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AQUATIC FLOWERING PLANTS IN THE GENESEE VALLEY REGION, WESTERN NEW YORK

by

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ABSTRACT

The area of this aquatic flora includes ten counties of western New York in or adjacent to the Genesee River Valley from Pennsylvania to Lake Ontario. All pertinent publications were reviewed and herbarium specimens examined from both regional and State herbaria. During the course of study (1967-1982) over 2,000 new specimens were collected, identified, and preserved. Special attention was directed to the taxonomy of submersed aquatic plants and the grass and sedge families. Pertinent synonymy of names is included. Observations are made on distribution, frequency, and on the increase or decline in numbers. Rare plants are noted. Forty-two angiosperm families, 78 genera, and 375 species are included in the floral list.

INTRODUCTION

The past twenty years have seen a tremendous upsurge of activity on the waters of New York. Recreational use expanded rapidly. Then, a conscious determination by the public to improve water quality resulted in widespread and large-scale construction for pollution abatement. In almost the same period, both scientific study and routine monitoring of the waters developed at an unprecendented rate. The National Environmental Policy Act of 1969 was followed by a mandate to perform environmental studies, and, to some degree, scientific study is now used in water quality management decisions in New York. Yet, the effort devoted to different fields has been uneven. In contrast with the many limnological studies, there has been little plant taxonomy and floristics.

Ironically, New York scientists were once pre-eminent in aquatic plants. The most widely known manuals are those of W. C. Muenscher (1944) and E. C. Ogden's revision of Fassett's book (1957). When we began to study aquatic vegetation in Conesus Lake during 1966, systematic collection and critical taxonomic work on the New York State aquatic flora had virtually ceased. It seemed important to assemble a working flora for the region from the literature, herbaria, and from new collections. The senior author and his students have collected submersed and floating-leaf plants, and Seanna Rugenstein has contributed specimens of *Carex* extensively, as well as a variety of other plants. The source of most submersed plants has been six Finger Lakes (Silver, Conesus, Hemlock, Canadice, Honeoye, Canandaigua) and two Lake Ontario Bays (Irondquoit and Sodus). The original assembly of this floral list was accomplished in 1967 when most of the specimens and references were twenty or more years old. For the present expanded list, almost 2,000 collections were added, references studied, and new herbaria searched. Modern collections are now well represented, but not for all groups.

A number of arbitrary decisions were necessary in order to complete this project. The original project was a thorough compilation of published references and herbarium specimens, species by species, with original identifications for specimens. This format is most useful as a central information source, but it was too clumsy for standard publication. The expanded format has been preserved and is permanently available to investigators (Forest, Rugenstein, and Mills, 1979). This shortened version includes names, synonomy, and distribution of specimens by counties. Where a herbarium specimen was not located, a reference to literature is cited. Also, notes on taxonomy, distribution and ecology have been added. Nomenclature follows the 8th Edition of Gray's Manual (Fernald, 1950), except where

*The revised manuscript included major contributions by Jean Q. Wade who also prepared the manuscript. Noelle Gibbs and Anne Kimber also assisted in the work. Valuable editorial advice was given by Richard H. Zander and Gary J. Pierce.

otherwise noted. The choice as to whether a plant was "aquatic" with a few exceptions, simply conforms to Fassett (1957). The synonomy applies only to names in regional references and follows standard authorities. No taxonomic or nomenclatural novelties are proposed here.

The ten counties included within the Genesee Valley Region are: Allegany (ALL), Genesee (GEN), Livingston (LIV), Monroe (MON), Ontario (ONT), Orleans (ORL), Steuben (STE), Wayne (WAY), Wyoming (WYO) and Yates (YAT). These constitute a tier about three counties wide and deep on both sides of the Genesee River from the Pennsylvania State border to Lake Ontario. At the periphery of the floristic region, drainage is to watersheds other than the Genesee. No political or other administrative unit corresponds to the study region, but it does approximate Region 8 of the New York State Department of Environmental Conservation.

The bibliography assembled for the region is comprehensive, and it is the first assembled. However, there is an overlap of the western row of counties with the Flora of the Niagara Frontier (Zenkert, 1934) (Zenkert and Zander, 1975) (Zander and Pierce, 1979). The Niagara Flora publications include references to local studies, primarily in the Allegany Park area, which are not included here. Few aquatic plants were listed in them.

A thorough review of specimens was completed for herbaria at the State University Colleges at Brockport (BROC) and at Geneseo (GESU), and also for the herbaria of the Rochester Academy of Science (ROCH) and Monroe County Parks (HPH). Limited searches for particular groups or specimens were made at the Buffalo Museum of Science (BUF), the New York State Museum at Albany (NYS), the herbarium of Hobart-William Smith Colleges at Geneva (DH), and the combined herbaria at Cornell University (BH) and (CU).

The Wiegand Herbarium (CU), now combined with the herbarium of the Bailey Hortorium (BH), contains voucher specimens for many of the reports by Clausen (1940), McVaugh (1938), and Muenscher (1927, 1944, 1946, 1951), while Ogden's specimens are at Albany. The Buffalo Museum of Science is the repository for the specimens cited in the Flora of the Niagara Frontier Region and its two supplements, and it also contains specimens collected for the earliest report considered in this study (Day, 1882-3). Specimens in the four herbaria in the Rochester area, however, have been collected at various times by a number of workers, and only part have been reported in writing. Consequently, a consolidation of information from these herbaria was a major aim of this project.

HISTORICAL REVIEW

The history of botanical studies in the region was summarized by Ehrle and Coleman (1969) except for the aquatic floras. The earliest writing considered here was that of Day (1882-3), whose "vicinity of Buffalo" extended into the Genesee Valley Region. Similarly, the Niagara Region Flora by Zenkert (1934), Zenkert and Zander, (1975) and Zander and Pierce (1979) overlapped in Allegany, Genesee, Livingston, Orleans, Wyoming and other counties.

The basic aquatic flora of the Genesee Valley Region was published in three articles on aquatic plants in the New York State Biological Survey Series. Muenscher (1927) provided a list for Conesus and Silver Lakes in the central portion of the area. In the same Survey issue, Muenscher recorded the unusual flora of saline Wolf Creek in Wyoming County. Clausen (1940) provided an aquatic flora of the Ontario watershed, including shore areas and inland lakes, and McVaugh (1938) prepared an aquatic flora of the Allegany and Chemung watershed, part of which is within the boundaries established for this report. Floral studies virtually ceased soon after the surveys of this period. Some collecting was continued by Muenscher, Coleman, and others for a few years, but very few specimens were preserved during thirty years. Ironically, the feasibility of aquatic floral studies was increased after 1940 with the publication of the general manuals on aquatic plants by Muenscher (1944) and by Fassett (1940), which was revised by E. C. Ogden (Fassett, 1957). In addition, study of the critical genus *Potamogeton* has been aided by the key of Ogden (1953) and his subsequent "*Potamogeton* in New York" (1974a). Ogden (1974b) also indicated distribution within the region for some aquatic plants in his writing on anatomical patterns.

A series of local floras for Monroe and adjacent counties was prepared between 1896 and 1953 and published in the Proceedings of the Rochester Academy of Science. Certain well-known aquatic collecting sites and specimens from them appear repeatedly in various writings: Bergen Swamp in Genesee County; Irondequoit Bay and Mendon Ponds in Monroe County; and Sodus Bay and Mud Pond in Wayne County. Other sites, and other counties have received far less attention.

The flora of Monroe County and adjacent territory was prepared by Beckwith and Macauley (1896) with supplementary lists by Beckwith, Macauley and Baxter (1910, 1917). Searing (1894) prepared a flora of Long Pond, the Lake Ontario embayment in western Monroe County. Local floras followed for Bergen Swamp (Baxter and House, 1925) (Stewart and Merrill, 1937) (Muenscher, 1946, 1951), and Mendon Ponds (Goodwin, 1943). The ecology of Monroe County was studied during the same period by R. E. Shanks (1966). Shanks and Goodwin (1943) provided valuable notes, including taxonomic re-evaluations. Shanks' full ecological report was published only posthumously and his original data was lost. Finally, Matthews and White (1953) prepared a monograph of the Cyperaceae of Monroe County and adjacent territory. This is a particularly valuable taxonomic report and re-evaluation. The three aquatic floras covering the region were all prepared for the biological surveys between 1926 and 1939 and Shanks' work was completed in 1940. The report of Matthews and White (1953) ended the series of Rochester region floras.

A revival of interest in floral studies occurred in the late 1960s. Babette B. Coleman of the University of Rochester was a personal link with the previous era when W. C. Muenscher and his students had been active. Under the vigorous leadership of Elwood B. Ehrle, vascular plants were collected and a modern herbarium begun at the State College at Geneseo. Among the resulting publications was a paper on aquatic vascular plants of Conesus Lake (Forest and Mills, 1971). New collections were added and both floristic and quantitative ecological data were collected. Preliminary analyses of this data were reported by: Forest and Maxwell (1971) for Honeoye Lake; Forest, Grow, and Maxwell (1971) for Canandaigua Lake; Forest, Maxwell and Doby (1973) for Irondequoit Bay; and Forest and Maxwell (1973) for Sodus Bay. Regional patterns began to emerge, and have been reported more recently. Submersed vascular plants have been investigated, using specimens collected from 1863 to 1979 (Kimber, 1977; Forest, 1977; Forest, Wade and Maxwell, 1978). The bulk of the data, however, has not been published.

Some floral data is also included in the series, "Lakes of New York State" (Bloomfield, 1978a, 1978b). In this series the Geneseo studies have provided information for Conesus, Hemlock, Canadice, Honeoye, and Canandaigua Lakes and Irondequoit Bay.

The research herbarium at the State University College at Brockport emerged since 1969 as a major botanical resource. Its director, E. David Hammond, both actively collected and obtained material through exchange. In respect to acquatic plants, his collections in Orleans County are particularly valuable in extending the known distribution of species, but specimens are included from other counties in the northern portion of the Genesee Valley Region as well. Unfortunately, both Hammond and his collection have now left the region. Both are at the New York Botanical Garden.

It is hoped that the assembly of bibilography and the compilation of species in herbaria (Forest, Rugenstein, and Mills, 1979) as well as the publication of this floral summary will stimulate further interest in the regional aquatic flora. Numerous inviting and challenging questions have arisen during this investigation, and there is a need for much more work to build from this base. A particular effort should be made to search for species which have not been collected since the early part of this Century or before, and to document the extent of change in species diversity and floral composition.

Notes for Systematic Section

1. Plant names are arranged alphabetically by family, genus, and species. Synonomy of all names has been traced as far as possible, using Fernald (1950) or Fassett (1957) in most cases. However, re-identification of specimens alters the list further. Baxter and House (1925) is included in Muenscher (1946).

2. Abbreviations for counties indicated that a specimen has been examined:

ALL - Allegany	ORL - Orleans
GEN - Genesee	STE - Steuben
LIV - Livingston	WAY - Wayne
MON - Monroe	WYO - Wyoming
ONT - Ontario	YAT - Yates

3. Forest, Rugenstein and Mills (1979), provides two kinds of information not contained in the curren writing: reference to all publications which list a species, and the herbaria where specimens ar deposited. This report and other Contributions of the Environmental Resource Center are on deposi at the Milne Library of the State University College, Geneseo, N.Y. 14454.
4. * an asterisk designates those species listed in Rare and Endangered Vasular Plant Species in Nev York State (Mitchell, Sheviak and Dean, 1980).
5. Recently there have been two efforts to assemble synonymised checklists of vascular plant name These are:

   Kartesz, J. H. and Rosemarie Kartesz. (1980).

   A Synonymized Checklist of the Vascular Flora of the United States, Canada and Greenlan Vol. II, The Biots of North America. Univ. North Carolina Press, Chapel Hill. Abbreviation, KK

   National List of Plant Names.

   Vol. I List of Scientific Plant Names. Vol. II Synonymy. U.S.D.A. Soil Conservation Servic Document SCS-TP-159. (1982). Abbreviation, NL.

   The first list (KK) is much more convenient to use than the second (NL). Although both lists we searched only KK is cited except for cases in which a name was missing or if the two lists disagree Neither list contains several of the older names which were determined to be synonyms by t authors of this report.

FAMILIES, GENERA, AND SPECIES OF MONOCOTYLEDONOUS PLANTS

ALSIMATACEAE

Alisma L. *A. gramineum* K.C. Gmel. var. *geyeri* (Torr.) Samuelsson — Reported from north (Clausen, 1940) and south (McVaugh, 1938) in region.
(KK: syn *A. plantago-aquatica* var. *graminifolia* Wahlenb.) Hendricks)

A. triviale Pursh — MON LIV ONT. Apparently widespread and common (*A. plantago-aquatica* L. in part).
(KK: syn *A plantago-aquatica* L.; NL: syn *A. plantago-aquatica* var. *americana* Schultes)

A. subcordatum Raf. — LIV ONT STE and Monroe County in Goodwin (1943) (*Alisma plantago-aquatica* L. var *parviflorum* (Pursh) Farw.).
(KK: syn *A. plantago-aquatica* var. *parviflorum* (Pursh) Torr.)

Sagittaria L. *S. cuneata* Sheldon — MON and Genesee County in Muenscher (1946), and in Clausen (1940) (*Sagittaria arifolia Nutt.).*

S. graminea Michx. — LIV ONT YAT and Wayne County in Clausen (1940).

S. latifolia Willd. — GEN LIV MON STE WAY. Widespread and common.

S. rigida Pursh — LIV ONT YAT. Widespread and common (*Sagittaria heterophylla* Pursh).
(KK: *S. heterophylla* Pursh syn of *S. cuneata* Sheldon)

ARACEAE

Acorus L. *A. calamus* L. — LIV MON ONT WAY WYO. Widespread and common.
(KK: syn *A. americanus* (Raf.) Raf.)

Calla L. *C. palustris* L. — MON ONT and Genesee in Muenscher (1946)

Peltandra Raf. *P. virginica* (L.) Schott & Endl. — LIV MON ONT WAY. Widespread and common.

CYPERACEAE

Carex L. *C. aquatilis* Wahl. var. *altior* (Rydb.) Fern. — GEN MON WAY YAT (*Carex substricta* (Kukenth.) Mack.; *C. aquatilis* var. *substricta* Kukenth.).

C. comosa Boott — GEN MON ORL YAT and south in McVaugh (1938) (Carex pseudo-cyperus L. var. *americana Hoschst.). Shanks and Goodwin (1943) mention a putative hybrid, Carex comosa* Boott x *C. retrorsa* Schw.

C. diandra Schrank — MON and Genesee and Ontario Counties in Matthews and White (1953).

C. flava L. — GEN MON WAY and Livingston County in Zenkert (1934).

C. flava L. var. *fertilis* Peck — GEN MON ONT (*Carex cryptolepis* Mack.; *C. flava* var. *rectirostrata Gaud.).*

> Note: *Carex flava* L., as circumscribed above is part of a series of plants which have a complicated nomenclaturial history. In combination with *Carex viridula* Michx. and its various varieties, the group may reflect a species complex from which taxonomists have segregated and named various well-marked plants. Interested persons are referred to Gray's 7th (Robinson & Fernald, 1908) and 8th ed. (Fernald, 1950), Gleason's Britton & Brown (1952), and the North American Cariceae of Mackenzie (1940). *Carex flava* L. is taken to indicate the oldest name of those included above and the preference for varieties rather than new species names is a reflection of the belief that this is not a grouping of well-defined species.

C. hystricina Muhl. — GEN MON WAY YAT and Wyoming County in Zenkert (1934).

C. lacustris Willd. — GEN MON WAY and Allegany County in Cook (1973) (*Carex ripara* Curtis).

C. laevivaginata (Kukenth.) Mack. — GEN MON ONT WYO.

C. lasiocarpa Ehrh. var. *americana* Fern. — GEN MON WAY and Ontario County in Matthews and White (1953). All specimens of the species have been included here in the variety (*Carex filiformis* L. of American authors; *C. filiformis* L. var. *latifolia* Boeck.).

Note: Fernald, in Gray's 8th ed. lists *C. filiformis* of Gray's 7th ed. as a synonym for *Carex lasiocarpa* Ehrh. and the author citation in Gray's 7th is *C. filiformis* L. Therefore, Beckwith's *C. filiformis* is *C. filiformis* L. A frequent notation in Gray's manual is "of American authors, not L." (or other European authority). This was intended to distinguish American from European material. It is confusing, nevertheless, because the material was customarily reported with the European name and authority.

C. limosa L. — MON WAY.

C. oligosperma Michx. — Allegany County in Cook (1973).

C. prasina Wahl. — GEN ONT WAY.

C. pseudo-cyperus L — MON and Genesee and Ontario Counties in Matthews and White (1953) and Wyoming County in Zenkert (1934).

C. rostrata Stokes — GEN MON WAY and south in McVaugh (1938).

C. rostrata Stokes var. *utriculata* (Boott) Bailey — Monroe and Wayne Counties in Matthews and White (1953).

C. scabrata Schw. — GEN LIV MON WAY WYO.

C. stipata Muhl. — GEN MON ORL and Ontario County in Matthews and White (1953).

C. stricta Lam. — MON STE WAY YAT.

C. stricta Lam. var. *strictior* (Dew.) Carey — MON WAY YAT (*Carex strictior* Dew.).

C. torta Boott — LIV MON YAT.

C. tuckermanii Boott — GEN MON WAY YAT.

C. vesicaria L. — YAT and Allegany County in Cook (1973) and Monroe County (1848) in Matthews and White (1953) (*Carex monile* Tuckerm.).

C. vesicaria L. var. *jejuna* Fern. — MON.
(KK: *C. monile* Tuckerm. syn of *C. vesicaria* var. *monile* (Tuckerm.) Fern.

C. viridula Michx. — GEN MON WAY (*Carex flava* L. var. *viridula* Bailey).

C. vulpinoidea Michx. — LIV MON ORL WAY WYO YAT. Appears to be widespread, although not reported often.

Cladium P.Br. *C. mariscoides* (Muhl.) Torr. — GEN MON and reported from north and south in region (*Mariscus mariscoides* (Muhl.) Kuntze).

Cyperus L. *C. diandrus* Torr. — GEN MON.

C. engelmanni Steud. — MON.

C. erythrorbizos Muhl. — Monroe (19th Century report) and Wayne Counties in Matthews and White (1953).

C. esculentus L. — LIV MON WAY YAT. Appears to be widespread, although not reported often.

C. inflexus Muhl.—Wayne County (1868-70) in Matthews and White (1953) (*Cyperus aristatus* Rottb.).
(KK: *C. inflex* Muhl. syn of *C. aristatus* Rottb.)

C. odoratus L. — MON (*Cyperus speciosus* Vahl).

C. rivularis Kunth — GEN MON (*Cyperus diandrus* Torr. var. *castaneus* Torr.).

C. schweinitzii Torr. — MON WAY.

C. strigosus L. — LIV MON ONT.

Dulichium Pers. *D. arundinaceus* (L.) Britt. — GEN MON and from north and south in region (*Dulichium spathaceum* Pers.).

Eleocharis R.Br. *E. acicularis* (L.)R. & S. — LIV MON WAY WYO and Genesee County in Muenscher (1946).

E. calva Torr. — GEN MON ORL and north and south in region.

E. compressa Sull. — MON and Genesee County in Muenscher (1946) as "reported not seen" (*Eleocharis acuminata* (Muhl.) Nees.).
(NL: *E. acuminata* (Muhl.) Nees a distinct, valid species)

E. elliptica Kunth — GEN (*Eleocharis capitata* (L.) R.Br. var. *borealis* Sven.).

**E. equisetoides* (Ell.) Torr. — Monroe County studies and in Clausen (1940) (*Eleocharis interstincta* (Vahl) R. & S.).

E. geniculata (L.) R. & S. — GEN.

E. intermedia (Muhl.) Schultes — MON ONT WAY and Genesee County in Muenscher (1946).

E. obtusa (Willd.) Schultes — GEN LIV MON ONT ORL STE WYO and south in McVaugh (1938). Apparently widespread and common (*Eleocharis ovata* R.Br.).

E. olivacea Torr. — MON and Wayne County in Clausen (1940).

*E. ovata (Roth.) R. & S. — WAY (*Eleocharis annua* of Ogden, 1974b).

E. palustris (L.) R. & S. — LIV MON WAY WYO and south in McVaugh (1938). Apparently widespread and common.

E. palustris (L.) R. & S. var. *major* Sonder — MON.

E. pauciflora (Lightf.) Link — GEN WAY and Monroe County in Shanks and Goodwin (1943) (*Scirpus pauciflorus* Lightf.).

> Note: This is a species of *Eleocharis* which lacks an obvious tubercle. For this reason, it was at one time assigned to the genus *Scirpus,* as the species *Scirpus pauciflorus* Lightf. Fernald, in Gray's 8th ed., places it with the genus *Eleocharis.*

E. rostellata Torr. — GEN MON ONT.

E. smallii Britt. — Monroe County and from north and south in region.

E. tenuis (Willd.) Schultes — Genesee County in Matthews and White (1953).

Excluded name: *Eleocharis erythropoda* of Ogden (1974b).

(NL: *E. erythropoda* Steud. a valid species)

Fimbristylis Vahl *F. autumnalis* (L.) R. & S. var. *mucronulta* (Michx.) Fern. — Monroe County. The same specimen is cited in Matthews and White (1953) and in Clausen (1940) (*Fimbristylis mucronulta* (Michx.) Blake).

Rynchospora Vahl *R. alba* (L.) Vahl — GEN MON ONT and Wayne County in Matthews and White (1953) and Allegany County in Cook (1973).

R. capillacea Torr. — GEN MON ONT (*Rynchospora capillacea* Torr. var. *leviseta* Hill).

Scirpus L. *S. acutus* Muhl. — MON ONT ORL WYO and Genesee County in Muenscher (1946) (*Scirpus occidentalis* (S.Wats.) Chase).

S. americanus Pers. — LIV MON WYO and Genesee County in Muenscher (1946). (*Scirpus pungens* Wahl).

S. atrocinctus Fern. — MON ORL and Genesee County in Muenscher (1946) and Ontario County in Matthews and White (1953).

S. atrovirens Willd. — GEN LIV MON ONT ORL WAY WYO. Apparently widespread and common.

(KK: *S. atrovirens* Willd. var *georgianus* (Harper) Fern. syn of *E. georgianus* Harper; NL: as above)

S. atrovirens Willd. var *georgianus* (Harper) Fern. — MON.

S. cyperinus (L.) Kunth — GEN MON WAY.

(KK: syn of the species, in part: NL as above)

S. cyperinus (L.) Kunth var. *pelius* Fern. — MON.

S. expansus Fern. — MON (*Scirpus sylvaticus* L.; *S. sylvaticus* L. var. *digynus* Boeck.).

(NL: *S. expansus* Fern. syn of *S. sylvaticus* L.)

S. fluviatilis (Torr.) Gray — MON and in Clausen (1940).

S. hudsonianus (Michx.) Fern. — MON WAY. The specimens are old (*Eriophorum alpinum* L.).

(KK: *S. hudsonianus* (Michx.) Fern. syn of *E. alpinum* L.; NL: as above)

(KK: *S. validus* Vahl syn of *S. acutus* Muhl.: NL: as above with *S. lacustris* L. recognized as properly applied)

S. lineatus Michx. — GEN MON ONT.

S. olneyi Gray — LIV.

S. pedicellatus Fern. — Genesee County in Muenscher (1946) and Monroe, Ontario and Wayne Counties in Matthews and White (1953).

S. polyphyllus Vahl — MON YAT.

S. rubrotinctus Fern. — Ontario County in Matthews and White (1953).

S. smithii Gray — WAY. Matthews and White (1953) noted that it had not been collected for some years at reported stations in Monroe and Wayne Counties.

S. subterminalis Torr. — Wayne County (1857 and 1882) in Matthews and White (1953).

S. torreyi Olney — MON. Muenscher (1946) noted that the species had not been found in Bergen Swamp, Genesee County since Day (1883).

S. validus Vahl var. *creber* Fern. — GEN LIV MON ONT ORL WYO. Widespread and common. All regional specimens of the species are referred to the variety (*Scirpus lacustris* L. of American authors).

(KK: *S. validus* Vahl syn of *S. acutus* Muhl.: NL: as above with *S. lacustris* L. recognized as properly applied)

ERIOCAULACEAE

Eriocaulon L. *E. septangulare* With. Ontario and Steuben Counties in Zenkert (1934) and from north and south in region (*Eriocaulon articulatum* (Huds.) Morong).

GRAMINEAE (POACEAE)

Alopecurus L. *A. aequalis* Sobol.—MON and Genesee County in Muenscher (1946) and from north and south in region (*Alopecurus geniculatus* L. var. *aristulatus* Torr.).

Calamagrostis Adans. *C. canadensis* (Michx.) Nutt. — MON ONT. Reported from all parts of the region.

(KK: syn *C. neglecta* (Ehr.) Gaetn., Mey. & Scherb.: NL: as above)

C. inexpansa Gray — Monroe County in Shanks and Goodwin (1943).

Eragrostis Beauv. *E. frankii* Mey. — Genesee County in Zenkert (1934).

E. hypnoides (Lam.) BSP — LIV MON ONT.

Glyceria R.Br. *G. acutiflora* Torr. — ONT.

G. borealis (Nash.) Batch. — GEN MON and from north and south in region.

G. canandensis (Michx.) Trin. — LIV MON STE and in Clausen (1940).

G. fluitans (L.) R. Br. — Monroe County in Shanks and Goodwin (1943).

G. grandis S.Wats. — GEN LIV MON WAY WYO and south in McVaugh (1938). Apparently widespread.

G. pallida (Torr.) Trin — MON and Wyoming County in Zenkert (1934) and south in McVaugh (1938).

G. septentrionalis Hitchc. — MON and south in McVaugh (1938).

G. striata (Lam.) Hitchc. — GEN LIV MON ONT ORL WAY. Apparently widespread (*Glyceria nervata* (Willd.) Trin.).

Leersia Sw. *L. oryzoides* (L.) Swartz — MON ONT WYO and reported from throughout the region.

