (unident.)                  | Anthomyiidae (unident.)               |
| ?Muscidae (unident.)                     |                                        |
| Chironomidae                             |                                        |
| Chironomus (Einfeldia) dorsalis (MEIGEN) |                                        |
| Phaenopsectra sp.                        |                                        |
| Trissocladius sp.                        |                                        |
| Eukiefferiella sp. (1)                   |                                        |
| [Corynoneura sp.]                        |                                        |
| Vertebrata                               |                                        |
| Rana sylvatica LE CONTE                  |                                        |
| Ambystoma sp.                            | ?Ambystoma sp.                        |

* Species in common
† Species with distributions restricted to the Pacific Coast of North America

17 Int. Revue ges. Hydrobiol. Vol. 68, No 2
For a small water body, Sunfish Pond supports a diverse fauna the members of which represent most of the major freshwater animal groups. The physical-chemical features of this habitat change both subtly and catastrophically in its annual cycle but, despite such extremes, a community of animals exists year round, though a succession of species is clearly evident. A few species seem hardy enough to exist in an active or semi-torpid state for most of the year, while others complete their growth and reproduction during the aquatic phase of the pond and avoid the rigours of the dry period in special aestival forms—usually eggs.

Wiggins et al. (1980), on the basis of an extensive study of temporary pools in southern Ontario, divided the typical fauna into four groups depending on each species' strategy for tolerating or avoiding drought and on period of recruitment to the community, and Williams and Hynes (1976) made a similar analysis of the faunas of temporary streams in Ontario. Such functional analyses reveal much about the adaptations of temporary water species and make discussion of this topic here largely unnecessary. However, subdivision based on the combination of tolerance strategy (physiological response) with period of recruitment (temporal response), as in the Wiggins et al. model, would seem to be a somewhat confusing classification. For example, we see aestivation taking place primarily in the egg or immature stage in species from 3 of the 4 groups designated. Again, the groupings “Overwintering residents”, “Overwintering spring recruits” and “Overwintering summer recruits” all contain species which are permanent residents of temporary ponds and whose active phases in these habitats often coincide.

An alternative approach to community analysis is to group species simply on the basis of their time of occurrence (as active forms) in the habitat (see Williams and Hynes, 1977) and, for the Sunfish Pond community, five groups can be recognized. Analysis of life cycles shows that although the members of any one group occupy the pond for roughly the same time span, their patterns of growth may be very different. Some grow quickly at first, then more slowly, some vice versa and some grow at a fairly constant rate throughout their lives. Temporal shifts in the trophic makeup of the community seem to coincide well with the seasonal occurrence of the pond's potential food resources.

The faunas of Sunfish and Page's ponds are remarkably similar considering that they are separated by a large distance, a mountain range and salt water. It is evident that they provide very similar niches which, in the case of cosmopolitan, readily-disseminated forms such as Daphnia pulex Leydig, are filled by identical species. In cases where the geographical range of a species does not encompass the two ponds, local endemic species of the same major taxon fill the gap, as in the case of the anostracans — Chirocephalopsis bundyi (Forbes) in Sunfish and Eubranchipus oregonus Creaser in Page's Pond.

Most of the species common to both ponds were microcrustaceans, and all show special characteristics of either their physiology or life cycle which would seem to make them successful in temporary pools as well as perhaps allowing them the means to colonize them. The literature contains the following useful information in this regard. Daphnia pulex Leydig is known to be a very widespread species (Brooks, 1959) and, according to Stross (1969), has several different strains which exhibit different seasonal cycles. Such plasticity, coupled with a drought-resistant ephippial stage and parthenogenesis, must favour establishment in temporary ponds. Canthocamptus staphylionoides Pearse is recorded as widespread in southern parts of Canada and the central United States (Borutski, 1964). It is capable of encystment and can survive...
long periods in anoxic sediments where it is thought to respire anaerobically (Cole 1953). Presumably, this would stand it in good stead in temporary waters, particularly as a very closely related species, *C. s. staphylinus*, is capable of withstanding drought. *C. staphylinoides* is thought to replace *C. s. staphylinus* in North America, the latter being widespread in the Palearctic (Borutzki, 1964). *Acanthocyclops vernalis* Fischer shows considerable environmental tolerance, sexually mature specimens having been found, for example, at temperatures of 1–30°C and in pH of 4.4–8.2. It is found in a large variety of water bodies, from the deep sublittoral of large lakes to swamps. It is capable of aestivating in an advanced state of metamorphosis and as such can survive drying (Rylov, 1963). *Cypria ophthalmica* (Jurine) occurs primarily in the mixed-woods and boreal forest zones (Delorme, 1970), particularly in ponds rich in decaying material (Tressler, 1959). Not much appears known of its biology other than the fact that Kenk (1949) showed it could exist in the damp substrate left in temporary pond basins.