Phalaris L. *P. arundinacea* L. — LIV MON ONT STE WAY WYO and Genesee County in Muenscher (1946) and south in McVaugh (1938). Widespread and common.

Phragmites Trin. *P. australis* (Cavanilles) Trin. — GEN MON and frequently reported in the region. Definitely known to be present in Ontario County (Victor and Farmington) where we have observed it often, and undoubtedly it occurs elsewhere. The species grows prolifically in swales alongside the New York State Thruway, perhaps influenced by de-icing salt. The species is commonly called *Phragmites communis* Trin., the name in Gray's Manual (Fernald, 1950).

Spartina Shreb. *S. patens* (Ait.) Muhl. — this was one of the unique halophytes reported from the Morton Salt Company area at Silver Springs, Wyoming County in 1927. Although other species remained, this species was no longer present by 1979 (Marcus, Forest & Shero, 1984).

S. pectinata Link. — MON ONT WAY. Reported only in Clausen (1940), but herbarium records indicated it may be more widespread.

Zizania L. *Z. aquatica* L. — MON WAY. The specimens are old, and the species is probably extirpated from the Ontario shore area of the region (*Zizania palustris* L.).

HYDROCHARITACEAE

Elodea Michx. *E. canadensis* Michx. — GEN LIV MON ONT ORL STE WAY. Widespread and common in all quiet waters except for the most turbid (*Anacharis canadensis* (Michx.) Planch.).

E. nuttallii (Planch.) St. John. — LIV ONT WAY and Genesee County in Muenscher (1946) (*Elodea occidentalis* (Pursh) St. John).

Limnobium Richard *L. spongia* (Bosc.) Steud. — Monroe County in Beckwith (1896), but even then it had not been seen for many years at the site (Braddocks Bay), and the same information is given by Clausen (1940). It is probably extirpated, as Fernald (1950) noted. Fassett (1957) indicated the authority as Richard.

Vallisneria L. *V. americana* Michx. — LIV MON ONT ORL WAY WYO YAT. Widespread and common, except in the most turbid and enriched waters. One of the most productive species among submerged plants in lakes (*Vallisneria spiralis* L. of the American authors).

IRIDACEAE

Iris L. *I. pseudacorus* L. — GEN LIV MON ONT. Although reported only three times, this exotic is probably distributed now throughout the region.

I. versicolor L. — GEN LIV MON ONT ORL WAY. Surprisingly, the species seldom has been reported in the region, although Zenkert (1934) considered it common. It is certainly widespread and is abundant in some areas.

JUNCACEAE

Juncus L. *J. acuminatus* Michx, — GEN WYO.

J. alpinus Vill. — MON WAY.

J. alpinus Vill. var. *rariflorus* (Fries) Hartm. — Monroe County in Shanks and Goodwin (1943) (*Juncus alpinus* var. *insignis* Fries).
(KK: the variety assigned to ssp *nodulosus* (Wahl.) Lind. of the species)

J. articulatus L. — MON ORL and south in McVaugh (1938).

J. balticus Willd. var. *littoralis* Engelm. — GEN MON WAY (*Juncus arcticus* Willd. of Ogden, 1974b).

J. brachycephalus (Engelm.) Buchenau — GEN MON ONT.

J. brevicaudatus (Engelm.) Fern. Genesee County in Beckwith (1896) (*Juncus canadensis* J. Gay var. *coarctatus* Engelm.).

J. bufonius L. — MON ONT ORL WAY and Genesee County in Muenscher (1946).

J. canadensis J. Gay — ALL MON WAY. Distributed throughout the region.

J. debilis Gray — MON.

J. dudleyi Wieg. — GEN MON ONT ORL.
(KK: syn *J. tenuis* Willd. var. *uniflorus* (Farw.) Farw.)

J. effusus L. var. *pylaei* (Laharpe) Fern. & Wieg. — MON ONT.

J. effusus L. var. *solutus* Fern. & Wieg. — GEN LIV MON ONT. An additional specimen from Orleans County was examined but the variety was not determined.

J. filiformis L. — LIV MON.

J. gerardi Loisel. — WYO. This plant, reported by Muenscher (1927), was found in 1969-1982 still growing beside the salt retention ponds at Silver Springs (Marcus, Forest & Shero, 1984, in press).

J. nodosus L. — MON ONT WAY WYO.

J. scirpoides Lam. — WAY.

J. tenuis Willd. — MON ONT ORL (*Juncus macer* S.F. Gray).

J. tenuis Willd. var. *wiliamsii* Fern. — LIV MON.

J. torreyi Coville — GEN MON WAY.

Excluded name: Juncus brevicaudatus var *longicaudatus* Engelm. of Beckwith (1896).

JUNCAGINACEAE or SCHEUCHERIACEAE

Scheuchzeria L. *S. palustris* L. var. *americana* Fern. — MON WAY and Allegany County in Cook (1973). Gray's Manual (Fernald, 1950) includes all American plants in the var. *americana* Fern. (ssp. *americana* (Fern.) Hulten).

Triglochin L. *T. maritima* L. — GEN and Monroe County in Shanks and Goodwin (1943).

T. palustris L. — GEN YAT.

LEMNACEAE

Lemna L. *L. minor* L. — GEN LIV MON ORL WAY. Widespread, common and abundant.

L. trisulca L. — GEN LIV MON WAY and south in McVaugh (1938). Probably common throughout the region.

Spirodela Schleid. *S. polyrhiza* (L.) Schleid. — LIV MON ONT ORL and south in McVaugh (1938). Probably common throughout the region.

Wolffia Horkel *W. columbiana* Karst. — LIV MON ORL and Genesee County in Muenscher (1946).

W. punctata Griseb. — MON and Genesee County in Muenscher (1946) (*Wolffia brasiliensis* Weddell).

Najas L. *N. flexilis* (Willd.) Rostk. & Schmidt — ALL LIV MON ONT ORL STE WYO. Widespread except in more fertile and turbid waters. Its disappearance is a good indication of the decline in water quality.

N. gracillima (A.Br.) Magnus. In McVaugh (1938) and Ogden (1974b).

N. guadalupensis (Spreng.) Magnus. — STE WAY.

N. marina L. — MON. the specimens are old, the most recent having been collected in 1939.

N. minor standl. — ALL LIV MON ONT WAY. The species has spread since Clausen (1940) reported that the collection from Braddock's Bay, Monroe County, was the first west of the Hudson River drainage.

Potamogeton L. Ogden (1974a) is followed in the nomenclature of this genus. Sometimes separated as POTAMOGETONACEAE.

P. alpinus Balbis — ONT. The only known specimen was collected by E. H. Eaton from Vandemark's Pond, which may be in Ontario County.

P. amplifolius Tuckerm. — GEN LIV MON ONT ORL WAY and south in McVaugh (1938). This is less common than earlier, and it has disappeared from some waters.

P. crispus L. — LIV MON ONT WAY WYO. Undoubtedly common throughout the region as previously reported by Zenkert (1934).

P. diversifolius Raf. — From north and south in region (*Potamogeton dimorphus* Raf.). Odgen (1974a) recognized the species. Our specimens with these identities from Hemlock Lake (now extirpated) and Canadice Lake (present in 1979) have been annotated as *Potamogeton spirillus* Tuckerm.

(KK and NL differ in their treatment of the three names above. NL: *P. spirillus* Tuckerm. syn *P. dimorphus* Raf.)

P. epihydrus Raf. — GEN MON ONT and south in McVaugh (1938) (Includes *Potamogeton ephihydrus* Raf. var. *cayugensis* (Wieg.) Benn.). The species has declined markedly in the region during the past half-century. Zenkert (1934) considered it frequent, Ogden (1974a) common for the state.

P. filiformis Pers. (Including *Potamogeton filiformis* Pers. var. *borealis* (Raf.) St. John; *P. marinus* L. of American authors). There are specimens in the Hobart herbarium (DH) from Canandaigua Lake, Ontario County, identified as this species by E. H. Eaton 1927-1932. The senior author has annotated them as *Potamogeton pectinatus* L.

(KK: the variety is assigned to the typical form of species)

P. foliosus Raf. — ALL GEN MON ONT. Uncommon to rare. Zenkert (1934) reported it as rare, but Ogden (1974a) considered it to be frequent (*Potamogeton niagarensis* Tuckerm.; *P. foliosus* var. *niagarensis* (Tuckerm.) Morong).

P. foliosus var. *macellus* Fern. — Genesee and Wyoming Counties in Zenkert (1934).

P. friesii Rupr. — LIV MON ONT WAY WYO and south in McVaugh (1938). The species appears to have declined in the region during the past half-century. Ogden (1974a) considered it to be frequent.

P. gramineus L. — LIV MON ONT WAY. Although widespread, this is no longer a common species. Ogden (1974a) reported it as common and often abundant (Includes *Potamogeton gramineus* L. var. *heterophyllus* Fries and var. *graminifolius* Fries).

P. illinoensis Morong — LIV MON ONT WYO. The species is not common, but it is plentiful in Canandaigua Lake, Sodus Bay and perhaps elsewhere. According to Zenkert (1934) and Ogden (1974a) it was once much more frequent, even abundant (*Potamogeton angustifolius* Bercht. & Presl.; *P. lucens* L. of American authors).

(NL: *P. illinoensis* Morong syn of *P. angustifolius* Bercht. & Presl.)

**P. lateralis* Morong — LIV. This is Lucy's 1882 specimen at Buffalo (BUF). According to Ogden (1974a), "collected in Hemlock Lake in 1882; not seen since. Apparently closely related to *Potamogeton vaseyi*, it may be merely a variant of that species."

Note: C. B. Hellquist reports that the species is invalid, having been described from specimens of two other species (personal communication).

P. natans L. — MON ONT WAY and Genesee County in Muenscher (1946) and south in McVaugh (1938). This species appears to have declined in the past half-century, even though according to Zenkert (1934) and Ogden (1974a) it was once rather frequent or common.

P. nodosus Poir. — LIV MON ONT ORL WAY. In contrast to *Potamogeton natans* L., this floating leaved species is now consistenly found in fertile turbid waters. It appears also to have been common in past times. (*Potamogeton americanus* C. & S.; *P. americanus* var. *novaeboracensis* (Morong) Benn.; *P. lonchites* Tuckerm.).

(NL: syn *P. fluitans* Roth)

P. oakesianus Robbins. — Reported by Ogden (1974a) and Kimber & Forest (1977). However, the single available specimen from Canadice Lake, Ontario County, has been reviewed and annotated as *Potamogeton epihydrus* Raf. by H. S. Forest and K. J. Korndoerfer.

P. obtusifolius Mert. & Koch. — From north and south in region. No recent collections have been made. There are specimens in the Hobart herbarium (DH) identified by E. H. Eaton (1927-1932) as this species. They have been annotated by the senior author as *Potamogeton freisii* Rupr. and *P. pusillus* L.

P. pectinatus L. — ALL LIV MON ONT ORL WAY WYO YAT and Genesee County in Muenscher (1946). Certainly one of the most common species in the region. It is able to grow in turbid polluted waters at least as well as *Potamogeton crispus* L. It was previously reported as frequent or common.

P. perfoliatus L. — LIV MON ONT WAY (Includes *Potamogeton perfoliatus* var. *lanceolatus* Robbins of Beckwith, Macauley & Baxter, 1910).

P. perfoliatus L. var. *bupleuroides* (Fern.) Farw. — ONT and from north and south in the region (*Potamogeton bupleuroides* Fern.). R. T. Clausen expressed doubt as to the separation of *Potamogeton perfoliatus* L. and *P. richardsonii* (Benn.) Rydb. Ogden continued to recognize both species. They are listed separately here, although intergrading specimens are commonly found in the field. The confusion has been illuminated recently by R. R. Haynes (personal communication, 1981) who concludes that there are two species. However, no single character, or even set of characters, in the vegatative state suffice for separation. Separation is positive only for mature plants. The western New York specimens are probably best referred to *P. richardsonii*.

P. praelongus Wulf. — LIV MON ONT WAY and south in McVaugh (1938). The species is only occasionally found, but it is a predominant species in Honeoye Lake. Zenkert (1934) considered it rare, so the species apparently has not declined in contrast to other infrequent species.

P. pulcher Tuckerm. — WAY. No recent collections of the species are known. The Monroe County specimens (1922) bearing this name are probably *Potamogeton nodosus* Poir.

P. pusillus L. — GEN LIV MON ONT WAY WYO and south in McVaugh (1938). Fairly common, quite widespread in a variety of waters except the most turbid. (*Potamogeton berchtoldii* Fieber; *P. panorimitanus* Biv.).

(KK: *P. berchtoldii* Fieber syn *P. pusillus* L. var. *pusillus; P. panorimitanus* Biv. sun P. pusillus L. var. *tenuissiumus* Mert. & Koch.)

P. richardsonii (Benn.) Rydb. — LIV MON ONT WYO and from north and south in region. Frequent in more fertile waters, but absent from the most turbid.

P. robbinsii Oakes. — ONT. Although reported from different parts of the region four times, beginning with Day (1882-3), the species was then rare in western New York and there are no recent specimens. That cited was from E. H. Eaton.

P. spirillus Tuckerm. — ALL LIV ONT STE YAT. The species has been extirpated from Hemlock Lake, but it remains in the nearby Canadice Lake. In 1980, it was found in a Yates County pond.

P. strictifolius Benn. var. *rutiloides* Fern. — MON. A single collection by Clausen and Hinkey (1939) is the basis of the report by Shanks and Goodwin (1943). No other collections are known, although according to Ogden (1974a), it was frequent in the state.

(KK: the variety is assigned to the typical form of the species)

**P. vaginatus* Turcz. — ONT. The only specimens known were collected by E. H. Eaton from Canandaigua Lake (1927-1930). It is now apparently extirpated.

P. vaseyi Robbins — Reported from north and south in region. Since identification is problematic, reports of this species should be regarded as tentative.

P. zosteriformis Fern. — ALL LIV MON ONT WAY WYO and Genesee County in Muenscher (1946). Widespread and fairly common in more fertile waters, but absent from the most turbid and enriched habitats. (*Potamogeton compressus* L. of American authors).

Excluded name: *Potamogeton pauciflorus* Pursh of Day (1882-3).

Ruppia L. *R. maritima* L. var. *longipes* Hagstr. — WAY WYO. No present site is known. Muenscher collected specimens from Wolf Creek, Wyoming County, in 1926 and 1945; only the earlier was reported (Meunscher, 1927). Specimens from both dates are preserved in the Wiegand Herbarium (CU). The last collection made was by S. J. Smith in 1968 from a ditch draining the Salt Works at Silver Springs; it is at Albany (NYS). *Potamogeton crispus* L., *P. pectinatus* L., and *P. zosteriformis* Fern. have replaced the species in Wolf Creek, as salinity has decreased (Marcus, Forest & Shero, 1984).

Zannichellia L. *Z. palustris* L. — MON STE WAY and from south in McVaugh (1938). The only recent collection is from the creek embayment west of Pultneyville, Wayne County. Other recent collections are known from Buffalo harbor, Erie County, and Montezuma Wildlife Refuge, Seneca County. Sometimes separated as ZANNICHELLIACEAE.

PONTEDERIACEAE

Heteranthera R. & P. *H. dubia* (Jacq.) MacM. — LIV MON ONT ORL WAY WYO, and south in McVaugh (1938). Widespread and common in all but the most turbid waters. Its crop ranks high among submerged plants in a number of fertile lakes (*Heteranthera graminea* Vahl).

> Note: C.N. Horn has determined that the valid species name is *Zosterella dubia* (Jacq.) Small, and it is separated from other *Heteranthera* species.

Pontederia L. *P. cordata* L. — LIV MON ONT YAT and south in McVaugh (1938). Widespread and frequent in the region.

SPARGANIACEAE

Sparganium L. *S. americanum* Nutt. — LIV ONT STE and from north and south in region (*Sparganium simplex* Huds. var *nuttallii* Engelm.; *S. simplex* Huds. var *androcladum* Engelm.). (KK: recognizes *S. emersum* Rehm. as valid and *S. americanum* Nutt. and *S. multipendiculatum* (Morong) Rydb. as its synonyms; NL does not)

S. chlorocarpum Rydb. — GEN LIV and south in McVaugh (1938).

S. eurycarpum Engelm. — GEN LIV MON ONT ORL STE and from north and south in region. This is apparently the most common species.

S. minimum (Hartm.) Fries. — Monroe County in Beckwith (1896) and in Clausen (1940).

S. multipedunculatum (Morong) Rydb. — MON. There are no recent specimens, although Beckwith (1896) found it frequently (*Sparganium simplex* Huds.).

TYPHACEAE

Typha L. *T. angustifolia* L. — GEN LIV MON ORL WAY WYO YAT. Widespread and common.

T. latifolia L. — GEN LIV MON ONT ORL. Widespread and common. Introgression between the two species has been reported, and material in the field sometimes appears intermediate. Most of the population in the wetlands south of Irondequoit Bay appears to be the robust hybrid. It sometimes has been referred to *Typha glauca* Godr. or to *T. latifolia* var. *elongata* Fern.

XYRIDACEAE

Xyris L. *X. caroliniana* Walt. — From south in McVaugh (1938).

SYSTEMATIC ACCOUNT

FAMILIES, GENERA AND SPECIES OF DICOTYLEDONOUS PLANTS

ACANTHACEAE

Justicia L *J. ameriana* (L.) Vahl — Ontario watershed in Clausen (1940) (*Dianthera americana* L.).

CALLITRICHACEAE

Callitriche L. *C. beterophylla* Pursh — MON ORL YAT and from north and south in region.

C. palustris L. — GEN LIV MON ONT ORL.
(KK: syn of *C. verna* L.; NL recognizes *C. palustris* L. as valid, noting that both names have been used for the same plant)

CAMPANULACEAE

Campanula L *C. aparinoides* Pursh — GEN MON ONT.

C. uliginosa Rydb. — MON and Genesee County in Muenscher (1946).
(KK: syn *C. aparinoides* Pursh; NL recognizes both)

CERATOPHYLLACEAE

Ceratophyllum L. *C. demersum* L. — LIV MON ONT ORL WAY WYO. Widespread and common in lakes and other quiet waters, including highly turbid habitats. Its crop ranks high among submersed plants in some lakes.

CHENOPODACEAE

Salicornia L. *S. europaea* L. — WYO. The plant which was observed by Muenscher in 1926 was present until 1979 at the only reported site near the Morton Salt Company ponds at Silver Springs, but it had disappeared the following year (Marcus, Forest & Shero, 1984).

COMPOSITAE (ASTERACEAE)

Bidens L. *B. cernua* L. — GEN LIV MON ORL WAY. Although reported only twice, the species appears to be widespread.

B. comosa (Gray) Wieg. — ORL and Genesee County in Muenscher (1946).
(KK: syn *B. tripartita* L.; NL both names have been applied to the other species)

B. connata Muhl. — MON and Genesee County in Muenscher (1946).

B. frondosa L. — GEN MON ORL WYO (includes *f. anomala* (Porter) Fern. or var. *anomala* Porter).

B. laevis (L.) BSP — MON.

B. vulgata Greene — GEN.

Megalodonta Greene *M. beckii* (Torr.) Greene — LIV ONT STE WAY and from north and south in region (*Bidens beckii* Torr.).

CRUCIFERAE

Armoracia Gaetn., May & Scherb. *A. aquatica* (Eat.) Wieg. — LIV MON and Genesee County in Muenscher (1946) and Wayne County in Clausen (1940) (*Rorippa aquatica* (Eat.) Robinson; *Nasturtium lacustre* Gray).

Nasturtium R.Br. *N. officinale* R.Br. — LIV MON ONT and Genesee County in Muenscher (1946). It is probably widespread and common (*Nasturtium nasturtium-aquaticum* (L.) Karst.; *Radicula nasturtium-aquaticum* (L.) Britt.).

Rorippa Scop. *R. islandica* (Oeder) Borbas — GEN ONT (*Nasturtium palustre* DC; *Rorippa palustris* (L.) Bess.).
(KK: *R. islandica* (Oeder) Borbas syn R. palustris (L.) Bess.; NL: both species valid, names misapplied)

HALORAGIDACEAE

Myriophyllum L. Until the 8th ed. of Gray's Manual, American specimens were referred to the European species, *M. spicatum*. Fernald then separated all American specimens as *M. exalbescens* Fern., and the precedent was accepted by Fassett. However, in the appendix to the 1957 edition, Ogden referred the American specimens to *M. spicatum* var. *exalbescens* (Fern.) Jepson. Ogden (1974b) also listed *M. exalbescens* as a subspecies instead of variety, but cited neither authority nor reference. Ogden commented then that the European species (*M. spicatum*) is growing in New York, but that its habitat is the same as that of the American plants (*M. exalbescens*). Josselyn (1972) most helpfully assembled the nomenclatural history and both cytological and morphological evidence of the existence of two species.

Either *M. spicatum* L. or *M. exalbescens* Fern. has been reported from the region by ten authors, who simply followed the authority of Gray's Manual then current. Susan G. Aiken (Aiken, Newroth, and Wile, 1979) has at last derived a convincing list of criteria for separation of the two species.

M. exalbescens Fern. — LIV MON ONT WAY WYO. Extirpated from the known Monroe County site, Irondequoit Bay, and probably declined sharply elsewhere. It is still present in three of the western Finger Lakes and Sodus Bay. Dr. Aiken has reviewed the available specimens along with the senior author. Annotated specimens support the county records given here.

M. heterophyllum Michx. — MON ONT ORL WAY. The only recent site where the species has been collected is Honeoye Lake, Ontario County. It seems to have declined markedly in the past half-century.

M. spicatum L. — LIV MON ONT ORL WAY YAT. This species invaded the region probably after 1940, and is now widespread and common in quiet waters from clear Canadice Lake to highly turbid Irondequoit Bay, and it also grows in streams.

M. tenellum Bigel. Reported from north and south in region. There are no modern collections.

M. verticillatum L— MON ONT WAY and south in McVaugh (1938) Extirpated from both Irondequoit Bay, Monroe County and Sodus Bay, Wayne County. With the increasing enrichment and pollution of waters, the species was apparently extirpated from the entire region. Remarkably, a single specimen was collected from Honeoye Lake in 1980.

Proserpinaca L. *P. palustris* L. — WAY. There are no modern collections, but the species is found in adjoining Seneca County.

HYPERICACEAE or CLUSIACEAE

Hypericum L. *H. canadense* L. — In Beckwith (1896), noted as frequent.

H. ellipticum Hook. — In Ogden (1974b).

H. majus (Gray) Britt. — Genesee County in Muenscher (1951).

H. punctatum Lam. — Genesee County in Zenkert (1934).

H. pyramidatum Ait. — Monroe County in Beckwith (1896). (*Hypericum ascyron* L.).

H. virginicum L. — MON ONT STE (*Triadenum virginicum* Raf.).
(KK: recognizes *T. virginicum* (L.) Raf. as valid and *H. virginicum* L. as its synonym; NL: as above.
(KK: the variety is assigned to the typical form of the species)

LABIATAE (LAMIACEAE)

Lycopus L. *L. americanus* Muhl. — ALL GEN LIV MON ONT ORL STE WAY.

L. americanus L. var. *longii* Benner — MON.

L. uniflorus Michx. — LIV MON ONT ORL.

L. virginicus L. — MON ORL.

LENTIBULARIACEAE

Utricularia L. *U. cornuta* Michx. — MON and from north and south in the region.

U. gibba L. — MON.

U. intermedia Hayne — Reported from throughout the region, but no specimens are present in local herbaria.

U. minor L. — MON and reported from elsewhere in the region.

U. resupinata B.D. Greene — Reported a few times from Monroe County and elsewhere.
U. vulgaris L. — MON ORL and reported frequently throughout the region.

LOBELIACEAE or CAMPANULACEAE

Lobelia L. *L. cardinalis* L. — GEN LIV MON ORL WAY. Although seldom reported, the species apparently is widespread in the northern half of the region and probably elsewhere.
L. kalmii L. — LIV MON ONT.
L. siphilitica L. — GEN LIV MON ONT. Widespread in the northern half of the region and probably elsewhere.

LYTHRACEAE

Decodon J.F. Gmel. *D. verticillatus* (L.) Ell. — LIV MON ONT ORL WAY YAT. Widespread and common at water margins.

Lythrum L. *L. salicaria* L. — LIV MON ORL WAY and from north and south in the region. Although reported only twice in the past, this species is quite common now in Monroe County. It is widespread throughout the region. Like *Phragmites australis* and some halophytic xerophytes, the species may have spread vigorously along the New York State Thruway and other express highways kept bare of snow and ice by salting.

NYMPHACEAE

Brasenia Schreb. *B. schreberi* Gmel. — ALL MON. The species may be widespread, but it has not been reported or collected often (*Brasenia peltata* Pursh).

****Nelumbo*** Adans. *N. lutea* (Willd.) Pers. — WAY. The single population known for western New York existed near the southeast end of Sodus Bay (Resort). According to J. W. Kelly (personal communication, 1977), it was exterminated by a hurricane which occurred in July, 1955.

Nuphar Sm. *N. advena* (Ait.) Ait. The species has been recognized on some specimens, and reported in Muenscher (1946). Although there appears to be a clear separation between it and *N. variegatum* Engelm. in Fernald (1950) and other general manuals, confusion remains. Zenkert (1934) reflected uncertainty when he noted that his reported *N. advena* might all be referred to *N. variegatum*. A review of specimens indicates that the common yellow water lily reported by Beckwith (1896), Clausen (1940), and Ogden (1974b) under different names is the same. We have not been able to apply distinctions from the general manuals, including Fassett (1957), successfully. The chosen course, at this time, is to refer all specimens of the common plant to *N. variegatum*.
N. microphyllum (Pers.) Fern. — Wayne County in Beckwith (1896). There are no recent specimens. (*Nuphar kalmianum* Ait.).
N. rubrodiscum Morong — Ontario watershed in Clausen (1940). In Gray's Manual (Fernald, 1950) the species is judged to be a fertile hybrid between *N. microphyllum* (Pers.) Fern. and *N. variegatum* Engelm. (*Nymphozanthus rubrodiscus* (Morong) Fern.).

(KK: syn *N. luteum* (L.) Sibth. & Smith ssp. *variegatum* (Engelm.) Beal)
N. variegatum Engelm. — LIV MON ORL YAT and reported frequently throughout the region (*Nymphozanthus variegatus* (Engelm.) Fern.). In his monograph of the genus, Beal (1956) considered American plants to be subspecies of the European *Nuphar lutea* Sibth. & Smith. The more northern variant in eastern North America was subspecies *variegatum*. The treatment is consistent with the findings of the senior author of this report.

(KK: also syn ssp. *pumilum*)

Excluded name: *Nuphar advena* f. *minus* Morong of Beckwith (1896).

Nymphaea L. *N. odorata* Ait. — MON ORL WAY YAT and reported frequently throughout the region. (Includes *Nymphaea odorata* Ait. var. *minor* Sims).
N. tuberosa Paine — LIV MON WYO and from north and south in the region (*Nymphaea reniformis DC).*

ONAGRACEAE

Ludwigia L. *L. palustris* (L.) Ell. — GEN MON ORL.

PIPERACEAE

Saururus L. *S. cernuus* L. — GEN MON. In 1981, this plant was still growing in Black Creek below Bergen Swamp, where Muenscher (1946) had observed it. There is a second population downstream in Black Creek County Park, Monroe County. Sometimes separated as SAURURACEAE.

PLANTAGINACEAE

Littorella Bergius **L. americana* Fern. From south in the region, McVaugh (1938). Mitchell, Sheviak and Dean (1980) actually list *L. uniflora* (L.) Asch. among rare and endangered species. The American plants are either not recognized as distinct, or referred to *L. uniflora* var. *americana* (Fern.) Gl.

(KK: recognizes *L. americana* Fern.; NL: var. *americana*, as above.

POLYGONACEAE

Polygonum L. *P. amphibium* L. — ALL LIV MON ONT ORL WAY and reported from throughout the region (includes *Polygonum amphibium* L. var. *aquaticum* Willd. of Day (1882-3)).

(KK: syn *P. amphibium* L. var. *emersum* Michx.; NL as above)

P. coccineum Muhl. — LIV MON and Genesee County in Muenscher (1946) and from north and south in the region (*Polygonum muhlenbergii* Meisn.) Wats.).

P. hydropiper L. — GEN LIV MON.

P. hydropiperoides Michx. — LIV MON ORL and from north and south in the region.

P. lapathifolium L. — LIV MON ORL (*Polygonum lapathifolium* L. var. *incarnatum* Wats.; *Polygonum incarnatum* Ell.).

P. pensylvanicum L. — LIV MON ORL WAY.

P. pensylvanicum L. var. *laevigatum* Fern. — Monroe County in Goodwin (1943).

(KK: the variety is assigned to the typical form of the species)

P. pensylvanicum L. var. *laevigatum* Fern. — Monroe County in Goodwin (1943).

P. persicaria L. — LIV MON ONT ORL WAY. Collections show that it is more widespread than reports suggest.

P. punctatum Ell. — LIV MON ONT ORL and from north and south in the region (*Polygonum acre* HBK.).

P. robustius (Small) Fern. — Genesee County in Muenscher (1946).

Rumex L. *R. maritimus* L. — GEN. The specimen is reported in Zenkert and Zander (1975).

R. obtusifolius L. — ORL.

R. orbiculatus Gray — LIV WAY and Genesee County in Muenscher (1946) (*Rumex britannica* L. of American authors).

R. verticillatus L. — GEN LIV MON ONT ORL WYO. Widespread in northern half of the region and probably elsewhere.

RANUNCULACEAE

Caltha L. *C. palustris* L. — GEN LIV MON ONT STE WYO. Widespread and common in region for wet sites.

Ranunculus L. *R. flabellaris* Raf. — LIV ONT and south in McVaugh (1938) (*Ranunculus delphinifolius* Torr.).

R. laxicaulis (T. & G.) Darby — from south in McVaugh (1938).

R. longirostris Godr. — LIV ONT ORL and from north and south in region.

R. pensylvanicus L. — MON. Although Ogden (Fassett, 1957) said that the species was common in wet areas from Newfoundland to Georgia, no specimen has been collected since Beckwith (1896) noted it as frequent. The current specimen is at Brockport (BROC) or the New York Botanical Garden.

R. reptans L. — ONT and from north and south in region (*Ranunculus flammula* L. var. *reptans* (L.) Mey.).

R. sceleratus L. — GEN MON ORL.

R. septentrionalis Poir. — GEN ONT.

R. trichophyllus Chaix. — LIV MON ONT and Genesee County in Muenscher (1946). (***Ranunculus aquatilis*** L. of American authors; ***R. aquatilis*** L. var. ***capillaceus*** DC; ***R. aquatilis*** L. var. ***trichophyllus*** Chaix.).

(KK: syn *R. aquatilis* L. var. *capillaceus* (Thuill.) DC)

RUBIACEAE

Cephalanthus L. *C. occidentalis* L. — GEN LIV MON ONT ORL. Widespread and common at water margins.

SAXIFRAGACEAE

Penthorum L. *P. sedoides* L. — LIV MON ONT ORL and Genesee County in Muenscher (1946).

SCROPHULARIACEAE

Gratiola L. *G. neglecta* Torr. — ONT and Genesee County in Muenscher (1946).

Lindernia All. *L. dubia* (L.) Pennell — MON YAT and in Clausen (1940) (***Ilysanthes dubia*** (L.) Barnh.).

L. dubia (L.) Pennell var. ***riparia*** (Raf.) Fern. Monroe County in Beckwith (1896) (***Ilysanthes riparia*** Raf.).

(KK: the variety is assigned to the typical form of the species)

Mimulus L. *M. alatus* Ait. — In Beckwith (1896) noted as rare.

M. ringens L. — LIV MON ONT ORL. Perhaps more common than the reports indicate. Beckwith (1896) noted it as frequent and Ogden (1974b) indicated about ten collections for the region.

Veronica L. *V. americana* (Raf.) Schw. — LIV MON and Genesee County in Muenscher (1946)

V. beccabunga L. — MON. The only two collections were made by M. S. Baxter in 1917 and 1918. These were reported in Shanks and Goodwin (1943).

V. connata Raf. — MON. The species was first found at Blue Pond, Wheatland, in 1980.

(KK: syn *V. catenata* Pennell; NL: as above)

V. scutellata L. — Genesee County in Muenscher (1946) and in Beckwith (1896) as frequent.

UMBELLIFERAE

Angelica L. *A. atropurpurea* L. — MON and Genesee County in Muenscher (1946). Undoubtedly more widespread than the single specimen indicates. It is known from Victor, Ontario County and from Wayne County. J. W. Kelly (personal communication) also reports a station in Ellison Park and another in Penfield, Monroe County.

Cicuta L. *C. bulbifera* L. — GEN MON ONT and south in McVaugh (1938).

C. maculata L. — ALL GEN LIV MON ONT ORL. Widespread and common.

Hydrocotyle L. *H. americana* L. — Monroe County in Beckwith, Macauley and Baxter (1910).

Sium L. *S. suave* Walt — ORL YAT and south in McVaugh (1938) (***Sium cicutaefolium*** Schrank; *S. lineare* Michx.).

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VASCULAR PLANT COMMUNITIES OF THE THOUSAND ACRE SWAMP PENFIELD, MONROE COUNTY, NEW YORK

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ABSTRACT

The Thousand Acre Swamp is an 800 acre, vegetationally diverse natural area located in the geographic center of the Town of Penfield. In the heart of the swamp, plant communities consist of open water ponds and stream channels, cattail marsh, wet meadow, successional shrub swamp and flooded woodlands. Xerophytic and mesophytic hardwood forest, pine plantation and successional fields are found in the adjacent upland sites. Forest composition was sampled through quadrats spaced along elevational change and cover type maps are presented. Approximately 480 vascular species of canopy, understory and herbaceous vegetation were field collected, identified and placed in herbaria. Post-glacial forest development was interpreted through pollen analysis of a coring of the mucky soil. Even though the recent pollen record is truncated by decomposition, a similarity to New England pollen profiles was perceived.

BACKGROUND INFORMATION

The Thousand Acre Swamp is a diverse natural area in western New York that has not been significantly altered by man. Its potential use as an outdoor education center prompted this study of the plant communities.

The swamp actually occupies about 800 acres of the central portion of the Town of Penfield (U.S.G.S. Webster topographic quadrangle map). With an elevation range between 482 and 502 feet above sea level, the swamp includes a large level bottomland with transition to adjacent uplands along varying slopes. In the drier upland areas, it is almost entirely forested by large hardwood species including red oak (*Quercus rubra* L.), white oak (*Quercus alba* L.), bur oak (*Quercus macrocarpa* Michx.), sugar maple (*Acer saccharum* Marsh.), beech (*Fagus grandifolia* Ehrh.), basswood (*Tilia americana* L.), black cherry (*Prunus serotina* Ehrh.), pignut (*Carya glabra* (Mill.) Sweet.) and tulip tree (*Liriodendron tulipifera* L.). In the lower, wetter regions are found swamp maple (*Acer freemanii* E. Murray)[1], red ash (*Fraxinum pensylvanica* Marsh.), black willow (*Salix nigra* Marsh.), swamp white oak (*Quercus bicolor* Willd.) and American elm (*Ulmus americana* L.). A prolific understory growth of vines, shrubs, wildflowers and ferns occurs on the moist soils and on decaying stumps of intermediate elevations. The lowest areas of the swamp are subject to frequent seasonal flooding and the vegetation is herbaceous. Dominant plants here include cattails (*Typha latifolia* L. and *T. angustifolia* L.), blue joint grass (*Calamagrostis canadensis* (Michx.) Nutt.), reed canary grass (*Phalaris arundinacea* L.), rice cutgrass (*Leersia oryzoides* (L.) SW.), water parsnip (*Sium suave* Walt.), water smartweed (*Polygonum coccineum* Muhl.), cursed buttercup (*Ranunculus sceleratus* L.), bur marigold (*Bidens*) and several species of duckweed (*Lemna*).

Current ownership is fragmented among local citizens and The Nature Conservancy, holding about 177 acres as a wildlife and nature study preserve. Further land acquisition by The Nature Conservancy is anticipated.

The swamp is underlain by a mosaic of glacial deposits that are responsible for the present land contour and the development of local soils. A drumlin along the western swamp border accounts for the steep slopes there and a recessional moraine deposit surrounding the swamp retards any near surface drainage for the basin (Monroe County Planning Council, Geology and Soils Report for Penfield, 1965). In certain upland areas, the underlying dolomitic limestone outcrops, making soils more alkaline and readily tolerated by such indicator species as basswood and butternut (*Juglans cinerea* L.).

Most of the swamp is dominated by organic soils and associated, poorly drained mineral soils (Soil Survey of Monroe County, 1973). A thick muck layer has developed in the swamp's basin as a result of restricted surface drainage. This is caused by the recessional moraine, surrounding higher elevations and obstructed ground drainage due to an impervious marl deposit approximately six feet down. The swamp

is subject to seasonal flooding and the water table is high throughout the year. Water depths approach 5 feet in the spring, but drawdown usually occurs each summer bringing the water table to the soil surface. Accumulation of organic debris is rapid but its deterioration is slow under such high soil moisture conditions.

Water discharge is slow and divided between two watersheds: Four Mile Creek draining the northern portion of the swamp directly into Lake Ontario and Irondequoit Creek draining the southern portion into Irondequoit Bay and then into Lake Ontario. The construction of two easement roads by fill across the swamp and subsequent vegetative dieback suggests that these roads interfere with the natural drainage pattern leading to increased spring time retention in the basin. Such additional water retention would cause root suffocation and may help account for the dieback. Perhaps also responsible are the higher chloride concentrations, presumably from roadsalt runoff, recently found in the swamp (Davis, 1978). Average concentrations as high as 135 mg/1 were recorded and these may interfere with tree root absorption.

METHODS

Forest quadrats measuring 10 meters by 20 meters were subjectively located in transects covering the elevations present. All woody vegetation was measured for diameter at breast height (DBH) and tallied according to species. Presence of understory vegetation was noted for each quadrat. Forest tree importance values (IV) were calculated as the average of relative dominance and relative density according to McIntosh (1957). Vegetative cover types for plant communities were developed by grouping quadrats containing species with similar importance values. Plant specimens were collected, identified according to Fernald (1950) and permanently deposited in the St. John Fisher Herbarium.

A fossil pollen profile was prepared after examination of a single soil core from the bottomland muck. The core was extracted through the use of a Davis peat sampler. The profile was 5 feet in depth and at regular four inch intervals counts were made of at least 200 individual whole pollen grains, with the exception near the surface where paucity of pollen did not allow this. No digestion of the muck was necessary as the pollen grains were easily discernible in a soil-water dilution.

RESULTS

The swamp can be subdivided into eight communities based on compositional similarities within the quadrat data. The extent of each covertype was established on aerial photographs to allow the construction of Figure 1. Within these covertypes over 470 species of pteridophytes, gymnosperms and angiosperms were found. Woody overstory vegetation dominated the forest and plantation covertypes but was virtually absent in the marsh and pond areas and, to a varying degree, in the successional fields. Specific vegetational information is given below based on the quadrat sampling. A quadrat summary is provided in the Appendix.

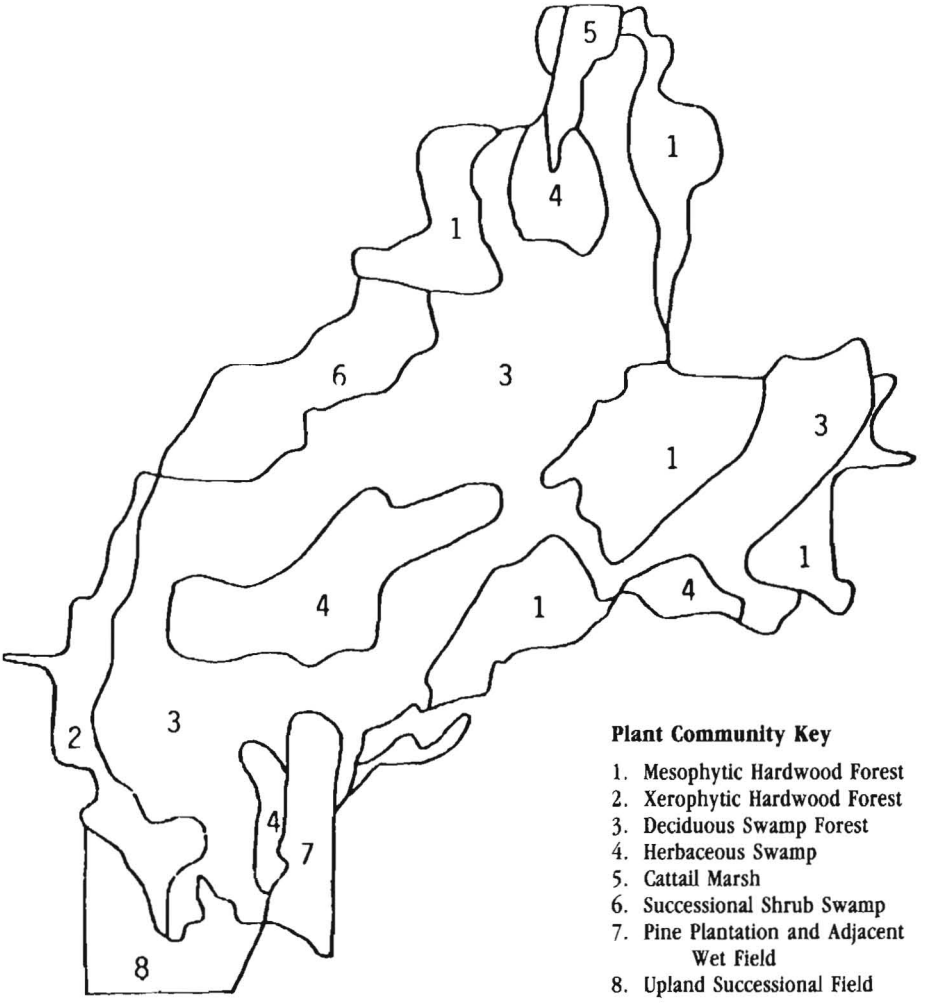

FIGURE 1: Plant Communities in the Thousand Acre Swamp.

1 - Mesophytic Hardwood Forest Community

(estimated 184 acres, quadrats 5, 6, 7, 18, 19, 20, 23, 30, 31, 32, 34)

This area along the eastern and northern swamp border is the site of the oldest forest and also of the most recent logging disturbance. Trees were removed from a 40 acre (estimated) section during the summer of 1975. Subsequent ring counts indicated that the forest community was over 200 years old with the largest specimen being a multiple trunk red oak with a DBH of 90 inches. Understory shrubs are almost absent where a mature canopy still exists. Northward within this covertype, white oak, bur oak and beech become locally abundant and the forest appears younger in age. This suggests past logging, perhaps around the turn of the century or use of the forest in woodland grazing, as stone walls and old barbed wire are present. A change in soil type may also help explain the local variation in species composition. The abundance of chestnut stump sprouts and fallen chestnut trees indicates that introduced diseases also influence forest composition. Red oak and tulip tree appear to be occupying the community role once filled by chestnut.

Dominants

Acer saccharum Marsh.	sugar maple	*Quercus alba* L.	white oak
Fagus grandifolia Ehrh.	beech	*Quercus rubra* L.	red oak
Prunus serotina Ehrh.	wild black cherry		

Associates

Acer rubrum L.	red maple	*Fraxinus americana* L.	white ash
Carya glabra L.	pignut hickory	*Liriodendron tulipifera* L.	tulip tree
Castanea dentata (Marsh.) Borkh.	chestnut (local sprouts)	*Quercus macrocarpa* L.	bur oak

Shrubs

Amelanchier laevis Wieg.	shadbush
Carpinus caroliniana Walt.	musclewood
Hamamelis virginiana L.	witch hazel
Ostrya virginiana K. Koch	hop hornbeam
Sambucus canadensis L.	black elderberry
Viburnum acerifolium L.	maple leaved virburnum
Zanthoxylum americanum Mill.	northern prickly ash

Ground Cover

Actaea alba (L.) Mill.	
Actaea pachypoda Ell.	white baneberry
Adiantum pedatum L.	maidenhair fern
Aster divaricatus L.	white wood aster
Circaea quadrisulcata (Maxim.) Franch. & Sav.	enchanter's nightshade
Dryopteris cristata (L.) Gray	crested fern
Dryopteris noveboracensis (L.)	New York fern
Dryopteris spinulosa Underw.	evergreen woodfern
Epipactis helleborine (L.) Crantz	helleborine orchid
Galium lanceolatum Torr.	wild yellow licorice
Geum aleppicum Jacq.	yellow avens
Lycopodium lucidulum Michx.	shining clubmoss
Medeola virgininana L.	Indian cucumber root.
Osmorbiza claytoni (Michx.) Clarke	sweet cicely
Polygonatum biflorum Cell.	true solomon's seal
Polystichum acrostichoides (Michx.) Schott.	christmas fern
Rhus radicans L.	poison ivy
Smilacina racemosa L.	false solomon's seal
Solidago flexicaulis L.	zig zag goldenrod
Taxus canadensis Marsh.	ground hemlock
Thalictrum dioicum L.	early meadowrue
Thelypteris hexagonoptera (Michx.) Weatherby	broad beech fern
Trillium erectum L.	purple trillium
Trillium grandiflorum Michx.	white trillium

2 - Xerophytic Hardwood Forest Community
(estimated 48 acres, quadrats 1, 2, 11, 12, 13)

Hickories that dominate this community are found growing on shallow and stony soils. Limestone outcrops are present here with red cedar, basswood and butternut occasionally observed. This forest community has been recently disturbed by use as a farmer's junkyard, and field stone piles are present. The dieback of American elms suggests that they were thriving in an earlier successional stage. The species is a pioneer woody plant in some regional fields.

Dominants

Carya glabra L.	pignut hickory
Carya ovata Mill.	shagbark hickory
Quercus rubra L.	northern red oak
Tilia americana L.	basswood

Associates

Acer negundo L. var. *violaceum* (Kirchn.) Jaeg.	box elder (the variety only grows in the Rochester area).
Carya cordiformis (Wang.) K. Koch	bitternut hickory
Fraxinus americana L.	white ash
Juglans cinerea L.	butternut
Platanus occidentalis L.	sycamore
Prunus avium L.	sweet cherry

Shrubs

Cornus florida L.	flowering dogwood
Cornus racemosa Lam.	red panicled dogwood
Crataegus spp.	hawthorn
Lindera benzoin L.	spicebush
Lonicera spp.	honeysuckle
Rhus typhina L.	staghorn sumac
Sassafras albidum (Nutt.) Nees.	sassafras
Xanthoxylum americanum Mill.	northern prickly ash

Ground Cover

Allium tricoccum Ait.	wild leek
Asarum canadense L.	wild ginger
Caulophyllum thalictroides L.	blue cohosh
Dentaria laciniata Muhl.	cut leaved toothwort
Desmodium paniculatum L	beggar's ticks
Dryopteris spinulosa Underw.	evergreen woodfern
Erythronium americanum Ker.	trout lily
Geranium maculatum L.	wild geranium
Geranium robertianum L.	herb robert
Parthenocissus quinquefolia L.	virginia creeper
Podophyllum peltatum L.	mayapple
Polystichum acrostichoides (Michx.) Schott.	christmas fern
Pteridium aquilinum L.	bracken fern
Rhus radicans L.	poison ivy
Ribes spp.	gooseberry
Sanguinaria canadensis L.	blood root

3 - Deciduous Swamp Forest Community
(estimated 397 acres, quadrats 3, 4, 8, 9, 10, 14, 15, 16, 17, 21, 22, 24, 25, 26, 27, 28, 29, 33, 35, 36, 37)

This low lying forest of the Thousand Acre Swamp is overwhelmingly dominated by swamp maple, red maple and green ash. Small American elm saplings are often observed along with dead or diseased older elm trees, suggesting their wetland community role was formerly significant. The forest floor is uneven due to numerous fallen limbs and is subject to seasonal inundation. Massive fallen trees provide the primary location for lush undergrowth of mosses, fungi, lichens and ferns. In many locations, these fallen trees are the only possible path through an area of loose, organic muck.

Dominanats

Acer rubrum L.	red maple
Acer freemanii E. Murray	swamp maple
Fraxinus pennsylvanica var. *subintegerrima* (Vahl.) Fern.	green ash

Associates

Fraxinus nigra Marsh.	black ash
Fraxinus pennsylvanica	red ash
Populus deltoides Marsh.	eastern cottonwood
Quercus bicolor Willd.	swamp white oak
Salix nigra Marsh.	black willow

Shrubs

Cornus alternifolia L.	alternate leaved dogwood
Cornus obliqua Raf	purple dogwood
Cornus racemosa Lam.	grey dogwood
Ilex verticillata (L.) Gray	winterberry
Lindera benzoin L.	spicebush
Rhus vernix L.	poison sumac
Salix bebbiana Sargent	Bebb's willow
Salix discolor Muhl.	pussy willow
Viburnum lentago L.	sweet virburnum

Ground Cover

Arisaema triphyllum L.	Jack-in-the-pulpit
Asclepias incarnata L.	swamp milkweed
Bidens cernua L.	bur marigold
Caltha palustris L.	marsh marigold
Chelone glabra L.	white turtlehead
Eupatorium fistulosum Barr	Joe Pye weed
Eupatorium perfoliatum L.	boneset
Eupatorium rugosum Houtt.	white snakeroot
Glyceria striata (Lam.) Hitchc.	manna grass
Impatiens biflora Walt.	spotted touch me not
Iris versicolor L.	blue flag iris
Lycopus americanus Muhl.	cut leaved water horehound
Mentha arvensis L.	wild mint
Onoclea sensibilis L.	sensitive fern
Osmunda cinnamomea L.	cinnamon fern
Osmunda regalis L.	royal fern
Phalaris arundinacea L.	reed canary grass
Pteretis pensylvanica Willd.	ostrich fern
Rhus radicans L.	poison ivy
Rumex crispus L.	curly dock
Solanum dulcamara L.	bittersweet nightshade
Thelypteris palustris L.	marsh fern
Tiarella cordifolia L.	foam flower
Verbena hastata L.	blue vervain

4 - Herbaceous Swamp Community
(estimated 117 acres)

The lowest areas within the swamp are characterized by dense stands of emergent vegetation, small intermittently flooded pools and the lack of a living forest canopy. Where wind-felled and decaying trees lay above the seasonal high water table, floral island clumps of bur marigold, spotted touch-me-not and bittersweet nightshade provide contrast to the intervening greenery of sedges, cattails and grasses. Occasional clumps of shrubs are scattered across this type of community.