Of the non-crustaceans, the success of *Thyas barbigera* (Viets) in temporary ponds can be attributed to several factors including the ability of later stages to withstand drought, fast growth of the parasitic stages and availability of suitable hosts during dispersion (Wiggins et al., 1980). *Limnephilus indivisus* Walker belongs to a genus widely distributed in the Nearctic (Wiggins, 1977). Its success in temporary habitats may be due to several features in its development, namely, the deposition of eggs in a gelatinous matrix in sheltered areas of the dry pond basin, rapid embryological development and retention of first instar larvae within the matrix until the pond is flooded (Wiggins, 1973).

The actual mechanism of transcontinental movement of these species varies. At various times since the last glaciation, some aquatic insect groups are thought to have emigrated westwards from the St. Lawrence system through drainage connections (Ross, 1956; Flannagan, 1978) but flight may also be important. This may also have been the method employed by mites in their parasitic phase on airborne hosts. The resting stages of micro-crustaceans may be light enough to be carried by air currents. Maguire (1963), for example, found this route to be very effective in the transport of disseminules of some small species of Cladocera, and Fryer (1972) has shown that some ephippia are easily picked up by wind.

In terms of the Wiggins et al. prediction of the faunal compliment of annual temporary pools, Sunfish Pond agrees well, with 69.9 % of its fauna, at the generic level (48 out of a possible total of 69 genera) appearing in their list. For Page's Pond the agreement at the generic level is also good, being 68.8 % (22 out of a possible 32 identified taxa). These figures are however, only approximations and are subject to inaccuracies due to incomplete identifications of some members of the communities and local endemism. Unfortunately, no study exists on temporary ponds in eastern maritime regions of the continent thus limiting this comparison. However, based on the present study, the provisional list of genera representing the temporary pool community in north-eastern North America outlined by Wiggins and his co-workers seems to have widespread predictive value.

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7. Summary

Physical, chemical and faunal characteristics of a temporary vernal pond in southern Ontario, Canada are given. As the pond water evaporated, temperature and conductivity rose while pH varied. 98 taxa were identified which showed seasonal succession over the annual cycle of the pond. Five recognizably distinct faunal groups, based on time of appearance and period of activity, were apparent. Group 1 animals were found during the entire aquatic phase. Group 2 animals were active within days of the pond filling in the spring and completed their life cycles within 4–6 weeks. Group 3 animals appeared 2–5 weeks after filling and typically took 5 weeks to mature. Species in Group 4 were evident only 2–3 week before the pond dried up and exhibited rapid growth. Group 5 animals appeared in the dry phase and included primarily terrestrial and riparian species. Community composition is analyzed in terms of trophic status of each taxon. This indicates shifts which were appropriate for seasonal changes in the pond’s potential food resources. The taxonomic composition of the spring-time fauna of this pond is compared with that of a very similar pond 2,400 km to the west, on Vancouver Island, British Columbia. The number of species in each major taxon was frequently identical in the two ponds. In addition, the faunas had 23 genera and 6 species in common. These two faunas are compared with a predictive model of the faunal compliment of annual temporary pools proposed by Wiggins et al. (1980) and good agreements are found. Adaptation of some cosmopolitan species to life in temporary ponds are discussed.

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