Shrubs

Cephalanthus occidentalis L.	buttonbush
Cornus obliqua Raf.	purple dogwood
Rosa palustis Marsh.	swamp rose
Salix lucida Muhl.	shining willow

Ground Cover

Alisma plantago-aquatica L.	water plantain
Bidens cernua L.	bur marigold
Bidens frondosa L.	beggar's ticks
Carex comosa Boott.	sedge
Carex lupulina Muhl.	sedge
Cicuta bulbifera L.	bulb-bearing water hemlock
Hydrocotyle americana L.	water pennywort
Impatiens biflora Walt.	spotted touch-me-not
Iris versicolor L.	blue flag iris
Lemna minor L.	lesser duckweed
Ludwigia palustris (L.) Ell.	water purslane
Onoclea sensibilis L.	sensitive fern
Pilea pumila (L.) Gray	clearweed
Ranunculus sceleratus L.	cursed buttercup
Sium suave Walt.	water parsnip
Solanum dulcamara L.	bittersweet nightshade
Sparganium eurycarpum Engelm.	broad fruited burreed
Typha angustifolia L.	narrow leaved cattail
Typa latifolia L.	wide leaved cattail
Wolffia columbiana Karst.	watermeal

5 - Cattail Marsh Community
(estimated 31 acres)

A streamside cattail marsh occurs in the northern section of the swamp. Local dominance is shared by *Typha latifolia* L. and *Typha angustifolia* L. with few other emergent plants present. Several swamp white oaks (*Quercus bicolor* Willd.) stand along the stream bank. The common remaining plants include the lesser duckweed (*Lemna minor* L.), star leaved duckweed (*Lemna trisulca* L.), water smartweed (*Polygonum amphibium* L.), bur marigold (*Bidens cernua* L.) and bittersweet nightshade (*Solanum dulcamara* L.). Recently flooded sections of this covertype appear to be colonized by water plantain (*Alisma plantago-aquatica* L.), nut sedge (*Cyperus strigosus* L.) and bur marigold.

6 - Successional Shrub Swamp Community
(estimated 57 acres)

Abandoned agricultural muck along the western edge of the swamp has been revegetated by a dense tangle of shrubs reaching over six feet in height. Common here are species of willows (*Salix*), viburnums (*Virburnum*), dogwoods (*Cornus*) and button bush (*Cephalanthus occidentalis* L.). With time it is expected that deciduous swamp forests will develop on this site. Due to stream channelization for post agricultural drainage, this community often has corridors of open water over the entire growing season.

7 - Pine Plantation and Adjacent Wet Field Community

(estimated 34 acres)

This is an area of planted pines along the perimeter of another abandoned muck farm. Scotch pine is most common with some scattered Austrian pines in the southern section. Succession in the adjacent wet field is dominated by reed canary grass. Two small excavated ponds and a rundown utility shed are here.

Dominants

Pinus nigra Arnold	Austrian pine
Pinus sylvestris L.	Scotch pine
Salix nigra Marsh.	black willow

Ground Cover

Aster novae-angliae L.	New England aster
Calamagrostis canandensis (Michx.) Nutt.	blue joint grass
Fragaria virginiana Duchesne	wild strawberry
Phalaris arundinacea L.	reed canary grass
Solidago canadensis L.	Canada goldenrod
Solidago graminifolia (L.) Salisb.	grass-leaved goldenrod

8 - Upland Successional Field Community

(estimated 170 acres)

The flora in abandoned fields generally depends on the time since abandonment, proximity to seed sources and disturbances since abandonment.

Directly south of the xerophytic hardwood forest is a small abandoned field of about 38 acres. Its plant community is in an early stage of succession, dominated by annual and perennial species with inclusions of woody species in hedgerows, wet depressions and stony outcrops. Common trees include bitternut hickory, wild black cherry, sassafras and butternut with the common shrubs being choke cherry (*Prunus virginiana* L.), northern prickly ash, red panicled dogwood, wild apple (*Malus pumila* Mill.) and several species of hawthorn (*Crataegus*). Herbaceous ground cover is diverse and finely patterned. Common species include field horsetail (*Equisetum arvense* L.), bracken fern (*Pteridium aquilinum* (L.) Kuhn.), timothy (*Phleum pratense* L.), stinging nettle (*Urtica dioica* L.), yellow rocket (*Barbarea vulgaris* R. Br.), white sweet clover (*Melilotus alba* Desr.), evening primrose (*Oenothera biennis* L.), Queen Anne's lace (*Daucus carota* L.), basil (*Satureja vulgaris* (L.) Fritsch.), Indian hemp (*Apocynum cannabinum* L.), butterfly weed ((*Asclepias tuberosa* L.), black swallowwort (*Cynanchum nigrum* (L.) Pers.), mullein (*Verbascum thapsus* L.), teasel (*Dipsacus sylvestris* Huds.), daisy fleabane (*Erigeron annuus* (L.) Pers.), black-eyed Susan (*Rudbeckia hirta* L.), and several species of aster (*Aster*) and goldenrod (*Solidago*).

Along the northeastern border of the swamp is another abandoned field about 20 acres in size. Forest succession is more advanced here with seedlings and saplings of white ash, bur oak, white oak, sugar maple, tulip tree, wild black cherry and black walnut (*Juglans nigra* L.). Shrubs are absent and the common ground cover includes several grasses, christmas fern, sensitive fern, wild ginger, periwinkle (*Vinca minor* L.) and several members of the sunflower family.

The largest successional field is found on the western edge of the swamp extending to Five Mile Line Road (estimated 72 acres). Portions of this field are dominated by trees, other areas by shrubs and remaining areas by herbs and forbs. Where a woody canopy is present, eastern cottonwood, gray birch (*Betula populifolia* Marsh.) and red maple are common. Purple dogwood, grey dogwood, honeysuckle and American elm saplings dominate the shrubby areas. Herbaceous ground cover often contains Queen Anne's lace, several leguminous plants, timothy, English plantain (*Plantago lanceolata* L.), common St. John's wort (*Hypericum punctatum* Lam.), rush (*Juncus effusus* L.) and several species of goldenrod (*Solidego*), aster (*Aster*) and hawkweed (*Hieracium*).

DISCUSSION

Past information about the Thousand Acre Swamp was limited to the brief description of the area by Shanks (1966) and the aerial photographic analysis done by the Monroe County Planning Council as part of a routine countywide activity. Information for the broader Great Lakes region is reviewed and discussed by Braun (1950). An initial discussion of deciduous swamp forests and coniferous bogs will be developed here due to the possibility that the Thousand Acre Swamp may have undergone long-term compositional changes involving both forest types.

Braun (1950) suggests that bogs occupy deep depressions where organic soils have accumulated while swamps occur on poorly drained recently exposed glacial topography. Most bogs contain coniferous species in abundance with a few invading bottomland hardwoods. Tamarack, black spruce and white cedar are the common conifers. Where tamarack is dominant, the forest canopy is more open and an abundant shrubby flora of ericaeous species is usually found. Tamarack bogs are often succeeded by white cedar communities. Swamps, on the other hand, have variable composition often including both coniferous and deciduous species.

Bogs are rare in Monroe County. Perhaps the best known example, Kennedy's Bog in Mendon Ponds Park, contains both tamarack and black spruce. Deciduous swamps, as described by Shanks (1966), occupy areas in Monroe County that are subject to seasonal flooding and maintain a high water table year round. The soils are largely mineral in contrast to the organic peats of the bog forest. These swamp soils may, however, be quite dark reflecting the incorporation of organic matter during soil development. Common swamp forest trees might include American elm, red maple, swamp maple, green ash, red ash, black ash and swamp white oak. All these species seem to tolerate a low soil aeration condition, suggesting other environmental factors affect the local compositional variation of swamp forests.

Shanks' report (1966) was published posthumously. The field work was completed chiefly in 1939. Shanks described Thousand Acres Swamp as a bog forest characterized by white cedar and tamarack. White pine, American elm, red maple and ericaceous shrubs are important associates within his description of this forest community type. The forest interior was described as dense, shaded and uneven from many slowly decaying bog conifers. The forests of the Thousand Acre Swamp as sampled in this study bear little resemblance to Shanks' (1966) suggestions. No white cedar, white pine, tamarack or ericaceous shrubs were found. Could the forest communities of the swamp have changed this quickly and completely? It appears more likely that Shanks' posthumous publication simply contained this error. Otherwise it has been found to be an accurate and illuminating document of Monroe County vegetation before World War II.

Long term historical changes in composition are often detected in the evidence provided by fossil pollen studies. Cox (1959) suggests the following climatic correlations:

Abies and *Picea:*	wet and cold
Pinus:	dry and cool (warmer than preceding)
Tsuga:	moist, cool to warm (hemlock is more an indicator of moisture than temperature.
Fagus:	moist and warm (beech is thought to indicate a slightly drier degree of mesophytism than hemlock)
Quercus:	warm (oak indicates more xerophytic conditions)

Good pollen preservation in soil requires low rates of decomposition. High moisture content, low aeration and low pH help to create this condition. A satisfactory comparison with New England profiles is not possible because there is no pollen near the surface in the swamp. An explanation of the absence can be conjectured. Following the retreat of the continental glacier, the area might have developed as a bog forest with little or no drainage. The outlet then may have been lowered improving drainage. Improved drainage may have coincided with the hypsithermal period. Increased evaporation would have reduced soil moisture to the level where bottomland hardwoods would be competitively favored. Under these conditions soil decomposers flourish and would have consumed the annual pollen load. Replacement of conifers by bottomland deciduous trees would also have changed the nature of accumulating organic material. A shift from a mor-like litter layer to a mull-like one might raise the surface pH, further enhancing the activity of soil decomposers. The actual pH of the muck varies from 5.5 to 6.5, increasing with depth, and it is extremely well buffered (Soil Survey of Monroe County, 1973). The source of this increased alkalinity may be the underlying limestone as well as changes caused by the history postulated above. Both the intrinsic and historical influences would be strong in a shallow basin, such as Thousand Acre Swamp.

The reconstruction of the post-glacial vegetational history of the swamp is presented in the pollen profile of Figure 2. In most eastern North American pollen studies, the lowermost layers are dominated by spruce (*Picea*) and fir (*Abies*), followed by a zone with spruce and pine (*Pinus*) indicating a warming climate sometimes followed by a spruce maximum showing a regional cooling trend (Davis, 1965). The next major zone is dominated by pine indicating a drier and perhaps warmer climate. This zone gradually gives way to a period characterized by the appearance of southern hardwood species, the so-called hypsithermal period. It is within the hypsithermal zone that regional variation in eastern North America first becomes noticeable. In Ohio, an increase in beech pollen is associated with the pine decline (Sears, 1931), while in New England an increase in oak and hemlock marks the beginning of the pine decline (Deevey, 1943).

Like the New England profiles, the Thousand Acre Swamp profile indicates the rise in dominance of hemlock and associated hardwoods including oak, basswood, hickory and tupelo (*Nyssa sylvatica* Marsh.). Dominance of oak and hickory is not shown here, but may have occurred where the profile is truncated due to soil decomposition. It would appear that the development of forest communities in the swamp involved plant migrations similar to those proposed for New England, rather than Ohio. Cooler and more moist conditions following the hypsithermal period led to an increase in the abundance of beech, birch and maple pollen near the surface. In other local pollen records (Sheldon, 1952), pine and spruce reasserted their dominance during this time, but this change is not evident in the Thousand Acre Swamp.

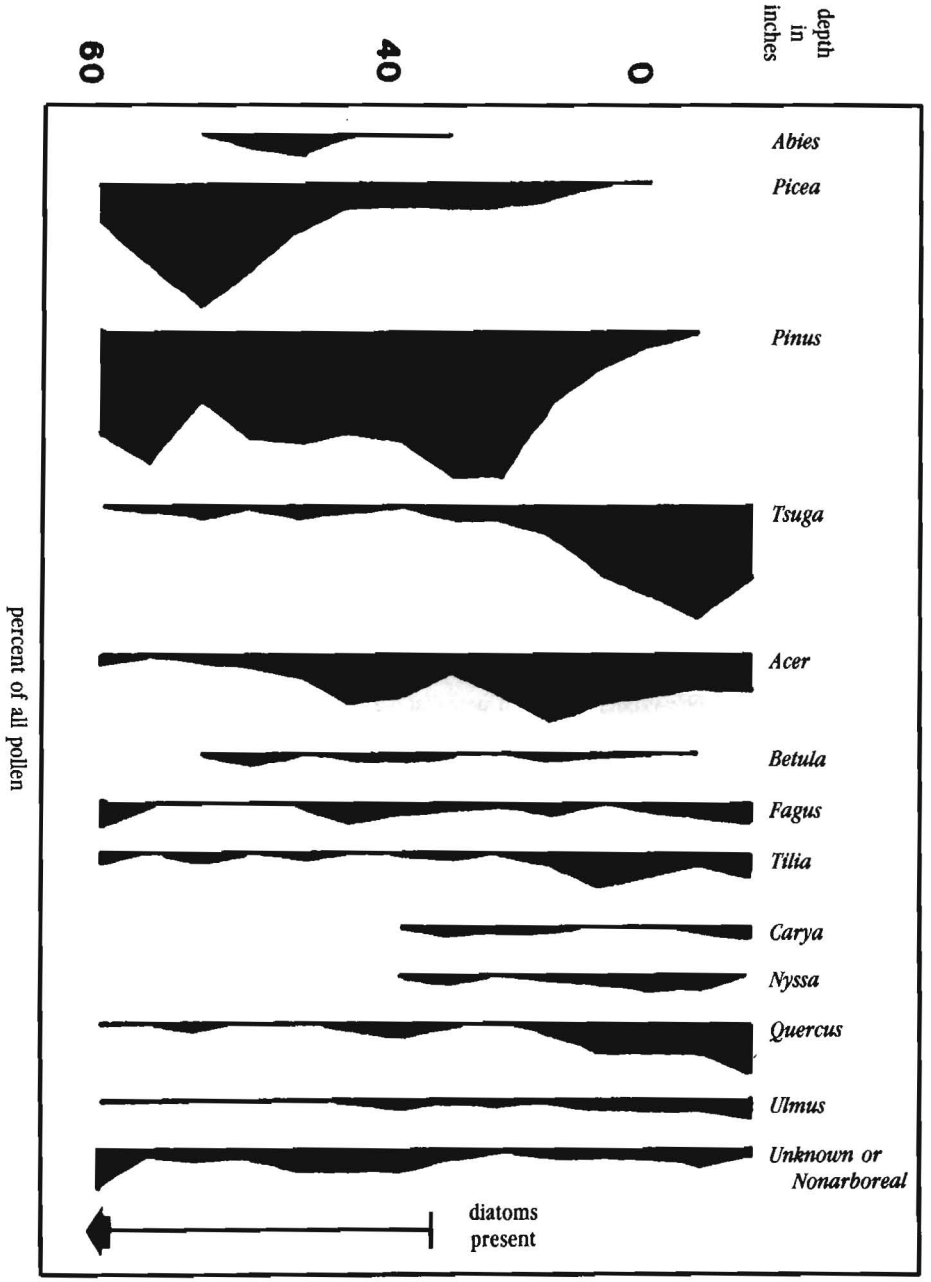

Figure 2: Reconstructed Fossil Pollen Profile of the Thousand Acre Swamp.

APPENDIX - Forest Tree Importance Value Summarized by Quadrat

Tree Species	Upland Forest Quadrat Number															
	#1	#2	#5	#6	#7	#11	#12	#13	#18	#19	#20	#23	#30	#31	#32	#34
Pignut Hickory	48					14	1	4	7							
White Ash	19	35				15	1	3	1		2	1				
Shagbark Hickory	17	49					29	12								
Box Elder	8															
American Elm	4	11														
Red Maple	2		34	3	5											
Sweet Cherry	2	5					7	1								
White Oak			33													
Musclewood			13		6	31	2		10		3	14				
Sugar Maple			11	44	22				17	1	30		57	19	31	10
Witch Hazel			4	3	20		3			18	2					
Bur Oak			3													
Shadbush			2	5	3						1					
Red Oak				34	26	11							17	43		43
Black Cherry				7		9		8				1	5	18	33	
Hop Hornbeam				4	5		25				2					
Tulip Tree					11				4				9			
Beech					1				26	31	36		12	18	14	
Flowering Dogwood					1											
Spicebush						16	17	5	35	1	9	16				36
Basswood						4		47			1	20			23	11
Prickly Ash							14	1				5				

(Continued on next page.)

APPENDIX - Forest Tree Importance Value Summarized by Quadrat *(continued)*

Tree Species	Upland Forest Quadrat Number															
	#1	#2	#5	#6	#7	#11	#12	#13	#18	#19	#20	#23	#30	#31	#32	#34
Choke Cherry							2	3								
Arrowwood								14								
Hawthorn								3								
Black Ash									1							
Wild Grape									1		1	9				
Sweet Birch										49						
Bitternut Hickory											13					
Butternut												26				
Honeysuckle												4				
Red Panicled Dogwood												3				
Virginia Creeper												2				
Alternate-Leaved Dogwood												1				
Yellow Birch														3		

APPENDIX - Forest Tree Importance Value Summarized by Quadrat *(continued)*

Tree Species	Lowland Forest Quadrat Number																				
	#3	#4	#8	#9	#10	#14	#15	#16	#17	#21	#22	#24	#25	#26	#27	#28	#29	#33	#35	#36	#37
Red Ash	64	34	29	30	16	12	13		24	26	59	5	27	65	76				18	19	
White Ash	31																				
American Elm	5		1							1	8	9	21	6	16	5				1	
Swamp Maple		45		47	64	54	67	63	45	13		55	11	25	2	32	54	100	61	19	
Red Maple		21	56						9	5	1			1		8			23		47
Spicebush			13	21	19		10	16	2	19	23	2	3		6		39			13	38
Silky Dogwood			1			1	7		8												
Black Ash				2		1		7	7					3							
Bebb's Willow						1															
Arrowwood						23			1	3										5	2
Winterberry						8															
Red Osier Dogwood						2		6													
Racemose Dogwood							3		5		4	5								1	
Black Willow								9					39			45					
Swamp White Oak										29							5				
Musclewood										2										4	
Wild Grape										1	1	10									
Sweet Viburnum										1	1										
Poison Ivy											3	2								1	
Alternate-Leaved Dogwood												12									
Virginia Creeper												2									
Eastern Cottonwood																10					

(Continued on next page.)

APPENDIX - Forest Tree Importance Value Summarized by Quadrat *(continued)*

Tree Species	Lowland Forest Quadrat Number																					
	#3	#4	#8	#9	#10	#14	#15	#16	#17	#21	#22	#24	#25	#26	#27	#28	#29	#33	#35	#36	#37
Sugar Maple																	3			22	
Choke Cherry																				6	
Red Oak																				5	
Basswood																				3	
Bitternut Hickory																				2	
Black Cherry																				1	
Hawthorn																				1	
Shining Willow																					4
Black Elderberry																					3
Rose																					3
Common Buckthorn																					1
Bittersweet Nightshade																					1

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CYTOCHEMICAL TESTS OF ACID PHOSPHATASE SECRETION BY CARNIVOROUS PLANTS

Robert Eliot Stauffer

ABSTRACT

This study utilized azo dye biochemical tests for acid and alkaline phosphatase on carnivorous plant leaves to indicate by heavy staining those tissues which are likely to be producing digestive enzymes. Heavy staining was observed in gland cells and in some interior (dorsal) epidermal cells. The results are consistent with Heslop-Harrison's report of finding digestive enzymes in the genus *Pinguicula* (Lentabulariaceae). Acid phosphatase was demonstrated for *Sarracenia purpurea* ssp. *gibbosa* (Raf.) Wherry and *S. flava* L., and three species of *Utricularia: U. cornuta* Michx., *U. minor* L. and *U. vulgaris* L. (Lentibulariaceae). Tests with phenolpthalein diphosphate as substrate demonstrated both acid and alkaline phosphatase in *U. vulgaris*.

INTRODUCTION

Carnivory in plants has intrigued observers for over two hundred years. Perhaps the earliest observation of the capture of insects by a plant can be credited to Governor Dobbs of North Carolina, who discovered the Venus' fly trap, *Dionaea muscipula* Ellis. The plant was described in a letter to Peter Collinson of London, dated at Brunswick, N.C. January 24, 1760 (Lloyd, 1942). The term "carnivorous" was applied to *Dionaea* by the French encyclopaedist, Diderot, some time between 1774 and 1780 (Lloyd, 1942).

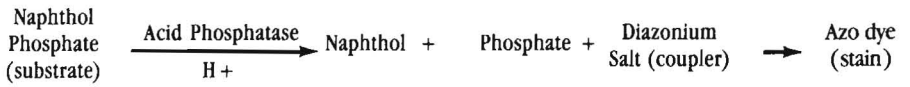
By the latter part of the 18th Century, *Drosera* (sundew) and *Sarracenia* (pitcher plant) were also suspected to be carnivorous. In 1829, Burnett suggested that plant carnivory could be tested experimentally (Heslop-Harrison, 1975), and Charles Darwin undertook the investigation. Darwin was assisted by his son, Francis, and Sir Joseph Hooker of Kew. This extended study resulted in the publication of "Insectivorous Plants" (Darwin, 1875).

Early work on the digestion in carnivorous plants left uncertainty whether digestive enzymes might be derived from associated bacteria in some species of *Sarracenia* (pitcher plants) and *Utricularia* (bladderworts).

Lloyd (1942) summarized the knowledge on the carnivorous plant habit from the time of Darwin. He added observations on the mechanism of bladderwort traps. After Lloyd, histochemical tests for enzymes were developed for animal tissue, and Yolande Heslop-Harrison (1971) at Kew has used some of these tests to study enzyme secretion by carnivorous plants.

This report describes localized staining of presumptive active digestive glands in two species of North American pitcher plants, *Sarracenia purpurea* ssp. *gibbosa* (Raf.) Wherry and *S. flava* L., and in three species of bladderwort, *Utricularia cornuta* Michx., *U. minor* L. and *U. vulgaris* L. The stain is not a direct enzyme test, since all active cells contain phosphatase, and tissues vary considerably in content, depending on their type and condition. Nevertheless, the sharp differences found in phosphatase activity show strong functional differences, and suggests a digestive function.

Localized staining of tissues depends on this reaction scheme:



An appropriate phosphate ester acts as the enzyme substrate, and a diazonium salt coupler reacts with the dye precursor released in enzymolysis. The product, an azo dye, stains the tissue. Suitable substrates and methods for their use for acid or alkaline phosphatases have been described by Burstone (1958) and Bowen (1971). These investigators, working with rat liver and other tissue, utilized various substituted naphthol phosphates, such as Naphthol AS-BI phosphate[1] and diazonium couplers, such as Red Violet LB salt[2] or Fast Red GG[3]. These reagents are a significant improvement over earlier substrates, such as phenolphthalein diphosphate. Heslop-Harrison (1971) has applied Burstone's and Bowen's techniques to detection of enzymes in several species of carnivorous plants, in particular to species of Lentibulariaceae: *Pinguicula* (butterwort), Nepenthaceae (Asiatic pitcher plants) and Droseraceae (sundews).

METHODS AND MATERIALS

In the present investigation, a preliminary test for acid or alkaline phosphatase activity in the common bladderwort, *Utricularia vulgaris,* was made using phenolphthalein diphosphate. A few crystals of the diphosphate were placed on a microscope well slide and dissolved in 3-4 drops of isopropanol. To this was added a sufficent volume of 0.2M acetate buffer, pH 4.43, to fill the well, and a small fragment of the live bladderwort with one or two traps was placed in the mixture. The whole was covered lightly with a coverslip and after 20-30 minutes at room temperature (18°C), 1-2 drops of 10% potassium hydroxide were run under the coverslip and allowed to mix throughout the solution in the well. Enzymolysis of the ester was indicated by the development of the purple color of phenolphthalein.

On the basis of the limited success with the phenolphthalein diphosphate procedure, experiments were undertaken with several azo dye precursors selected on the basis of the work of Burstone (1958), Bowen (1971), Heslop-Harrison (1971), Rutenburg (1966), Hayashi (1977) and Vaughn, Guilbault and Hackney (1971). Trials of substrates included p-nitrophenyldihydrogen phosphate and Naphthol AS-BI phosphate. Couplers tried included Fast Red GG, p-diethylaminobenzenediazonium chlorozincate Azoene Fast Red PDC[4], and N, N-dimethylamino-p-nitrosoaniline[5].

Each combination produced localized staining with good resolution of regions of enzyme activity. The various combinations were evaluated by following the procedure used in Heslop-Harrison's experiments on high resolution staining of the stalked and sessile glands of butterwort, using *Pinguicula vulgaria* L. Particularly convenient combinations proved to be:

1. p-Nitrophenyldihydrogen phosphate with p-diethylaminobenzene diazonium chlorozincate, and
2. Naphthol AS-BI phosphate with either Fast Red GG or Azoene Fast Red PDC[4].

The dyes produced are red with good tinctorial strength and the working reagents were sufficiently stable to afford convenience in experimentation.

The following description of the preparation of the working reagents of Naphthol AS-BI phosphate and Azoene Fast Red PDC and their application to portions of the leaf of *Sarracenia purpurea* ssp. *gibbosa* illustrates the technique.

Solution A: Dissolve 10 mg of Naphthol AS-BI phosphate in 2-3 ml of isopropanol, then dilute to 12.5 ml with 0.2 M acetate buffer (pH 4.43). Filter.

Solution B: Dissolve 10 mg of Azoene Fast Red PDC in 2 ml of isopropanol and dilute to 12.5 ml with 0.2 M acetate buffer (pH 4.43). Filter.

Reagents A and B were mixed 1:1 and diluted with 35 ml of water. A portion of *Sarracenia* leaf was rinsed in running water for a few seconds and placed in the mixture. Localized staining of sessile glands was observed within 30-60 minutes, but staining increased over periods of 12-60 hours depending on the vigor and maturity of the leaf. The process was stopped by removing the specimens and rinsing in water and mounting portions of the leaf for microscopic examination in gylcerine-jelly mountant.

[1]7-Bromo-3-phosphate-2-naphth-o-anisidide.
[2]Diazotized 5-benzamido-4-chloro-2-toluidine.
[3]p-Nitrobenzene diazonium-tetrafluoborate.
[4]Trademark.
[5]All compounds supplied by Eastman Organic Chemicals, Eastman Kodak Company.

RESULTS

Heslop-Harrison's (1971) results on *Pinguicula* were paralleled with *Sarracenia* and *Utriculuria.* Dye deposits resulting from phosphatase action were produced in both sessile and stalked glands as well as sessile dorsal glands.

1. *Sarracenia*

For the purposes of describing the results of acid phosphatase cytochemical tests on *Sarracenia purpurea,* the principal anatomical features associated with carnivory are those described by Lloyd (1942, Plate 2, Figures 12, 15, 16).

The sessile glands of the outside of the *Sarracenia* leaf and of the lid and collar have been considered to function as nectar producers, and only the interior sessile glands below the collar have been considered to be digestive. In this study, azo dye tests showed phosphatase activity for all sessile glands regardless of where located on the leaf (Fig. 1). Fresh, younger leaves showed strong reactions, while old traps were choked with prey residues and showed many glands partially or fully discharged. Pitcher fluid removed from young leaves and mixed with the reagents rapidly developed a deep pink color, indicating the presence of acid phosphatase. The results suggest that the source of digestive enzymes is the plant itself, although the possible presence of bacterial enzymes was not excluded.

Also stained were some of the isodiametric epidermal cells and their walls in the interior bottom half of the pitcher (Fig. 2). This zone has been considered to be an absorptive zone (Lloyd, 1942).

Acid phosphatase studies on *Sarracenia flava* from the Carolina coastal plain showed comparable reactions to *S. purpurea.*

2. *Utricularia*

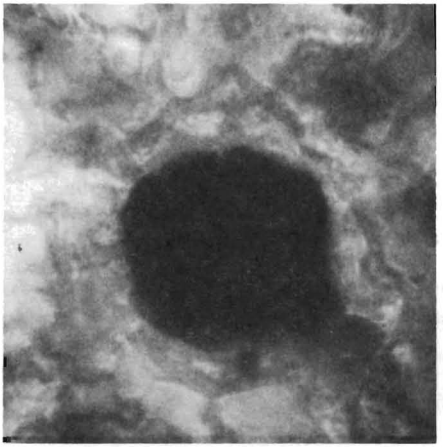
The bladderworts are generally placed in the Lentibulariaceae which includes the carnivorous genera *Pinguicula, Genlisea, Polypompholyx* and *Biovularia.*

Bladderworts are freely floating or anchored aquatics or are ephiphytic in wet moss or are terrestrial in wet sandy or peaty soils. The various species are distinguished by the presence of numerous "small (2-5 mm) flattened pear-shaped hollow bodies (traps) attached to the plant by means of a short stalk" (Lloyd, 1942). Of the three bladderworts studied, *U. cornuta* is terrestrial while *U. minor* and *U. vulgaris* are floating aquatic species. All are studded with sessile spherical glands on the exterior of the traps and along the stems. The interiors of the traps contain many specialized 2 (bifid) and 4 (quadrifid) armed glands (only bifid in *U. cornuta*).

The entrance and outer surfaces of the doors of the traps bear longer or shorter stalked mucilage glands. These and the spherical glands are reputed to play a role in attracting prey. The bifids and quadrifids are generally assumed to be involved in the secretion of digestive enzymes and in the assimilation of the digestion products. Aquatic species like *U. minor* and *U. vulgaris* are equipped with appendages near the entrance which are called antennae, which serve as drift fences or guides to bring the prey to the vicinity of the door. These species also possess trigger hairs on the door exterior. Species like *U. cornuta,* which are terrestrial, lack both the antennae and trigger hairs. Heslop-Harrison (1975) stated that esterases and phosphatases are present in *Utricularia* (species unspecified).

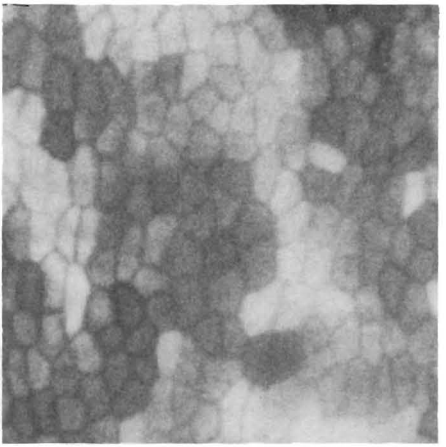
Strong acid phosphatase reactions were demonstrated by means of azo dye formation for all three bladderwort species. Activity was present in the spherical glands of the traps and stems, in the alluring glands at the door, and in the bifids and quadrifids in the interior of healthy traps (Fig. 3, 4, 5 and 6). The localized staining of the interior glands could be demonstrated only by triggering the traps to initiate ingestion of the substrate. Older traps clogged with prey residue generally showed weak phosphatase activity in the glands. In addition, large amounts of microscopic prey and probably bacteria in old traps gave rise to intense general staining of the trap and its contents.

1



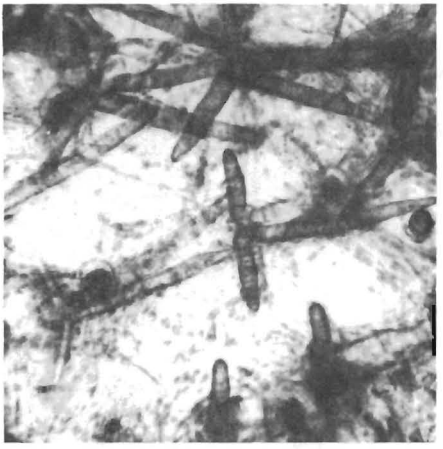
Stained Nectar Gland of ***Sarracenia purpurea.***

2



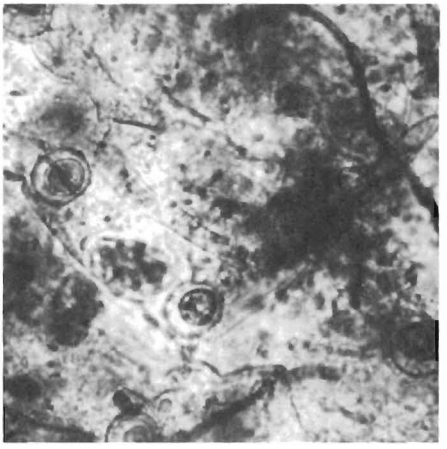
Stained Cells of Lower Interior, ***S. purpurea.***

3



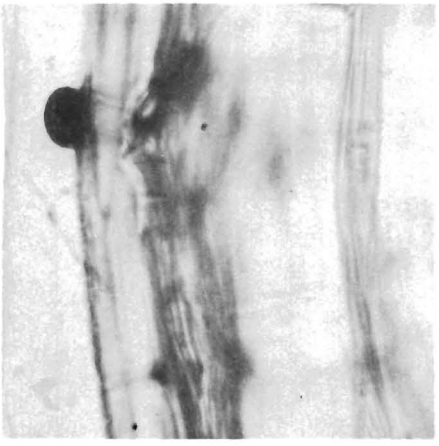
Stained Quadrifids, ***Utricularia vulgaris.***

4



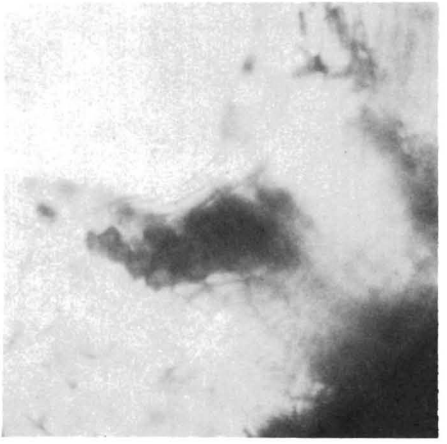
Stained Sessile Glands, ***U. vulgaris.***

5



Stained Gland in Outer Wall, ***U. cornuta.***

6



Stained Cells of Door Area, ***U. cornuta.***

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DUNBAR'S NOTEWORTHY TREES OF ROCHESTER AND VICINITY REVISITED AFTER SIXTY YEARS (with notes on other unusual specimens)

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Addendum by J. W. Kelly, Richard J. Cook,
Cary Conrow, and H. S. Forest

ABSTRACT

In 1917, John Dunbar reported as "noteworthy" 59 individual trees and some tree groups in or near Rochester, New York. Included were 33 species and two hybrids. Ten of the species were at the Ellwanger and Barry Nurseries, and subsequent owners of the land have preserved over half of them. Only ten trees could be found of the individuals reported and measured in 1917. These were remeasured in 1977 and their locations redescribed. In addition, specimens of 18 species were reported for the first time as noteworthy trees not located in public parks. Other trees were added to the list and identifications of some individuals were clarified by the editor's review group in 1983.

INTRODUCTION

In 1917, John Dunbar, then Assistant Superintendent for Parks for the City of Rochester, New York, located and described some "Noteworthy trees in Rochester and vicinity." These observations were published as a section (pp 64-74) of a larger article, "Plants of Monroe County, New York and Adjacent Territory; Second Supplementary List," published in the Proceedings of the Rochester Academy of Science, Vol. 5, 1917 (Beckwith, Macauley and Baxter, 1917). The article stimulated the author to see how many of those trees survived in 1977.

Subsequently, the article by Baxter and Maloy (1932) was found containing a section on "Noteworthy trees mostly of early introduction." This section reported the condition of most of the trees reported by Dunbar 15 years earlier. However, the trees were not remeasured. They reported an additional station of pawpaw *Asimina triloba* (L.) Dun., one mile north of Adams Basin, Monroe County. They also reported a giant sequoia, *Sequoiadendron giganteum* (Lindl.) Buchholz. (as *Sequoia Wellingtonia* Seem.) on the Ellwanger and Barry Nursery grounds on Mt. Hope Avenue (Rochester, New York.) although an article by Edward R. Foreman (1930) states that the "last one was taken down in 1925."

Dunbar limited his report principally to "foreign trees" and "a few of the most prominent native trees." The term "foreign" apparently meant trees not native to the Rochester region since he did not limit his selection to trees from foreign countries. In searching for the specimens Dunbar described, the author also sought other mature specimens of each species, with the goal of updating the information about the presence of these species in Rochester and vicinity at the time (1977).

Dunbar reported 33 species and two hybrids. He located and identified 59 individual specimens. He reported two groves of pawpaw (*A. triloba*), a row of magnolias (*Magnolia* spp.), a collection of horsechestnuts (*Aesculus* spp.) and an orchard of English walnut trees (*Juglans regia* L.). Ten of the 33 species Dunbar described were on the grounds of the Ellwanger-Barry Nurseries. Six of the 11 specimens and the row of magnolias at the site were living in 1977. The trees were preserved by subsequent property owners, the University of Rochester (Mt. Hope Ave.) and the Colgate Rochester Divinity School (Highland Parkway). Several specimens near the center of the city disappeared as the commercial and industrial areas expanded and others no longer exist in residential areas..

*The help of these individuals is gratefully acknowledged. James W. Kelly, taxonomist of the Monroe County Parks Department, assisted in identification and location. Munro Will provided historical information and locations. Babette Coleman and R. Eliot Stauffer helped in locating examples of some species. Helen Ellwanger and Louis Thompson provided living links with their respective grandfathers.

Species are listed here in alphabetical order and selected observations or comments about each species and specimen reported by Dunbar are provided. In addition, other noteworthy specimens identified in 1977 and their locations are given. Almost all of the species discussed are present in Highland Park, but the list presented here does not include those in the Park, except in instances where other specimens were not found or were very few in number. Circumference was measured at 4½ feet above the ground. The height and breadth of crown were determined by using an "optical tape measure" manufactured by Ranging, Inc. of East Rochester, New York. The nomenclature now follows that provided in Hortus Third (Bailey and Bailey, 1976). Measurements are given in order of circumference, height and crown spread (e.g. 10′5″ × 70′ × 30′).

Acer campestre L. (hedge maple) - In 1917, 360 West Avenue - gone. The site is in the Ritter Company parking lot. The field maple is rare in Rochester today.

Added, 1977: *Acer campestre* L. - Crittenden Boulevard in front of Helen Wood Hall 5′4″ × 45′ × 45′ and 5′4″ × 35′ × 35′.

A. cappadocicum Gled. (colosseum maple) - In 1917, 973 East Avenue. (Rochester Health Association) - gone. The species is rare in Rochester.

Added, 1977: *Acer cappadocicum* - 1005 East Avenue 13′6″ × 85′ × 70′. Several grow in Highland Park.

A. macrophyllum Pursh. (big leaf maple) - In 1917, T. B. Yale Nursery at Winton and the canal bridge. Already cut down before publication.

Added, 1977: *Acer macrophyllum* - Highland Park, northeast corner of South Avenue and Reservoir Road, about 15 yards west of the bust of Goethe.

A. opalus L. (Italian maple) - In 1917, 200′ northeast of the Stone Cottage on Mt. Hope Avenue on the Warner Estate. (Highland Park) 100 yards north of Reservoir Road; in 1977, 200′ NNE a large stump, with many shoots, remained. It has since been removed.

Aesculus turbinata Blume (Japanese horsechestnut) - In 1917, near east end of the grass walk from the Ellwanger and Barry Office to South Avenue. In 1977, only *A. hippocastanum* L. at site. Horsechestnuts, usually white, but occasionally pink, have been planted throughout the region.

Added, 1977 and 1983: *Aesculus hippocastanum* (white) - 1)45 Hoyt Place 10′6″ × 55′ × 40′ 2) 692 Mt. Hope Avenue 13′2″ × 60′ × 70′ 3) 668 Mt. Hope Avenue 14′0″ × 60′ × 55′.

Aesculus hippocastanum L. f. *baumanii* Schneid. (double white) - Highland Avenue, north side 20 yards east of Lilac Drive 12′9″ x 60′ x 40′.

Aesculus x *carnea* Hayne F. *briotii* (Carr) Nichols (scarlet hybrid) - 360 Allens Creek Road 3′8″ x 20′ x 25′.

Abies normanniana (Steven) Spach. (Caucasian fir) - On Highland Avenue at the bottom of the south slope of the Ellwanger and Barry vineyard. Miss Helen Ellwanger, granddaughter of the founder of the Ellwanger and Barry Nurseries, describes the vineyards as having been on the land now occupied by the campus of the Colgate Rochester-Bexley Hall Divinity School. Near Highland Avenue is a group of trees, and two specimens are *A. normanniana*, neither is as large as that reported by Dunbar in 1917, 4′9″ × 75′. Consequently, these trees may not be Dunbar's, but they must have been growing in 1917: 1) north side of Highland Avenue, 50 yards west of David Avenue, 5′5″ x 50′ x 20′2″) Highland Avenue opposite the entry of Lilac Drive, 7′2″ x 65′ x 40′. Also here is *Abies veitchii* (Veitch fir) 6′10′ × 75′ × 35′. These species appear not to have been planted recently, even though they are disease resistant and capable of thriving in Rochester.

Added, 1977: *Abies normanniana* - 421 East Avenue 1) 5′7′ × 55′ × 30′ and 2) 5′3″ × 45′ × 35′.

Asmina triloba (L.) Dun. (pawpaw) - This native species was reported by Dunbar from the Budlong farm, north of Ridge Road in Greece. The site could not be located. Another grove was mentioned as "near Brockport." Babette B. Coleman located specific populations, however.

Added, 1977: *Asimina triloba* - *1)* Clarkson-Parma Town Line Road approximately 1/4 mile south of Ridge Road just before line crosses a small creek. They are on the east and west side of a small opening in the woods (10-15) largest 2'0" × 20' × 15' 2) south side of N.Y. Central R.R. tracks, now Amtrak, 0.6 miles west of crossing of Sweden Walker Road (Rt. 260); two or three hundred plants. There are two separate populations, one group by tracks, other SW in woods.

Catalpa speciosa Warden ex. Engelm (Indian cigar tree) - In 1917, described as planted at several sites, but only two were specified 1) Near Highland Avenue in front of the Ellwanger and Barry vineyards. In 1977, this is at the north edge of Highland Ave., 50 yards west of the intersection with David Avenue; in 1917, 8'1", and in 1977, 11'6", with much of the crown gone 2) Two trees, 1075 East Avenue in 1917 - gone.

Added, 1977: *Catalpa speciosa* - 1) 749 Grand Avenue 12'0" × 60' × 45', 1675 Clover Street 9'5" × 70' × 55' 2) 1200 Westfall Road (several) largest 9'3" × 50' × 40' (species determined 1983, J. W. Kelly).

Chamaecyparis lawsoniana A. Murr. (Port Orford cedar) - At bottom of south slope of the Ellwanger and Barry vineyard (Colgate Rochester-Bexley Hall, Divinity School, northeast corner of Highland Avenue and Goodman Street) - In 1977: 1) 4'9" × 40'; approximately 75 yards east of the entrance of Lilac Drive 2) 4'10" × 50' × 20'. The tree had, and still has, "a peculiarly swollen base," and has grown little.

Cladrastis lutea (Michx.) C. Koch (yellow wood) - In 1917, 668 Mt. Hope Avenue. In 1977, 20 yards SW of the Office - there. In 1917, had five boles, the largest measuring 6'5"; in 1977, one had been removed. The largest bole remaining measured 8'4", and the trunk measured 22'6" two feet above the ground × 55' × 25'. The species is rarely planted in Rochester.

Added, 1977: *Cladrastis lutea* - 1) Highland Avenue, north side - 200 yards east of entry of Lilac Drive 8'9" × 45' × 50' 2) 901 East Avenue south side 9'6" × 55' × 55' 3) Holy Sepulchre Cemetery - east side of Lake Avenue, south of gate 12'5"' × 60' × 65'.

Crataegus pedicellata form *ellwangerana* Sarg. (a hawthorn) - The specimen described in 1917 was the type tree of this hawthorn cultivar (as *C. ellwangerana* Sarg.). West end of the grass walk from the Ellwanger and Barry Office to South Avenue. Found 100 yards east of the building, 668 Mt. Hope Avenue. Verified by Helen Ellwanger. In 1917, 3'7" × 25'; in 1977, 5'3" × 30' × 25'. Hawthorns of various species are planted commonly in the Rochester region and there are both wild and ferile species in fields and fence rows.

Ginkgo biloba L. (maiden hair tree) - 1) 455 Lake Avenue - gone 2) Near the office of the Ellwanger and Barry Nursery, 668 Mt. Hope Avenue 3) a third speciman at 695 Mt. Hope Avenue must have been present at that time 4) Winton Road near the bridge over the Barge Canal - gone. This species continues to be planted in Rochester and vicinity.

Added, 1977: 1) 668 Mt. Hope Avenue, east side, - 40 yards east of driveway circle 13'0" × 60' × 55' 2) 28 Prince Street, east side 11'0" × 90' × 50' 3) 1496 Clover Street, east side 9'4" × 95' × 40'.

Gymnocladus dioica (L.) K. Koch (Kentucky coffee tree) - In 1917, 1) 344 West Avenue, 2) at Culver Road and Bay Street, 3) 174 South Goodman and at the Homeopathic (now Genesee) Hospital on Alexander Street. In 1977, The first is now the parking lot of the Ritter Company. In 1917, 4' × 40'; in 1977, 8'0" × 50' × 30'. The Kentucky coffee tree is now found in plantings both in local parks and in yards throughout the region.

Added, 1977: *Gymnocladus dioica* - 1) 930 East Avenue, north side 10'4" × 95' × 60' 2) southwest corner of Westfall Road and Winton Road 9'4" × 60' × 40' 3)southwest corner - Goodman Street and Highland Avenue 9'0" × 65' × 60'.

Juglans regia L. (English walnut) - South side of Ridge Road in Greece - gone. A walnut orchard described on the L. S. Thompson Farm in East Avon was killed in the severe winter of 1933-34. Louis Thompson, grandson of L. S. Thompson, credits him with developing several named cultivars of the species. *J. regia* is now fairly common in the Rochester region.

Libocedrus decurrens Torr. (incense cedar) - Winton Road and the canal bridge - gone.

Added, 1977: *Libocedrus decurrens* - Highland Park, ESE of corner of Goodman and Highland Streets 2′4″ × 30′ × 10′.

Lirodendron tulipifera L. (tulip tree or yellow poplar) - 5 Livingston Park - gone. In 1977 the site was occupied by the skating rink of the Rochester Institute of Technology. Tulip trees are common in suitable natural sites in the region, and several have been planted as ornamentals.

Maclura pomifera (Raf.) Schneid. (Osage orange) - Corner of Culver Road and Merchants Road - gone. Osage orange is still uncommon, but a number of plantings can be found throughout the region.

Magnolia accuminata L. (cucumber tree) - 455 Lake Avenue and 344 West Avenue - both gone.

The cucumber tree is occasionally found in parks and residental plantings in Rochester, and it is occasionally found native in southwestern New York; specimens have been observed in Orleans County (J. W. Kelly), and in Steuben County (R. J. Cook and H. S. Forest).

Added, 1977: *Magnolia acuminata* Museum and Science Center - East Avenue 11′4″ × 50′ × 80′.

Magnolia macrophylla Michx. (big leafed magnolia) - Ellwanger and Barry Nursery. A specimen 35 yards NE of NE corner of "Patrick Barry House," 692 Mt. Hope Avenue. In 1917, 4′; in 1977, 6′4″ × 35′ × 50′. This species is rare in Rochester.

Saucer magnolias - Center mall of Oxford Street. In 1977, most trees at the site are small. However, a few of the largest may be survivors. The species indicated was probably *M. soulangeana* Soul. (saucer magnolia) which is commonly planted in the region (editor's note).

Paulownia tomentosa (Thunb.) Steud. (princess tree) - Several sites, but only one was specific, 66 James Street (now Midtown Plaza) - gone. Though hardy in Rochester, the species is rarely planted.

Added, 1977: *Paulownia tomentosa (f. imperialis)* - Highland Park (2) southeast of intersection of Goodman Street and Highland Avenue. One is 35 yards from corner - 5′5″ × 35′ × 20′. The second is 50 yards south of the first - 5′2″ × 35′ × 30′.

Picea abies (L.) Karst. (Norway spruce) - Specimen at Winton Road and the Barge Canal bridge -gone.

The Norway spruce has been widely planted in the Rochester region, several specimens are now large.

Added, 1977: *Picea abies* - 1237 Clover Street west side, 12′9″ × 80′ × 60′.

Pinus ponderosa Dougl. (Ponderosa pine) - Two specimens at 668 Mt. Hope Avenue: 1) 12 yards WSW of the SW corner of the present office building. In 1917, 6′9″ and 5′8″; in 1977, the survivor measured 8′10″ x 75′ x 40′. 2) at 455 Lake Avenue, near the south line of present property. In 1917, 6′5″ x 55′; in 1977, 8′0″ x 65′ x 30′. This species, apparently well adapted to the Rochester region, has not been planted often.

Added, 1977: *Pinus ponderosa* - A mature tree grows in the backyard of 29 Wadsworth Street, Geneseo, New York.

Pinus wallichiana A. B. Jacks. (as *Pinus excelsa* Wallich) (Himalayan Pine) (Bhutan pine) - gone.

Added, 1977: 1) 625 Mt. Hope Avenue, west side the Ellwanger Home 8′1″ x 65′ x 30′ 2) Highland Park - entrance from Goodman Street, 140 yards on north side, one bole 6′3″ x 72′ x 30′; the other bole has been removed.

Populus nigra L. var *betulifolia.* (black poplar, birch leafed variety) - Rochester Trade School and Exposition Park (now Jefferson High School and Edgerton Park respectively) - gone.

Quercus cerris L. (turkey oak) - East side of the Rochester Trade School in Exposition Park (see above). In 1917, 5′ × 40′; in 1977, 9′11″ × 60′ × 65′. A hybrid of *Q. alba* (white oak) was described in Maplewood Park, but could not be found in 1977.

Added, 1977: *Quercus cerris* - 1) Riverside Cemetery - Section H, 10′0″ × 65′ × 30′ 2) 3774 Lake Avenue, east side 6′9″ × 70′ × 45′.

Sequoiadendron gigantea (Lindl.) Buchholtz. (big tree, giant redwood) - Five trees 668 Mt. Hope Avenue, a sixth on Winton Road - gone. According to Foreman (1930), the trees were cut down in 1925, having been damaged by unusually cold winter in 1917.

Sophora japonica L. (Japanese pagoda tree) - In 1917 at 88 University Avenue - gone. The tree is not common, but several young specimens have been planted along Rochester streets and in yards. In mid-August, its loose spikes of white flowers are quite showy and in fall, its long green fruits are conspicuous.

Added, 1977: *Sophora japonica* - 335 Yarmouth Road (Irondequoit) west side 7′0″ x 50′ x 55′.

Tilia petiolaris DC (pendant silver linden) - In 1917 at 7 Livingston Park - gone. The site was occupied by the Rochester Institute of Technology skating rink. Many European lindens have been planted in the region and the American linden or basswood (*T. americana* L.) is native to bottomland forests.

Added, 1977: *Tilia* - several species. *T. tomentosa* Moench. - 1) 566 East Avenue, north side (weeping) 11′5″ × 85′ × 65′ 2) Arnold-Goodman Street 1040 East Avenue, north side (weeping 11′5″ × 85′ × 65′ 3) Berkley-Buckingham Streets, 1127 East Avenue, south side (2) larger 12′6″ × 65′ × 55′.

Ulmus campestris L. (a synonym for *U. procera* Salisb.) (English elm) and *U. hollandica* var. *vegeta* Rehd. (Huntingston elm) were listed in 1917 - gone. *Ulmus procera* Salisb. f. *berardi* (Simon-Louis) Rehd. is the bushy form with upright slender branches. The remains of the Markham elm, an American elm (*U. americana* L.) were described by Mr. Dunbar on East River Road, about two miles east of Avon, but none remained in 1977. Gone too were the elm on Latta Road one mile west of Charlotte. However, many *U. americana* are still living in the region, in the wake of ravages by the Dutch Elm Disease.

Added, 1977: *Ulmus americana* - 1) 574 Allens Creek Road, north side 11′8″ × 95′ × 80′ 2) Irondequoit Country Club, north of entry drive from East Avenue in the bottom of an open swale 15′0″ × 90′ × 70′ 3) Genesee Valley Park - in middle of playing field, south of Barge Canal 11′11″ × 90′ × 80′ 4) Crittenden Boulevard - west of Helen Wood Hall 10′0″ × 60′ × 50′ 5) 1446 Creek Street in Penfield, east side 11′8″ × 70′ × 80′ 6) 2540 Highland Avenue, north side 14′3″ × 70′ × 90′.

Added, 1977: *Ulmus hollandica* Mill. is the elm from which the Dutch elm disease gets its name - 1) Cutler Union on University Avenue (2) 8′5″ × 50′ × 50′ (NE), 8′8″ × 85′ × 40′ (SE) 2) 65 Arbordale Avenue, west side 8′10″ × 60′ × 60′ 3) Crosman Terrace, lined by mature specimens of U. *hollandica* f. *major* (Sm.) Rehd. (26) ranging up to 10′3″ × 70′ × 70′ 4) Yarmouth Drive (10) ranging up to 9′2″ × 65′ × 60′. Located here is *U. carpinifolia* Gled. as well as *U. hollandica.*

ADDENDUM

Noteworthy trees added from street and yard plantings.

Abies lasiocarpa (Hook.) Nutt. var. *arizonica* (Merriam) Lemm. (Rocky Mountain fir) - 3581 St. Paul St. (Irondequoit).

Acer pseudoplatanus L. (sycamore leaved maple) - Barry Estate, Mt. Hope Avenue, Rochester, New York.

A. pseudoplatanus L. f. *variegatum* West (variegated sycamore leaved maple) - Goodman St., Incarnate Lutheran Church.

A. saccharinum L. (silver maple) - 1) 805 Exchange St. Rochester, New York 14′ × 85′ × 75′ 2) 1218 Genesee Street 13′ × 65′ × 50′.

Although the swamp maple (*A. freemanii* E. Murray) of this area is frequently misidentified as silver maple, *A. saccharinum* is not native to New York state. It is common in older plantings, however.

Cedrela sinensis Juss. (Chinese mahogany) - 80 Corwin Road.

Chamaecyparis pisifera (S. & Z.) Endl. (corrected identification, *Sawara* false cypress) - 57 Dorchester Road 3′9″ × 50′ × 15′ in 1977.

C. obtusa f. *gracilis* Rehd. (slender form) - 150 Dorchester Road 2′7″ × 25′ × 15′ in 1977.

Cornus florida f. *welchii* Bailey (variegated flowering dogwood) - 325 Beresford Road.

Evodia hupehensis Dode (Hupeh evodia) - 3591 St. Paul Street (Irondequoit).

Fagus sylvatica L. (This individual is copper beech, one of the many horticultural forms of the species, the European beech) - 1600 East Avenue 17′7″ × 90′ × 54′. There are other specimens on East Avenue which are only a little less magnificent.

Fraxinum americana L. (American or white ash) - 32 Genesee Park Blvd. 10′9″ × 85′ × 62′.

Ilex ciliospinosa Loes. (Central Chinese holly) - 81 Dorchester Road. 5′ high.

Magnolia denudata Derouss. (Yulan m.) (corrected identification) - 14 Gramercy Park on Dorchester Road. 30′ high.

M. tripetala L. (three petaled m.) 944 Allens Creek Road and 71 Dorchester Road. 3′ × 55′ × 35′.

Pinus cembra L. (Swiss stone pine, Russian form) - 275 Dorchester Road (2) 53′ and 55′ high.

Quercus alba L. (white oak) - 430 North Winton Road 11′9″ × 65′ × 50′.

Ulmus americana f. *ascendens* Slavin (Amerian elm, ascending form) extremely rare in cultivation - 2080 St. Paul Street 6′8″ × 50′ × 33′. This is the only known local specimen of this form which was found in Maplewood Park and named for its finder, Bernard Slavin of the Rochester Parks Department.

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FISHES IN THE BARGE CANAL AND TRIBUTARY WATERS OF CENTRAL AND WESTERN NEW YORK, 1979-80

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ABSTRACT

During 1979 and 1980 fishes were collected from the New York State Barge Canal west of Syracuse, the Oswego River Canal, the Seneca-Cayuga Canal and selected tributaries into the canal system with electroshocking techniques. Nearly 50 species were identified from these collections. Minnows (Cyprinidae) were best represented. Fifteen fish were designated as "major" canal species, with pumpkinseed (*Lepomis gibbosus* L.), smallmouth bass (*Micropterus dolomieui* Lac.) and yellow perch (*Perca flavescens* (Mitch.)) present at all canal sites on all sample dates. In addition, 42 Walleye (*Stizostedion vitreum vitreum* (Mitch.)) were tagged and recaptures indicated that species moved freely through the canal and Genesee River watersheds. These data, complemented with some available gill net data, provide a practical assessment of the canal system's present population and its potential for sports fishing.

INTRODUCTION

Rochester Gas and Electric Corporation (RG&E) has conducted impingement studies at the Beebee Power Station (BPS), located on the Genesee River in downtown Rochester, New York, since 1976 (RG&E, 1982). These studies indicated an annual autumnal, downstream migration of juvenile gizzard shad and, during certain years, also alewife and rainbow smelt.

In an attempt to understand further the upstream fish populations, RG&E conducted investigations during 1976 thorugh 1978 in the Genesee River watershed. These investigations were expanded during 1979 and 1980 to include all major inflows into this area from Lockport, New York, eastward to Brewerton (Fig. 1). This report presents the results of the last two years of the program, 1979 and 1980.

METHODS

Nine areas were sampled in 1979. The Rochester sampling included Locks 32 and 33 of the Erie Section of the N.Y.S. Barge Canal, as well as some sites near the junction of the Genesee River and the Canal. Between Brewerton and Three Rivers area, where the Seneca, Oswego and Oneida Rivers meet, a number of sites were sampled along the Oneida River. Other locations are indicated in Figure 1. All sampling was conducted during the fall. The Owasco and Canandaigua outlets were sampled only twice and Lockport and Black Creek were sampled only once. Three to five samples were taken from the Oneida River, Oswego River, Seneca-Cayuga Canal, and near Rochester. The canal is drained in late fall, but samples were taken at Rochester and Lockport after draining, when water and entrapped fish remained in low areas. In 1980 only the Canal System proper was sampled.

A pulsed, D.C., electro-shocking unit was used to immobilize fish and specimens were retrieved by dip-netting, usually from a boat. During 1979, two lake outlets (Canandaigua, Owasco) were sampled using hand-held probes and collection by wading. Collected fish were placed in a holding tank prior to identification and release. Specimens were counted and sometimes measured for length prior to release. Nearly all fish were identified to species and counted at each location.

Acknowledgements

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RESULTS AND DISCUSSION

Representatives of 18 families and at least 49 species were collected (Table I.) Further details of this survey were reported in RG&E (1982a). The Minnow family (Cyprinidae) were represented by 15 species. Four other families, Catostomidae (Sucker), Ictaluridae (Catfish, Bullhead), Centrarchidae (Bass, Sunfish) and Percidae (Perch) were represented each by 4-6 species. The Rochester stations produced the greatest number of species, 30, followed by Oneida with 27. Except for the Seneca/Belgium station, all canal stations were highly diverse, with 22-30 species found at each location. The low species diversity at Seneca/Belgium is probably a data artifact, based on only two samplings. The species number in tributaries ranged from 6 to 15, with Canandaigua station the most diverse.

Species which appeared to be ubiquitous and constant throughout the NYS Canal System during the sampling period were designated as the 15 "major" species. This evaluation was not made for the tributaries. Table II presents the evaluation in terms of frequency of occurrence during both years. It is limited to fish present at greater than or equal to 50% of all canal stations sampled. Pumpkinseed, smallmouth bass and yellow perch were present at all locations on each sampling trip.

Tables III and IV compare species found in the tributaries sampled in 1979 with those found in the canal proper. The results indicate a degree of selectivity of certain species for the fast-flowing, clearer water of the tributaries rather than the slow-moving, more turbid waters of the canal. Seven species were found exclusively in the Canandaigua outlet and were absent from the canal proper (Table III). A review of the habit preferences reported for these species (Scott and Crossman, 1973) indicated that all seven prefer stream-type habitats, so their absence from the canal was expected. Table IV compares species found in both canal and stream habitats. A number of species, including the desirable pan fish (pumpkinseed, smallmouth bass, yellow perch, northern pike, rock bass, and largemouth bass) are found in both habitats. The greater diversity of species in the Owasco outlet probably reflects a more diverse habitat.

There have been few previous studies of fish populations in the NYS Barge Canal. The most recent investigations were made by groups from the State University College at Brockport (Ellis, *et al.* 1974-75 and Haines and Ellis, 1977)[1] In the Brockport studies the canal was sampled at a number of locations between Lockport to the west and Clyde to the east, with an additional station located at Waterloo on the Seneca/Cayuga Canal (Fig. 1). The Brockport studies reported 27 species, four of which were not collected in this survey. In this study 17 species were observed which were not reported earlier.

The additional species found in the RG&E survey are primarily smaller fish: seven species of minnows, brook silversides, darters, etc., while most species found only in the Brockport surveys are larger species: black bullhead, channel catfish, etc. This difference probably resulted from the different sampling methods. Experimental gill nets were the primary sampling apparatus used in the Brockport survey, while this study used electroshocking exclusively (Table V). The two techniques do not allow quantitative comparisons, but utilized together, they provide a fuller assessment of the species composition. Table VI compares major species found in previous and current studies, similar to the presentation in Table II for the RG&E results. The Brockport sampling found white sucker, redhorse sucker, goldfish and white perch frequently, whereas these species were much less frequent in the RG&E survey. Conversely, smallmouth bass and pumpkinseed were present in every RG&E survey sample, but in less than half the earlier samples.

Forty-two walleye were tagged and released: 13 in the Oneida River/Canal, nine at the Rochester locks and 20 at Lockport. Three released at Lockport were recaptured nearby and a fourth was found seven months later in the Genesee River near Mt. Morris. The mark-recapture program demonstrated a sizeable population of this desirable game fish in the Canal System, and indicated that they move between the canal and tributary waters.

[1] Further work has been done by K.M. Kucharski (1982).

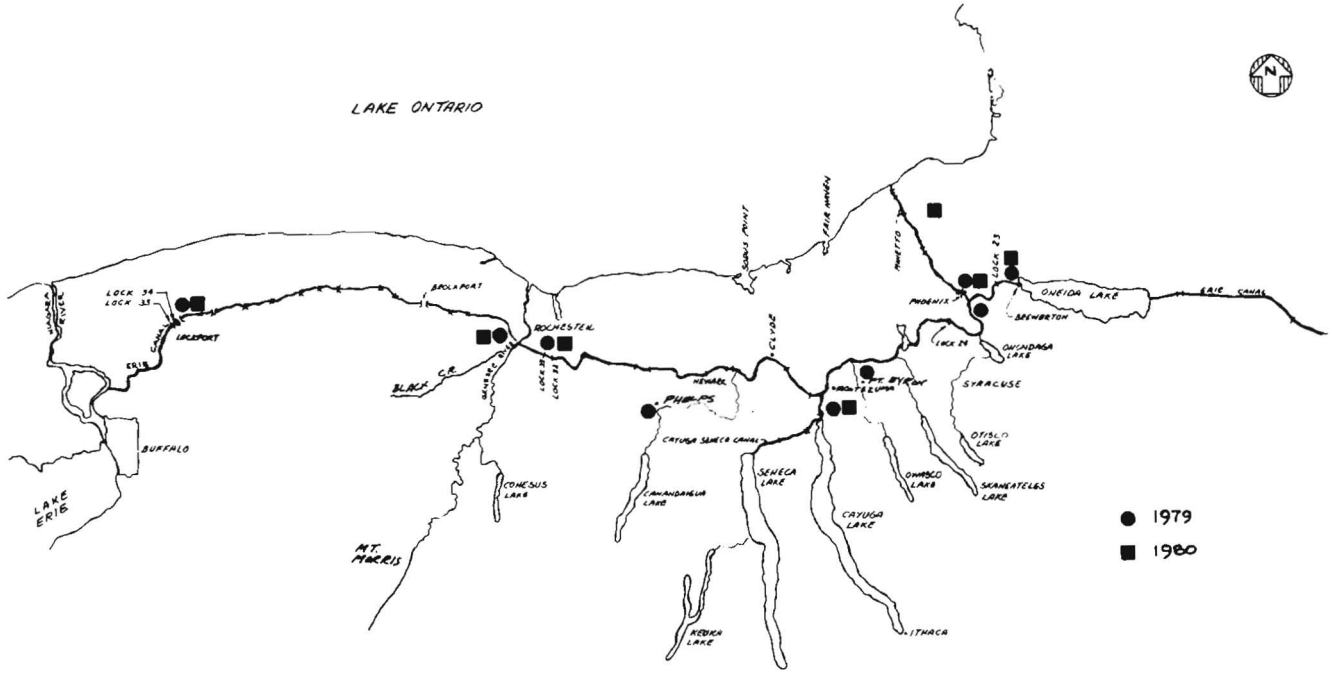

Figure 1 Sampling locations for fish, 1979 and 1980

Western portion of New York State

Canal System and adjacent tributaries

TABLE I

LIST OF SPECIES, LOCATION AND YEAR OF COLLECTION, NYS CANAL SYSTEM FISHERIES SURVEY

Family Species	CANAL STATIONS						TRIBUTARIES		
	One	Osw	S/B	S/C	Roc	Loc	Owa	Can	BCr
Petromyzontidae									
Sea lamprey Petromyzon marinus Linnaeus	O								
Amiidae									
Bowfin Amia calva Linnaeus	X								
Anguillidae									
American eel Anguilla rostrata (Lesueur)		X							
Clupeidae									
Alewife Alosa pseudoharengus (Wilson)	⊠	X		⊠	X	X			
Gizzard shad Dorosoma cepedianum (Lesueur)	⊠	X		⊠	⊠	X			X
Unidentified Clupeidae	O								
Salmonidae									
Unidentified Salmonidae						X			
Osmeridae									
Smelt Osmerus mordax (Mitchill)					X				
Esocidae									
Northern pike Esox lucius Linnaeus	X	O		⊠	⊠	⊠		O	
Chain pikerel Esox niger Lesueur				X					
Cyprinidae									
Stoneroller Campostoma anomalum (Rafinesque)				O			O		
Goldfish Carassius auratus (Linnaeus)					O				
Carp Cyprinus carpio Linnaeus	⊠	⊠	O	⊠	⊠	X	O		
Cutlips minnow Exoglossum maxillingua (Lesueur)								O	
River chub Nocomis micropogon (Cope)								O	
Golden shiner Notomigonus crysoleucas (Mitchill)	X	⊠		⊠	⊠	X			O
Emerald shiner Notropis atherinoides Rafinesque	⊠	⊠	O	X	⊠	X			X
Common shiner Notropis cornutus (Mitchill)				X	O	X		O	
Spottail shiner Notropis hudsonius (Clinton)					X	⊠			
Spotfin shiner Notropis spilopterus (Cope)				O			O		
Mimic shiner Notropis volucellus (Cope)				O	O				
Bluntnose minnow Pimephales notatus (Rafinesque)		X			X		O		

TABLE I (Continued)

Family Species	CANAL STATIONS						TRIBUTARIES		
	One	Osw	S/B	S/C	Roc	Loc	Owa	Can	BCr
Fathead minnow Pimephales promelas Rafinesque	O								
Dace Rhinichthys sp.								O	
Fallfish Semotilus corporalis (Mitchill)								O	
Unidentified Cyprinidae	⊠	O		O		O			
Catostomidae									
White sucker Catostomus commersoni (Lacepede)	O	O		O	⊠	⊠	O	O	
Northern hogsucker Hypentelium nigricans (Lesueur)								O	
Silver redhorse Moxostoma anisurum (Rafinesque)					O				
Shorthead redhorse Moxostoma macrolepidotum (Lesueur)					O				
Redhorse sucker Moxostoma sp.		X			⊠	⊠			
Ictaluridae									
Yellow bullhead Ictalurus natalis (Lesueur)	X							O	
Brown bullhead Ictalurus nebulosus (Lesueur)	⊠	X		⊠	O				
Stonecat Noturus flavus Rafinesque								O	
Margined madtom Noturus insignis (Richardson)	O					O			
Percopsidae									
Trout-perch Percopsis omiscomaycus (Walbaum)					O	O			O
Gadidae									
Burbot Lota lota (Linnaeus)	O								
Cyprinodontidae									
Killifish Fundulus sp.								O	
Atherinidae									
Brook silverside Labidesthes sicculus (Cope)	⊠	⊠	O	⊠	O	X	O		
Percichthyidae									
White perch Morone americana (Gmelin)	⊠	⊠		X		X			
White bass Morone chrysops (Rafinesque)	X	O			X	X			
Centrarchidae									
Rock bass Ambloplites rupestris (Rafinesque)	⊠	⊠		⊠	⊠	⊠	O	O	
Pumpkinseed Lepomis gibbosus (Linnaeus)	⊠	⊠	O	⊠	⊠	⊠	O		X
Bluegill Lepomis macrochirus Rafinesque	⊠	⊠		⊠					X

TABLE I (Continued)

Family / Species	CANAL STATIONS One	Osw	S/B	S/C	Roc	Loc	TRIBUTARIES Owa	Can	BCr
Smallmouth bass *Micropterus dolomieui* Lacepede	⊠	⊠	O	⊠	⊠	⊠	O	O	
Largemouth bass *Micropterus salmoides* (Lacepede)	X	⊠		⊠	X	⊠		O	
Black crappie *Pomoxis nigromaculatus* (Lesueur)	⊠	⊠		⊠	⊠	X			
Percidae									
Johnny darter *Etheostoma nigrum* Rafinesque		X			O	O	O	O	
Darter *Etheostoma* sp.								O	
Yellow perch *Perca flavescens* (Mitchill)	⊠	⊠	O	⊠	⊠	⊠	O		
Logperch *Percina caprodes* (Rafinesque)	X	⊠	O		O		O		
Walleye *Stizostedion vitreum vitreum* (Mitchill)	⊠				⊠	⊠			
Sciaenidae									
Freshwater Drum *Aplodinotus grunniens* Rafinesque	X	X			X				
Total No. of Species/Location	27	24	7	22	30	24	12	15	6

Key to Stations:
One - Oneida
Osw - Oswego
S/B - Seneca Belgium
S/C - Seneca Cayuga
Roc - Rochester
Loc - Lockport
Owa - Owasco
Can - Canandaigua
BCr - Black Creek

Key to Years:
O - Present in 1979
X - Present in 1980
⊠ - Present both years

Table II Major Species in NYS Canal System

Presence at ≥ 50% of all Stations 1979 (6 samples) and 1980 (5 samples).

1979	1980	Species	1979	1980	Species
100	100	Pumpkinseed Smallmouth Bass Yellow Perch	50	100	Gizzard Shad Golden Shiner Largemouth Bass
83	100	Rock Bass	67	80	Northern Pike Brook Silverside
83	80	Carp	50	60	Brown Bullhead Bluegill Walleye
67	100	Emerald Shiner Black Crappie			

Table III Species Found Exclusively in Canandaigua Outlet

Cutlips Minnow
River Chub
Fallfish
Northern Hogsucker
Stonecat
Dace
Killifish

Table IV Species Common to Owasco (O) and/or Canandaigua (C) Outlets and NYS Canal System

	Outlet	Number of Canal Locations
Brook Silverside	O	6
Pumpkinseed	O	6
Smallmouth Bass	O, C	6
Yellow Perch	O	6
Northern Pike	C	5
Carp	O	5
White Sucker	O, C	5
Rock Bass	O, C	5
Largemouth Bass	C	5
Logperch	O	4
Common Shiner	C	3
Johnny Darter	O, C	3
Bluntnose Minnow	O	2
Stoneroller	O	1
Spotfin Shiner	O	1
Yellow Bullhead	C	1

Table V Fish Species Limited to Previous or 1979-80 Surveys of Canal System

Brockport Surveys	1979-80 RG&E Survey	
Quillback	Sea Lamprey	Mimic Shiner
Northern Hogsucker	Alewife	Bluntnose Minnow
Black Bullhead	Salmonid	Fathead Minnow
Channel Catfish	Smelt	Margined Madtom
	Stoneroller	Trout-perch
	Emerald Shiner	Burbot
	Spottail Shiner	Brook Silverside
	Spotfin Shiner	Johnny Darter
		Logperch

Table VI Major Canal Species (presence $\geq$ 50% locations)

Brockport Studies	RG&E Survey
Carp	Carp
White Sucker	-
Silver Redhorse Sucker	-
Brown Bullhead	Brown Bullhead
Goldfish	-
Rock Bass	Rock Bass
Yellow Perch	Yellow Perch
Walleye	Walleye
Northern Pike	Northern Pike
White Perch	-
Black Crappie	Black Crappie
Gizzard Shad	Gizzard Shad
Channel Catfish	-
-	Smallmouth Bass
-	Pumpkinseed
-	Emerald Shiner
-	Brook Silverside
-	Golden Shiner
-	Bluegill
-	Largemouth Bass

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TREMATODE PARASITES OF THE FISHES OF McCARGO LAKE, ORLEANS COUNTY, NEW YORK

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ABSTRACT

Fish from McCargo Lake, Orleans County, New York, were collected during a four-month period, October-January, 1976-1977, and examined for their internal and external trematode parasites. A total of 72 fish, representing 10 different species, were examined. Monogenetic and digenetic flukes were found in eight species and two or more fluke species were commonly found in or on a single fish. Approximately 1/4 of the fish had three different trematodes, while 40% had four species. The highest infection was by *Clinostomum marginatum* (Rud.) which occurred in seven of the eight fish species; it was especially frequent in Yellow Perch (*Perca flavescens* (Mitchill)). The monogenetic fluke, *Cleidodiscus* (Muel.) was present in 50% of the fish harboring parasites. All specimens of the Pumpkinseed (*Lepomis gibbosus* (L.)) and Bluegill (*L. macrochirus* Raf.) were infected. *Posthodiplostomum minimum centrarchi* (MacCallum) was found only in the Centrachidae. Pumpkinseeds were heavily infested, averaging more than 80 metacercaria per individual. Approximately 90% of the Black Crappie (*Pomoxis nigromaculatus* (Lesueur)) and 3/4 of the Bluegills were parasitized by this species. *Uvulifer ambloplitis* (Hughes) infestations were heaviest in Northern Pike (*Esox lucius* L.); 80% were parasitized.

INTRODUCTION

Studies of incidence and types of fish parasites in different ecosystems have been of keen interest to specialists in parasitology, fishery biology and aquatic ecology. The findings are of interest not only to professionals but also to fish farmers or culturists. Techniques for identification of parasitic pests are invaluable to both.

This study determined occurrence and identification of the trematode parasites of the fishes of McCargo Lake (Fancher, New York). The biota of this lake has been studied by faculty and students of the Biology Department, State University of New York, College at Brockport. Of collateral importance are the theses and publications of Fortuna (1971) on the algal community; Horst (1971) on the snail populations. Also of interest are Horst and Costa (1975); Brian (1969) on the Cladoceran component of the zooplankton community; and Post (1971) on the periphyton algal community. The chemical-physical properties of the lake are documented in the thesis of Micchia (1971). Such background data is necessary for evaluating the incidence of parasitism in relation to biotic and abiotic factors. The present report, however, treats only the incidence of parasitism in sampled fish.

METHODS AND MATERIALS

Fish were collected with a standard hoop net, anchored near the shore areas, at a depth of approximately 2.5 meters. Eight collection sites were located in the southwest, west, and northern portions of the lake, totaling 125 meters of shore. The collecting nets remained at each site for two weeks and were checked four times.

The collected fishes were placed in plastic containers with lake water, and the temperature was controlled to vary no more than five degrees Celsius in 24 hours. This procedure aimed to maintain the parasite population, particularly the monogenetic trematodes.

Procedure used for the isolation of parasites followed that Amlacher (1970). Fish were immobilized by severing the spinal cord at a point immediately anterior to the nape region, maintaining the fish alive and in fresh condition. Consequently, examination need not be hasty, and traumatic for the fish.

Gross examination of the fish integument was made with a 10X hand lens with the axillae and bases of the fins receiving particular attention. Skin smears were made by scraping the body with a spatula, moving cephalocaudally across the operculum, trunk and tail, and examined under the scanning lens of a compound microscope. Fins were then removed, including a portion of the fin bases, and examined under a dissecting microscope. The gills were excised and placed in a petri dish with water and examined

for monogenetic trematodes under the dissecting microscope. Infested gills were placed in a plastic bag with a small amount of water and frozen for two hours. This procedure relaxed the hold of ectoparasites.

The viscera were removed from the specimen and an incision made along the midline from the anus to the base of the oral cavity, followed by lateral and opercular incisions. Care was exercised to maintain the intra-abdominal point of the scissors close to the body wall, cutting as it were with the outer blade of the instrument. Individual organs were isolated and each placed in a separate petri dish. Ringer's solution was used to maintain the osmotic balance of the internal parasites to avoid distortion. The individual organs were then examined under a dissecting microscope. Tissues were teased with straight and bent fine sewing needles instead of the standard size.

The gastro-intestinal tract, in most cases, was divided into several sections which were then incised longitudinally and flattened. Trematodes from each organ were removed to a separate dish of Ringer's solution.

All muscles were examined for encysted cercaria by making a longitudinal incision immediately lateral to the dorsal pterygiophores.

Whole mounts were made using a slight modification of the method of Cable (1969) using Semichon's carmine stain.

Table I - Results. Presence, incidence and site of parasitism of the flukes found in the fishes of McCargo Lake. Arrangement of the host fish is alphabetical by family, genus, and species.

Catastomidae-Sucker Family:	**Number**	**Length**	
White sucker *Catostomus commersoni* (Lacepede)	1	445 mm	no parasites
Black redhorse *Moxostoma duquesnei* (Lesueur)	2	430 mm	no parasites
Centrarchidae-Sunfish Family:			
Pumpkinseed *Lepomis gibbosus* (L.) Trematodes present: *Cleidodiscus megalonchus* (Muell.) Mizl. & Hugh. - Monogenetic, on gill filaments; incidence 100%. *Clinostomum marginatum* (Rud). - Digenetic, encysted in muscle tissue; incidence 7 of 15 fish. *Posthodiplostomum minimum centrarchi* (MacCallum) Dubois - Digenetic, encysted on heart and in liver, spleen and kidney; incidence 100%. Neascus of *Uvulifer ambloplitis* (Hughes) - Digenetic, restricted to black cysts on integument; incidence 5 of 15 fish.	15	104-147 mm	
Bluegill *Lepomis macrochirus* (Raf.) Trematodes present: *Cleidodiscus* sp. - monogenetic, on gill filaments; incidence 100% Neascus of *Uvulifer ambloplitis* (Hughes) - Digenetic, restricted to black cysts on integument; incidence 20%. *Posthodiplostomum minimum centrarchi* (MacCallum) Dubois - Digenetic, encysted on heart, in liver, spleen and kidney, incidence 11 of 15 fish.	15	97-152 mm	

	Number	Length
Largemouth bass *Micropterus salmoides* (Lacepede) Trematodes present: *Cleidodiscus* sp. - Monogenetic, on gill filaments; incidence 100%. *Clinostomum marginatum* (Rud.) - Digenetic, encysted in muscle tissue; incidence 100%.	1	299 mm
Black crappie *Pomoxis nigromaculatus* (Lesueur) Trematodes present: *Clinostomum marginatum* (Rud.) - Digenetic, encysted in muscle tissue; frequent between pterygiophores; incidence 100% Neascus of *Uvulifer ambloplitis* (Hughes) - Digenetic, restricted to black cysts on integument; incidence 100%	9	192-229 mm
Esocidae-Pike Family:		
Northern pike *Esox lucius* L. Trematodes present: *Cleidodiscus* sp. - Monogenetic, on gill filaments; incidence 90%. *Clinostomum marginatum* (Rud.) - Digenetic, in muscle tissue; incidence 20%. Neascus of *Uvulifer ambloplitis* (Hughes) - Digenetic, in black cysts on integument; incidence 80%.	10	395-807 mm
Ictaluridae-Catfish Family:		
Brown bullhead *Ictalurus nebulosus* (Lesueur) Trematodes present: *Clinostomum marginatum* (Rud.) - Digenetic, encysted in muscle tissue; incidence 7 of 8 fish.	8	217-258 mm
Percidae-Perch Family:		
Yellow perch *Perca flavescens* (Mitchill) Trematodes present: *Clinostomum marginatum* (Rud.) - Digenetic, encysted in muscle tissue; incidence 100%. Neascus of *Uvulifer ambloplitie* (Hughes) -Digenetic, restricted to black cysts on integument; incidence 40%.	10	272-307 mm

Table II. - Occurrence of parasites in species of fish, McCargo Lake, Orleans County, New York, 1976-1977.

Parasite key:
1. *Cleidodiscus megalonchus*
2. *Clinostomum marginatum*
3. *Posthodiplostomum m. centrarchi*
4. Neascus of *Uvulifer amploplitis*
5. *P. minimum*

Centrarchidae-Sunfish Family	**1**	**2**	**3**	**4**	**5**
Pumpkinseed *Lepomis gibbosus* (Muell.)	X	X	X	X	
Bluegill *L. macrochirus* Raf.	X		X	X	
Largemouth bass *Micropterus salmoides* (Lacepede)	X	X			
Black crappie *Pomoxis nigromaculatus* (Lesueur)		X			X
Rock bass *Amblopites rupestris* (Raf.)		X		X	
Esocidae-Pike Family					
Northern pike *Esox lucius* L.	X	X		X	
Ictaluridae-Catfish Family					
Brown bullhead *Ictalurus nebulosus* (Lesueur)		X			
Percidae-Perch Family					
Yellow perch *Perca flavescens* (Mitchell)		X		X	

SUMMARY AND ADDITIONAL OBSERVATIONS

The incidence of trematodes in the fishes of McCargo Lake (New York) appeared to be quite high. *Clinostomum marginatum* (Rud.) was observed in the largest number of parasitized fish species, 7 of the 8. The cysts were generally conspicuous (up to 3 mm. in diameter) and were frequently found between rays of the fin bases. All of the Perch were infected, 78% of the Black Crappie, and 88% of the Brown Bullheads.

Clinostomum marginatum was found in 7 of 8 fish species. Of 54 fish in 7 species, 65% were infested with *Clinostomum*; it parasitized 40 fish in four fish species.

Cleidodiscus sp. was found in 50% of the fish species harboring parasites. In two species of fish (Pumpkinseed and Bluegill) every specimen examined were parasitized by *Cleidodiscus*. Ninety percent of the Northern Pike were infested. Very heavy *Cleidodiscus* infestations were noted for *Esox lucius* which bore an average of 32 individuals per gill arch. These parasites were in constant motion while feeding and conspicuous. *Cleidodiscus megalonchus* were observed only in *Lepomis gibbosus*. Infestations were light, averaging seven individuals per arch.

Postbodiplostomum minimum was found only in the centrarchids of Lake McCargo. Cysts were readily observable on the heart and other organs. The Pumpkinseed bore the heaviest burden of these parasites with an average of 86 metacercaria per individual. One individual had 87 cysts on the heart alone. The incidence of *Postbodiplostomum* in the Pumpkinseed was 100 %. Approximately 75% of the Bluegills and 90% of the Black Crappie were infected.

Uvulifer ambloplitis was present in 5 of 8 fish species, occurring in 41% of 51 fish examined. The heaviest infestations were in Northern Pike where 80% of the fish were parasitized, particularly younger pike. The average for all the pike was 85 cysts per individual, while one individual bore 270 cysts in its integument.

Although the study primarily involved the trematode parasites, some observations were made on other parasites. Cestodes were conspicuous. Very heavy infections by tapeworms were noted in Northern Pike. One young specimen harbored 486 tapeworms, with average length of 34 cm. Nematode parasites were also common, especially in the lower intestinal tract. About 80% of all fish examined were infested.

More than 50% of the fish species that were parasitized had at least two species of flukes present. Approximately 25% had three trematode species while 40% had four species. Multiple parasitism was especially evident for the Bluegill, Northern Pike and Pumpkinseed.

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STUDIES IN THE GASTROPODS OF CONESUS LAKE, LIVINGSTON COUNTY, NEW YORK

II. Identification, Occurrence and Ecology of Species

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ABSTRACT

Gastropods were collected from Conesus Lake, Livingston County, New York, from 1971 to 1980, during all seasons. Fourteen species, belonging to 11 genera and seven families were identified. All studies have now reported a total of 22 species. The distribution of species has been discussed both geographically, and in terms of spacial and seasonal appearance in Conesus Lake. Critical characters for identification have been selected from both field and laboratory observations, and the abundance of species compared. The most common snail was *Viviparus georgianus* (Lea). The Viviparidae, *V. georgianus* (Lea) and *Campeloma decisa* (Say), made up over half the number of individuals collected during the study.

BACKGROUND OF THIS REPORT

Gastropods were collected from Conesus Lake, Livingston County, New York, from 1971 to 1980. The identification of 14 species (four tentatively) was reported earlier with some observations on relative abundance of species (Wade and Vasey, 1976). Some data was also incorporated into the monograph on Conesus Lake (Forest, Wade and Maxwell, 1978). The studies were broadened to include; assembly of an extensive bibliography of related gastropod literature; discussion of evolution; history of studies; distribution in North America; environmental information; morphology of *Viviparus georgianus* (Lea); detailed discussions of seven families, Pleuroceridae, Planorbidae, Physidae, Valvatidae, Hydrobidae, Ancylidae and Lymnaelidae; and reproductive systems and embryology and comparative study of radulae of selected species.

Observations were also recorded of a wide variety of other organisms (algae and invertebrates) which shared the lake community with the gastropods. The full report was prepared in 1980 and is available from the Milne Library of the State University College at Geneseo, New York (Wade, 1980). The 1980 report is illustrated with photographs and drawings, and includes six tables of data. The present report is limited to distribution, identification and occurrence of the gastropod species. It is based on the full report. (Table I).

REVIEW

Regional studies of gastropods begin with John Walton's report on the "Mollusca of Monroe County, New York" (Walton, 1891). Walton studied mollusca in and around Rochester, crediting G. W. Binney (1865) and J. E. DeKay (1843) in his report along with his own collections and drawings which included 135 species of snails (30 genera, 14 families). Baker (1920) summarized the effects of the Genesee River pollution on river fauna. His report was the result of 27 years of careful monitoring. In 1892 nine species of gastropods were found, but by 1910 the river was completely devoid of snail life. However, in 1919, after the installation of the treatment plant which diverted most of the city's sewage, six species of snails were found.

Maury (1916) reported only six snail species for Conesus Lake in her survey of central and western New York. Robertson and Blakeslee (1948) in their broadly sweeping survey of the "Niagara Frontier" region, recorded collecting nine species of snail from the Conesus Lake inlet and the west side of the lake at Long Point. Blakeslee's extensive collection was later donated to the Rochester Museum and Science Center. Nine Conesus Lake snails were included in Walker's (1975) invertebrate survey. His list and that of this investigator are combined in the Conesus Lake monograph (Forest, Wade and Maxwell, 1978).

A generalized geographic distribution for the snail species found in Conesus Lake is adapted from Harman and Berg (1971): *Physa gyrina, Lymnaea* sp., *Gyraulus parvus, Viviparus georgianus, Promenetus exacuous* and *Valvata tricarinata* are found throughout central and northeastern United

States, while *Physa integra* appears more centrally located; *Helisoma trivolvis, H. campanulata, Laevapex* sp., *Campeloma decisa, Pleurocera acuta, Goniobasis livescens* and *Amnicola lacustrica* are more common on the eastern part of the United States but is found as well as in the central areas. Table II assembles identifications of these studies.

IDENTIFICATION AND ECOLOGY

PLEUROCERIDAE

Two species of this family were collected in Conesus Lake, *Goniobasis livescens* (Menke) and *Pleurocera acuta* Raf. Maury (1916) listed *Elimia virginica* Say and *Goniobasis livescens* while Harman and Berg (1971) reported four species of Pleurocerids in Central New York State. This family is one of the most common present in all parts of the country except in the Rocky Mountains (Pennak, 1953). The Pleuroceridae is the only one among the 18 snail families of North America to be indigenous to this continent (Ward and Whipple, 1918).

In our five-year study, this family averaged 33% of all collections. The largest number were found clinging to the underwater roots of an old tree growing in the outlet where the water runs rapidly out of the lake into Conesus Creek. They were also picked from a mid-lake breakwater where the wave motion was also turbulent, constant and occasionally quite strong. None were found in the south (inlet) end of the lake where bulldozing had spread tree limbs, soil and debris in the water. On one occasion, we found them on the uprights of a boat hoist in the water just before the ice formed on the lake in December. After the severe storm of June 1972 (Hurricane Agnes), the Pleuroceridae were found in much greater numbers than any others - possibly due to their very strong foot which clings tenaciously to a substrate - while other species were swept away in the tossing waves.

Goniobasis livescens. While it is difficult to distinguish between the two members of this family, this species is not as narrow in the spire (20 mm h × 9 mm w) as the *Pleurocera acuta* and the aperture is rounded, not markedly canaliculate. The juveniles present short, squatty carinate shells easily mistaken for a different species.

The shells of *G. livescens* and *P. acuta* are dull green-brown with brightly colored body of orange and black. The long, slender tentacles, constantly waving in front of the large black-striped rostrum, are also of the same vivid colors. One of the outstanding characteristics is a small, round foot, protected by an operculum, and possessing great muscular strength.

We observed that when the sole of the foot was touched, it was quickly retracted, in contrast to the operculum which showed no reaction. When there was light or movement nearby, the aperture opened wider, then the operculum moved back and the foot was extended. We also noted that this snail has a strange way of lying on its back on the bottom of the isolation cup. The foot becomes cup-shaped on closing and the organism can turn its snout around enabling it to eat encrusted algae off its shell and operculum. This is truly one of the most beautiful and interesting snails in the lake.

Pleurocera acuta. Distribution of this species is much like that of *G. livescens,* but it was much less common representing less than a tenth of the numbers collected. The shell (15 mm h × 5 mm w) appears much smaller than those reported by other authors. A narrowly channeled aperture is a distinguishing characteristic. The tear-shaped operculum seems small in comparison to the size of the shell.

PLANORBIDAE

Certain members of this family are intermediate hosts for the trematode (fluke), *Schistosoma mansoni* Weinland (Chandler and Clark, 1961). Schistosomes have not been reported from Conesus Lake. Baker (1920) noted that *Planorbis trivolvis (Helisoma trivolvis)* were present in the Genesee River in 1892 and again in 1919 having been absent in the interim due to heavy pollution in the river.

The habitat extends from eastern United States to the central states and into parts of Canada (Baker 1928a). Harman and Berg (1971) reported the family common in all aquatic habitats in central New York. Maury (1916) reported two species of this family in Conesus Lake. Planorbids made up only 6% of the snails collected during her study, being more prevalent in the north and northwest shallow, weedy shores of the lake. Curiously, in 1972, more were found in the inlet and south end of the lake in comparison to other years.

Helisoma campanulata (Say). The species made up 2% of snails collected in our study. It is small (10.0 mm w × 5.0 mm h) and lacks the flat platform umbilicus of the *H. trivolvis.* The round whorls (ramshorn) are hooded near the aperture with ridges that resemble thread wound about a spool.

H. trivolvis (Say). Large black specimens were collected in the murky, debris-ladened water, as well as on submersed plants, near the lake inlet at the time when the natural habitat was being destroyed by development. *H. trivolvis* has no distinct hood, but the flat umbilicus and rounded whorls are easily recognized. Its size varied greatly in our collection but averaged approximately 7-12 mm w(diameter) × 6.0 mm h.

It is interesting to note that one specimen contained fork-tailed cercaria which resembled *Schistosoma mansoni*. Further investigation is indicated.

Gyraulus parvus (Say). Few specimens were collected, although Harman and Berg (1971) considered them common in the Susquehanna and Oswego River watersheds of Central New York. It is a surface feeder, characterized by a large air bubble under the thin discoid shell. A long black neck and snout with a black nerve extending the length of the tentacle were distinguishing marks of this species. This very small (4.0 mm w × 1.0 mm h) snail was found only in the last days of collecting.

Promenetus exacuous (Say). The range of this snail is east of the Rockies and Harman and Berg (1971) reported it from the Oswego watershed in central New York. A single specimen was found on a dead log, on the northwest shore of Conesus Lake.

This is a tiny (3.0 mm w × 1.5 mm h) very flat discoid snail with long thin tentacles, lappets on the back of the eye stalk,a small foot and an orange, transparent body. The full carina on the outer edge of the shell sets it apart from other members of this family. Viscera can be observed through the thin shell.

HYDROBIIDAE

The distribution of members of the family was recorded by Baker (1928a) to extend from New York State to Minnesota and Ohio to southern Ontario. We discovered it late in the study - it appeared in quantity in our last collections. Harman and Berg (1971) noted that it was seen in large rivers and small lakes but not in the Finger Lakes. Baker (1945) reported it from two sites in Monroe County. The report of *Amnicola limosa* (Say) in Wade and Vasey (1976) and Forest, Wade and Maxwell (1978) should be altered to *A. lacustrica* Pilsbry.

Most careful inspection of shallow water vegetation was required before the snails were found floating and attached to larger algae encrusted shells of other snails and to stems and leaves. It may well be that this is one of the most common small snails in Conesus Lake.

The globose shell (approx. 2 mm h x 1.5 mm w) is thin, smooth, and uniformly horncolored, exhibiting the black viscera in a chain of spots through the shell. A paucispiral operculum closes the round or slightly canaliculate aperture.

PHYSIDAE

This family is well represented in Conesus Lake. Harman and Berg (1971) also reported it as common in the Oswego and Susquehanna watersheds of central New York. Averaging 7% of the total snails collected, it was found in almost every site during our investigation, predominantly from both the inlet and outlet of the lake.

Physa gyrina Say. This species occurs from the Gulf of Mexico to Arctic North America, and it has been reported from Conesus itself and adjoining Hemlock Lake and from streams near Caledonia in northwestern Livingston County (Robertson and Blakeslee, 1948). A very thin light-colored shell (17 mm h x 11 mm w) covers the yellow and black body which glistens like gold out of the water. An air bubble can be seen through the thin shell. A distinct white stripe is evident on the shell and a heavy callus is prominent on the inner lip of the aperture. Like other members of this family, *P. gyrina* can be seen floating at the water surface, where it forages on algae and macrophytes.

Physa integra Haldeman. Its distribution and frequency are similar to those of *P. gyrina*. The spire of this species is narrower and the shell smaller (4 mm h x 2 mm w); the aperture callus is heavy and laid back on the body whorl. Fine growth lines can be seen between shouldered whorls. The lack of a white stripe on the spire also helps identify this species. The narrow extended foot has been observed hooked to the left. Although *Physa* is an aquatic genus, collected individuals frequently moved some distance from water in the laboratory.

VALVATIDAE

Members of this family are found northward to the Arctic from Virginia and the Ohio River and westward to Iowa (Baker 1928a). They have been reported from Erie, Genesee, Monroe, Niagara and Ontario Counties of western New York (Baker, 1928a; Baker, 1945). Harman and Berg (1971) reported four species of this one-genus family. Only one species was collected during our investigation.

Valvata tricarinata (Say). This tiny snail (2 mm h × 3 mm w approximately) was not immediately observed in our investigation. The three prominent carina on flat whorls are distinctive of this species. The foot has frontal lobes, apparent when viewed from above. These lobes grasp aquatic plants like mittened hands as the animal makes its way among the stems. A multispiral operculum fits tightly into the notched aperture when the foot is withdrawn. Not only is this the only freshwater hermaphroditic snail (Hyman 1968), but, strangely enough, it possesses an external respiratory organ which, when extended, forms the appearance of a "white Christmas tree."

ANCYLIDAE

This family was reported from the Susquehanna and Oswego River watersheds (Harman and Berg, 1971) while Baker (1928a) noted the general distribution as eastern United States from Massachusetts to Louisiana. It is considered rare in Conesus Lake.

Laevapex fuscus (Adams). Only three empty shells were found (2.7 mm w × 5.5 mm h). The protoconch is present on the top of the patelliform shell nearer the posterior end. This limpet is shiny and somewhat smooth, and because of its small size it was overlooked until late in our investigation. Identification is tentative.

LYMNAEIDAE

Members of the family occur widely in eastern United States. Robertson and Blakeslee (1948) reported its distribution in New York State as did Harman and Berg (1971) and Baker 1911). Lymnaeids are fairly common throughout the northern United States, particularly in the northeast and middle west. Maury (1916) listed two species of *Lymnaea* in Conesus Lake, as did Robertson and Blakeslee (1948). The latter also reported two genera as present in a marl swamp near Caledonia in the northwestern part of Livingston County, the outlet of Hemlock Lake and near Wester's Crossing. Only one shell (5mm h × 3 mm w) was obtained during this investigation, tentatively identified as *Lymnae stagnalis* (L).

VIVIPARIDAE

The members of this world-wide family have been found throughout the middle west and eastern United States. In New York, it appears quite common as reported by Harman and Berg (1971) in central areas of the state. *Viviparus georgianus* (Lea) occurs more frequently than *Campeloma decisa* (Say) in this region. In Conesus Lake, our records show these two species making up 53% of all snails taken for a five-year period.

Campeloma decisa (Say). This species (35 mm h × 22 mm w) was found only in the southern marshy end of the lake, although empty shells were found on the western shore.

The mature adult is larger than the *V. georgianus* but is devoid of the brown bands of the *V. georgianus*. The shell is greenish brown with prominent growth lines. Its foot, viewed in an aquarium, appeared large and pink with black speckles. A wavy motion of the foot served as an effective shovel to burrow in the muddy bottom substrate. Harman and Berg (1971) reported it to be the only burrowing species among freshwater snails. Only 2% of the Viviparidae collected during our study were *Campeloma decisa*. This is much less frequent than indicated by other authors for the region.

Viviparus georgianus (Lea). This species is considered common throughout the eastern United States and it was abundant in all Conesus Lake sites. Harman and Berg (1971) found the species in all of the Finger Lakes except Canandaigua and Owasco Lakes. Large specimens were displayed at the Rochester Museum of Arts and Science, collected by Blakeslee (Robertson, Blakeslee and Blakeslee, 1948).

This large (approx. 20 mm h × 17 mm w), handsome snail is the most abundant of all species in Conesus Lake. In the fall, when the water level is low and white caps are whipped up by the winds, parallel furrows of *V. georgianus* shells are laid on the beaches by turbulent waves, particularly on the northwestern shores. From mid-May to the end of September, they congregate in the shallow waters among aquatic plants. Summer or winter, SCUBA divers find them numerous and active on the bottom. The population remains relatively high from year to year.

Table I. Distribution of snail families in terms of number and percent for the five-year study, Conesus Lake.

Period dated	Families				
	Viviparidae	**Pleuroceridae**	**Planorbidae**	**Physidae**	
9/19/71 to 10/31/71	174	101	26	20	(321)
	54.2%	31.4%	8.1%	6.2%	
6/21/72 to 8/20/72	92	97	15	15	(219)
	42.0%	44.4%	6.8%	6.8%	
6/19/73 to 12/8/73	283	112	22	22	(439)
	64.4%	25.5%	5.0%	5.0%	
5/27/74 to 2/16/75	148	85	8	34	(275)
	53.8%	30.9%	2.9%	12.3%	
5/18/75 to 9/22/75 and 11/1/75	40	75	7	17	(139)
	28.7%	54.0%	5.0%	12.2%	
Summary of years 1971-1975	737	470	78	108	(1,393)
	53%	33%	6%	7%	

Table II. Species of snails reported from Conesus Lake Livingston County, New York

	Maury (1916)	Robertson and Blakeslee	Walker (1975)	Wade (1978, 1980)
ANCYLIDAE				
Laevapex fuscus (Adams)			X	X
HYDROBIIDAE				
Amnicola lacustrica Pilsbry				X
A. limosa (Say)			X	X
LYMNAEIDAE				
Fossaria modicella Say	X	X		
Lymnaea sp.	X	X	X	X
L. catascopium Say		X		
L. Columella Say	X	X		
L. elodes var.				
L. umbrosa Say	X			
PHYSIDAE				
Physa elliptica Lea			X	
P. gyrina Say		X		X
P. integra Haldeman		X		X
P. sayii Tappan		X		
PLANORBIDAE				
Helisoma campanulata (Say)	X			X
H. trivolvis (Say)	X	X	X	X
Gyraulus parvus (Say)			X	X
Promenetus exacuous (Say)			X	X
PLEUROCERIDAE				
Elimia virginica Say	X			
Goniobasis livescens (Menke)		X	X	X
Pleurocera acuta Raf.				X
VALVATIDAE				
Valvata tricarinata (Say)			X	X
VIVIPARIDAE				
Campeloma decisa (Say)	X	X		X
Viviparus georgianus (Lea)		X	X	X

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STUDIES OF THE GASTROPODS OF CONESUS LAKE LIVINGSTON COUNTY, NEW YORK

III. Endozoic and Parasitic Organisms Obtained From Gastropods

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ABSTRACT

Organisms found in 81 individuals of *Vivaparus georgianus* (Lea) included cercaria, metacercaria, two ciliated protozoans, the annelid *Chaetogaster,* and Chironomid larve. An association between organism and host location is indicated, as well as specific associations of different organisms found in a single host.

INTRODUCTION

Cercariae were expected and found, but the presence of five other organisms within *Viviparus georgianus* was somewhat surprising.

Ciliated protozoans were first found in the gill, and later in the proximal and distal intestine. It is likely that they are common, but generally overlooked. One of these has been tentatively identified as a *Colpidium* and the other of the Family Anoplophyridae (both Protozoans). Between 20-30 specimens of the *Chaetogaster* (an Annelid) were obtained from ten snails, in and around the mantle cavity. In two snails, Chironomid (red midge) larvae were found crawling in the midviscera area. Cercariae and metacercariae were frequently present in the stomach-hepatic-pancreatic region, the gonads and oviduct (uterine brood chamber). Metacercariae were also found curled up on the operculum of developing embryos. Table I summarizes these findings.

Eighty-one individuals of *V. georgianus* were examined during the period Sept. 1 - Oct. 25, 1976. The methodology used has been described in the initial paper (Wade & Vasey, 1976).

Our observations indicate that certain associations may exist between organism and site. Midge larvae were found in the central visceral region; sporocysts and rediae, as well as cercariae were observed in the gonads, adjacent glands and ducts; metacercariae were present in the oviduct and were also observed on the mucous surface of organs and ducts in the central region. Ciliates were mostly confined to the intestinal areas. These associations were found in the same snail: both ciliates; *Chaetogaster,* sporocysts, cercariae; metacercariae and ciliates; and midge larvae, sporocysts and cercariae. Other associations were not found; we never found metacercariae and cercariae in the same snail, for example, however, metacercariae, *Chaetogaster* and ciliates did occur in one individual.

The size of the snail is apparently related to the depth of the habitat as well as to age; the greater the depth - the larger the snail; likewise, the older the snail - the larger the animal. Females are known to live at least two years longer than males (Hyman, 1967). The size of *Viviparus georgianus* ranged from 20 mm H × 6 mm W to 30 mm H × 25 mm W. No parasites were found in small snails.

Most of the parasites were observed in *Viviparus georgianus.* However, during 1972, 1973 and 1974, we encountered four cercariae from four other host snails. From the physid, we obtained a monostome type, having three eye spots, oral sucker and long smooth tail, similar to that described by Schell (1970). From the planorbid, an amphistome type possessing a "triangular head collar usually present around oral sucker" (Schell, 1970) with a tail of elaborate design; also from the planorbid, similar to Schell's Brevifurcate-pharyngeate-Clinostomatoid cercariae was isolated. This cercaria swam sideways and hung by the forked tail from the surface of the water and sides of the container before going into the vigorous swimming movements characteristic of free cercariae. The pleurocerid hosted a cercaria approximating Schell's pleurolophocercous type, the chief characteristic of which is a finned tail and two eye spots.

The snails were hand picked from lake weeds, brought to the laboratory and placed in isolation cups with plants and fresh water added every day. The snails were examined every 24 hours for cercariae, and if infected, these appeared in the water usually 24 to 48 hours after being isolated. The pattern of emergence differed greatly from individual to individual, but our findings showed that

emergence was greater during the first few days and then dwindled quite sharply. A snail might emit at 8 AM the first day or 5-6 PM and 4 PM second and third day, then intermittently on 8th, 18th, 19th and 23rd, 24th day. One *V. georgianus* collected 8/31/73 emitted on the first day and frequently during September and October, until 2/17/74 (died).

I dropped a piece of commercial fish-food on the nose of a rather sleepy snail and a swarm of cercariae issued up from under the anterior shell almost at once, while the snail chomped down on the fish-food. This action might be used to induce the freeing of cercariae to indicate infestation more quickly.

Table I. Organisms found in *Viviparus georgianus* collected from Conesus Lake, Livingston County, New York 9/1/76 - 10/25/76.

Parasite	Percent of Infestations	Descriptions and Locations
Chironimid larvae	11.7	Bright red body, worm like, easily seen in ducts and viscera.
Ciliate (*Colpidium* sp.)	17.6	Abundantly present in upper intestine and in length of intestine.
Ciliate (Family Anaplophryidae)	17.6	Astomate ciliate found with previous ciliate.
Chaetogaster (Oligochaete)	53.0	Common, active in mantle cavity, lung, other sites and water.
Metacercariae (Unencysted trematode larvae)	76.4	In pancreatic-hepatico region, gonads, ducts and other sites.
Cercariae (Xiphidiocercariae)	6.0	With sporocytes, in gonads and viscera, mantle cavity.

Table II. Summary of Cercariae emitted from Viviparidae, Planorbidae, Physidae and Pleurocidae.

Host Snail	Tentative Identification
Viviparidae #177 1972	Xipidiocercariae
Physidae #102 1974	Monostome
Planorbidae #165 1974	Amphistome
Planorbidae #146 1974	Brevifurcate pharyngeat-Clinostomatoid
Pleuroceridae #222 1973	Pleurolophocercous

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A SHORT COMMUNICATION[1]: THE MINERALOGICAL COMPOSITION OF SILURIAN PHOSPHATE FROM WESTERN NEW YORK

P. D. Boger and H. B. Sutphin

Although the occurence of thin, discontinuous phosphate beds in the Silurian age Clinton Group of western New York has been reported by several authors, the available literature makes no reference to a specific mineralogical analysis of the phosphate-bearing material. Thus, the purpose of this study was to determine the specific mineralogical composition of the Clinton Group phosphate beds. Samples were collected from the Maplewood Shale and Brewer Dock Limestone of the Lower Clinton as well as from the Williamson Shale of the Upper Clinton, all of which are particularly well exposed in the Genesee Gorge, Rochester, New York. An additional suite of samples was collected from an exposure in Densmore Creek, approximately four miles east of the Genesee Gorge. The phosphate samples occurred in two general forms. The primary form consisted of individual nodules which ranged in size from a few mm to about 2 cm. These nodules are typically black, well-rounded and shiny, although some have pitted surfaces. The second type consisted of larger, phosphate-encrusted masses of the smaller, rounded nodules. The largest of these encrusted masses was 12 cm long, 6 cm wide and 1 cm thick. Microscopic analysis showed inclusions of quartz and dolomite but there was no evidence for replacement of calcareous material by phosphate. Based on these observations, the individual nodules were classified as authigenic pellets and the encrusted masses as authigenic quartzitic packstones.

The samples were analyzed by x-ray diffraction in order to determine d-spacing, unit cell dimensions and CO_2 content of the phosphate-bearing material. The results are consistent with the conclusion that the phosphate mineral is carbonate fluorapatite (francolite) for which the formula is $(Ca,X)_{10}\ (P,C)_6\ (O,F)_{26}$ where $CO_2 > 1\%$ and $F > 1\%$ and the cell dimensions are $a \leq 9.36$Å and $c < 6.89$Å. All of the samples showed the same physical characteristics and mineralogical composition regardless of their geographic or stratigraphic location. These observations imply that the physical and chemical environments of formation were both widespread and recurring during the time represented by these samples. Once the chemical conditions were favorable, carbonate fluorapatite precipitated and was concentrated by a winnowing and reworking process where sediment deposition was low. Because carbonate fluorapatite is relatively dense, it could be effectively concentrated in this way. The rounded and polished characteristics of the nodules (authigenic pellets) reflect the abrasion of the winnowing process. The phosphate-encrusted masses (authigenic packstones) probably represent a later carbonate-fluorapatite precipitating event.

[1]The full text of this paper has been accepted for publication (8/83) in Sedimentary Geology.

HONORS

WILLIAM F. COONS
FELLOW
1979

The current President of the Rochester Academy of Science, William Coons, was born in St. Paul, Minnesota. He attended the University of Minnesota and graduated with Bachelor's degrees in Mechanical Engineering and Business Administration in 1953. Bill accepted a position with Eastman Kodak Company as an Industrial Engineer immediately following graduation and completed 25 years at Kodak in June of 978. His present position there is Industrial Engineering Associate. He is married and has two childern.

Bill joined the Rochester Academy of Science and the Mineral Section in 1968. He quickly became nvolved in activities of the Mineral Section and worked on the Eastern Federation Show held in tochester in 1969 and helped to prepare the Field Trip booklet published for that show. He was asked to ıe Treasurer of the Mineral Section in 1970 when the elected candidate resigned, and he served in that ɔosition for two years. Bill went on to serve the Mineral Section as Vice-President and Program Chairman ınd then President. He continues to be involved in the section as a member of the Board of Directors. Bill ıas also served in several important capacities in the planning and running of the Annual Gem and ⁄lineral Show. In 1977 Bill was elected Vice-President of the Rochester Academy of Science and in 1978 ıe was elected President, a post to which he has been re-elected for next year. In all of these varied areas ɔf responsibilities, he has done an outstanding job of accomplishing the task at hand carefully, often neticulously, and with undaunted good humor and patience. Those who work with him can always :ount on a job well done.

Bill also enjoys collecting mineral specimens in the field and attends section field trips whenever ɔossible. He has a strong interest in choral singing and was a member of his church choir for over 20 ⁄ears. He currently sings with the Greece Choral Society and serves as its treasurer.

For his dedicated accomplishments on behalf of the Mineral Section and the Academy in numerous areas of service, we are pleased to make William F. Coons a Fellow of the Rochester Academy of Science.

SARAH M. TALPEY
FELLOW
1979

Sarah M. Talpey is a native of St. Louis, Missouri. After graduating from its Washington University, she married, and in 1950, came to Rochester where her husband was invited to intern at the University of Rochester Medical School. The couple have three sons.

Sarah has been a member of the Genesee Ornithological Society for some twenty years and of the Rochester Academy of Science for fifteen. During this time she exhibited her organizing and leadership abilities, serving on the GOS Council for eight years, two as vice president and four as program chairman. She also served a term on the Council of the Academy, edited several issues of the ***Bulletin*** and wrote occasional articles for that publication.

Not only has she been interested in the birds of the United States, but also has listed two hundred species she observed along Egypt's Nile River. She has visited bird sanctuaries in India and Nepal, and observed animals, birds, and plants in eight of the Galapagos Islands of South America.

Her home zoo boasts pet horses, sheep, land hermit crabs, toads, and, of course, birds, including a pet crow named Budweiser. She has made an intensive study of the common toad, and shares the dining room with two pairs of them.

With an insatiable appetite for learning the ways of the wild, she is presently enjoying courses in the Conservation Department of the Community College of the Finger Lakes. Not interested in knowledge merely for its own sake, she strives to imbue the community with a love of the outdoor world and the urge to preserve its resources. This is the thirteenth year she has taught a Spring Bird Spotting course at the School of Science and Man at the Rochester Museum and Science Center. Garden clubs, Scouts, and students of many ages have profited from her talks and the field trips she has conducted.

Because of her past service to the GOS and the RAS, and because she has opened doors for so many to the enjoyment of nature, the Rochester Academy of Science is pleased to name her a Fellow.

PETER G. EMBREY
HONORARY MEMBER
1979

Peter Embrey is the curator of Mineralogy at the British Museum of Natural History in London, England. He was born in 1929 and celebrated his 50th birthday in January. Peter graduated from Oxford in 1954 with a masters in Chemistry. He is an ex-RAF pilot who through the years has become a wine connoisseur and a gourmet. His hobbies range from collecting old optical mineralogy devices and developing new ones to belonging to a town committee dedicated to dislodging dishonest politicians.

Mr. Embrey is a noted mineralogical historian with interests in structure determination in systematic mineralogy. He is curator of one of the major world collections of over 180,000 specimens and has published many papers on the mineralogy of Tsumeb, S. W. Africa and England. He has just written a book on the minerals of Cornwall and Devon, England, soon to be published.

Peter has made many contributions to the science of Mineralogy and has described several new mineral specimens. Among them are Keyite and Ludlockite. We are proud to elect him to Honorary Membership in the Rochester Academy of Science.

JAMES LOWELL ORBISON, M.D.
FELLOW
1980

James Lowell Orbison was born in the small town of Bronson, Kansas, where he received his elementary and high school education, and learned to love nature while hiking and hunting with his father. He earned his bachelor's degree at Ottowa University, Kansas, his master of science in biochemistry at Michigan State University before entering Northwestern University for his medical degree. It was while there that he married Olga Dianich of Ramsey, Michigan. They have two grown children, a daughter and a son, both married, and one grandchild.

After interning at St. Luke's Hospital in Chicago, he served as resident in Pathology at University Hospitals and Cleveland City Hospital. He served in the armed forces as pathologist at William Beaumont General, and afterward on the faculty of Western Reserve University and University Hospitals. He was appointed the George H. Whipple Professor of Pathology at the University of Rochester, and became Chairman of the Department of Pathology in 1955 and ultimately Dean and Director of the University of Rochester Medical School. He is a member of several professional societies, has served as President of the International Academy of Pathology, and as Secretary-Treasurer, Vice-President and as President of the American Association of Pathologists and Bacteriologists. Among his many honors and awards are the Centennial Certificate of Merit, Northwestern University Medical School; University of Rochester Alumni Federation Citation; Honorary Degree of D. Sc., Ottowa University; Alumni Gold Medal of the University of Rochester Medical Alumni Association; Albert David Kaiser Medal by Rochester Academy of Medicine; Honorary Degree of D. Sc., Bucknell University; and Honorary Doctor of Laws, Nazareth College of Rochester. Perhaps his greatest contribution to medicine has been his integrity while holding the highest standards in medicine and human concern as an example to the students, qualities which have endeared him to those who have been fortunate enough to work for and with him.

As the pressure of his administrative work increased, he turned to nature for study and relaxation, particularly trees in the parks near his home and work. It was while Dean of the Medical School that he brought the results of some of this work to the Botany Section of the Rochester Academy of Science, on field trips and in illustrated lectures. For his outstanding achievements in the medical profession, and for sharing with us the results of his meticulous studies of trees and knowledge of the parks in the Rochester area, we are proud to elect Dr. James Lowell Orbison a Fellow in the Rochester Academy of Science.

ALFRED E. VRAGEL
FELLOW
1980

Alfred E. Vragel is a native of Rochester, New York. He received a degree in Management from Rochester Institute of Technology in 1940. The United States Army claimed Al in 1941, and he served as a Captain in the Adjutant General's Department until 1945. There followed a 36-year career with the Eastman Kodak Company, ended by his retirement in 1972.

Through the years, Al has volunteered his services to many civic and charitable organizations in Rochester. He has been actively engaged in fund-raising for the Rochester Institute of Technology, and has served on the Executive Board of the Alumni Association since 1962. Al was President of the Board in 1971. In 1979, he was awarded an outstanding Alumni Service Award from R.I.T. Al is active in several Masonic bodies, and received a meritorious service award from that organization in 1972. He has currently finished his eighth year of volunteer driving for the FISH organization.

Al was introduced to the Rochester Academy of Science, Mineral Section, in 1968, and has been an active member ever since. He has served as Curator, Field Trip Chairman, First Vice-President and President of the Mineral Section. At present, he serves on its Executive Board in the capacity of immediate Past-President, and is a Director of the Rochester Academy of Science.

Al has given many slide-talks on minerals to groups such as the Boy and Girl Scouts, the Kiwanis, and an American Legion Ladies' Auxiliary. He presented a unique 'Touch and Feel' mineral program to members of the Association for the Blind. After serving in the Boy Scout organization for 35 years, Al took on the responsibility of Geology Merit Badge Counselor at Camp Massawepie in 1977. He expects to be there again this summer. Al has also spent many hours of his time explaining minerals to the children in his neighborhood. They always have first choice of his hand-collected field trip specimens.

For his considerable contributions to the Rochester Academy of Science, Mineral Section, and his dedication to inspiring interest in minerals to others, especially children, we are proud to elect Alfred E. Vragel a Fellow of the Rochester Academy of Science.

DR. ROBERT F. SMITH
HONORARY MEMBER
1980

Dr. Robert F. Smith began a 26 year career at Brookhaven National Laboratories following World War II, in which he was a combat photographer with the Marines. As Director of Analytical Microscopy and Photography, he was the first to examine and photograph the Apollo 11 moon rocks. In 1973 he left Brookhaven to establish a Biomedical Communications Department at Cornell's College of Veterinary Medicine.

In addition to 72 awards for excellence in photography and microscopy, Dr. Smith is the only United States recipient of the Diplomate/RMS awarded by the Royal Microscopical Society and Oxford University. He is on the faculty of the W. Alton Jones Cell Science Center in Lake Placid. He has authored over 100 papers on microscopy and biological photography and has represented the United States as a scientific photographer in an exchange program with the Soviet Union. He has received four Charles Foster Citations in microscopy.

In honor of his many achievements, The Rochester Academy of Science is proud to award him an Honorary Membership.

HERMAN SILVA FOREST
FELLOW
1981

Several early Rochester area botanical studies were published in 1891, and Herman Forest has followed this long tradition through his many regional studies. His interest and contributions extend into the wider ecological, environmental and philosophical areas. He has published more than 60 articles in journals and conference presentations and has regularly contributed to the Academy Fall Paper Sessions.

Herman was born in Chattanooga, Tennessee and received his undergraduate schooling at the University of Tennessee. His advanced studies were pursued at Michigan State University where he received both his master's and doctoral degrees, with research emphasis on those ubiquitous plants, the algae. Teaching and research appointments followed at the College of William and Mary and at the Universities of Tennessee, Oklahoma and Rochester. Since 1956 he has been Professor of Biology at the State University College of Arts and Sciences at Geneseo, New York, where he also directed the Environmental Resource Center for 10 years. He has been a member of the Botany Section of the Rochester Academy of Science since 1965.

Herman's early academic emphasis was soley botanical, focusing especially on the nonmarine algae, and this led to a book on algae published in 1954. However, his undergraduate professors also

instilled in him a strong ecological viewpoint. He became active in the Rochester Committee for Scientific Information (RCSI) just two years after its founding in 1963 and has served in different executive capacities as well as continuing to serve as a director since that time. He has authored 35 RCSI *'Bulletins'* and has edited over 100.

In recent years Herman Forest's major research efforts have involved environmental biology, specifically investigations of the Finger Lakes and bays of Lake Ontario. His studies of the aquatic vascular plants in these waters began in 1967; summaries that he and his students prepared were published in RAS *Proceedings* in 1971 and 1977. Another major sequel is currently in press. He also contributed an interdisciplinary monograph, *'Limnology of Conesus Lake,'* to the 1978 volume titled *Lakes of New York State.*

Herman is internationally known for his biological studies of the Finger Lakes and has traveled as an Exchange Scholar to the Soviet Union and to Czechoslovakia. He has served as an advisor to state and national environmental programs and in 1979 was chairman of the XXXII International Great Lakes Conference held in Rochester. He and his wife, Grace, reside in Rochester with their two sons.

For his contributions to the aquatic biology of the Finger Lakes, for encouragement of students in research, and for dedicated efforts in environmental biology, we are pleased to elect Herman Silva Forest a Fellow of the Rochester Academy of Science.

WILLIAM C. LAWRENCE
FELLOW
1981

William C. Lawrence is a native of Ithaca, New York. His father was a physician, but was also an avid outdoorsman who instilled a love of nature in Bill at a very early age.

Bill graduated from Cornell University in 1942 with a degree in Mechanical Engineering. He was employed briefly by General Motors Corporation in Dayton, Ohio, before enlisting in the United States Navy during World War II, where he served as officer-in-charge of a landing craft in the Pacific theater. After the war he was in the Naval Reserve for 30 years and retired with the rank of Lt. Commander.

Bill began working for Eastman Kodak Company in 1946, where he is still employed and is currently an Engineering Associate specializing in energy conservation. He has been registered as a Professional Engineer since 1949.

Bill's interest in Mineralogy began in 1963 when his daughter Pat began collecting rocks as souvenirs from all the states visited on family vacation trips. In 1968 the entire family joined the Mineral Section of the Rochester Academy of Science. Bill and his wife LaVerne took a two-year leave-of-absence from the RAS when Eastman Kodak transferred them to Sao Paulo, Brazil in 1970. While there they were able to visit many of their famous mineral localities of Minas Gerais and added to their mineral collection. After their stay in Brazil, the Lawrences spent six weeks traveling through Bolivia, Peru, Equador, Colombia, Panama and Mexico. Arrangements had been made with the Colombian government to visit the famous Emerald Mines, but Bill discovered that it entailed a three-day jeep ride through terrorist country with machine guns mounted on the jeep, and decided to content himself with a visit to the mine showrooms in downtown Bogota.

In 1972 Bill rejoined the Mineral Section and served for two years as Exhibit Chairman of the Gem and Mineral Show. For the next two years he was a Co-Chairman of the Show, then served as 1st Vice-President and President of the Mineral Section. During his last year as President he also served another year as Co-Chairman of the Gem and Mineral Show. Bill is currently Vice-President-Elect of the Rochester Academy of Science.

In addition to his interest in minerals, Bill is also a member of the Academy Ornithology Section. His interest in birds stems from his interest in nature photography. From 1977 to 1979 Bill was chairman of the Nature Division of the Kodak Park Camera Club, and he has served on committees for the Rochester International Salon of Photography. In 1978 he entered four nature slides in the Kodak International Salon of Photography, held that year in Paris, France, and was both pleased and surprised to win two bronze medals and an Honorable Mention for his slides.

For his dedication to the Rochester Academy of Science and his pursuit of nature through film, we are proud to elect William C. Lawrence a Fellow of the Academy.

THOMAS C. DUNSTAN
HONORARY MEMBER
1981

Thomas C. Dunstan was born in Minneapolis, Minnesota. He received his bachelor's degree from the University of Minnesota in 1963 and then went on to earn master's and doctoral degrees at the University of South Dakota. He is currently an Associate Professor at Western Illinois University.

Dr. Dunstan's areas of special study include the ecology and ethology of birds of prey, the application of radio-telemetry to wildlife studies, land use management for wildlife and animal ecology.

He is a member of a number of professional organizations, especially those associated with ornithology; he serves as a consultant for the Illinois Chapter of the Nature Conservancy and he has served on the Board of Directors of the Raptor Research Foundation. Dr. Dunstan has been very active in the areas of research and writing. He has received over a dozen grants, presented numerous papers at professional meetings and has published more than 30 articles in such magazines as *Nature Conservancy News, National Geographic, Raptor Research* and many others.

For all his work on the study of wildlife and of birds of prey in particular, we are pleased to make Thomas C. Dunstan an Honorary Member of the Rochester Academy of Science.

ERNEST H. MULLER
Honorary Member
1981

Ernest H. Muller was born in Tabriz, Iran. He was an Airways Weather Forecaster for the U.S. Army Air Force during World War II. He then went to Wooster College, where he received his bachelor's degree in Geology in 1947. He went on to receive both his master's and doctoral degree in Geology from the University of Illinois. Dr. Muller taught at Cornell University from 1954-1959, then joined the faculty at Syracuse University, where he has taught since then. He is currently Professor of Geology and Interim Chairman of the Department of Geology.

Though he has been on the faculty at Syracuse University since 1959, Dr. Muller has journeyed to many parts of the world to enrich his professional experience. He has been a visiting professor of Geology in New Zealand, a research associate in Iceland, a lecturer in India, an Investigator for National Science Foundation sponsored research in Alaska and a geologist in Chile. He has also worked with the U.S. Geological Survey and the N.Y. State Geological Survey in New York State.

Through the years Dr. Muller has done extensive research in geology, most recently in the areas of glacial drift and field mapping of New York geology. He has published more than 70 papers and is a member of a number of professional societies.

For his extensive research in a number of geological areas and his many contributions to the body of knowledge in Geology, we are pleased to make Ernest H. Muller an Honorary Member of the Rochester Academy of Science.

MERLIN L. GROFF
FELLOW
1982

The Rochester Academy of Science is proud to extend the honor of Fellowship to Merlin Groff for his service to the Academy. Our candidate is a skilled accountant, which talent he has generously used to guide the Academy financial records along the complicated paths of professional accounting practice and through the maze of records and forms required by the Internal Revenue Service.

He was born in Rochester, New York, and received the degree of Bachelor of Arts in History at the University of Rochester with Election to Phi Beta Kappa. Later, he went on to Niagara University, receiving a Bachelor of Business Administration Degree (Magna Cum Laude) in Accounting and Business Law. He has spent most of his professional life in private practice as a Certified Public Accountant.

Our candidate is a charter member of the Astronomy Section, joining the Academy in 1947 at the same time that the former Astronomy Club joined the Academy as a Section. He has presented lectures to the Section, was an active member of the telescope making group and the Rochester Moonwatch Team, an artifical satellite locating and timing group.

In the community he has volunteered his services at the Rochester Museum and Science Center as a regional history teacher to visiting school children and a demonstrator of the art of bread baking. He has been active with the Literacy Volunteers, teaching English to a Spanish speaking family from Colombia, has helped in his local high school library, and provided accounting support for his church.

For his distinguished accounting services to the Academy we are honored to extend our Fellowship to Merlin Groff.

BARBARA A. WALTERS
FELLOW
1982

Barbara A. Walters is a native of Rochester, New York. She received a degree in Economics from the State University of New York at Brockport and has done graduate work in education, mathematics and psychology. Her career has taken her through positions in teaching, administrative secretary, and insurance agent, to her present occupation in recruiting, training and management with the local office of a national insurance company.

Her involvement in astronomy began through her husband, Alan. They both joined the Academy and its Astronomy Section in 1974. Barbara presently serves as Section Secretary. Not long after joining the Academy, her talents were recognized by a Nominating Committee and she was elected to serve as Corresponding Secretary beginning in 1976. It is estimated that in this capacity, she has addressed and mailed nearly 50,000 Bulletins, Annual Ballots and special mailings to Academy members and friends. She has often worked far into the night or on the weekend to meet a mailing deadline.

For her diligent attention to the communication of information to Academy members and her service to the Astronomy Section, we are proud to name Barbara A. Walters a Fellow of the Rochester Academy of Science.

JULIA F. MORTON
HONORARY MEMBER
1982

Julia F. Morton, Doctor of Science, Research Professor of Biology, Fellow of Linnean Society of London, and Director of the Morton Collectanea at the University of Miami in Florida, was born and raised on a Vermont farm and it was there that she learned to love and study plants. Her research on the edibility of plants, started in New York in 1933 with husband Kendall, became the focus of her interests with the beginning of the Collectanea. She moved to the Carribean during World War II, then to Homestead and finally, in 1949, to the University of Miami; the Collectanea remains the center of her interests.

Having travelled widely, especially in the tropical areas of the world, she has an intimate knowledge not only of the plants but also of their uses by native cultures. An internationally recognized authority on tropical fruits, edible wild plants, medicinal plants, poisonous plants and honeybee plants, she serves as Consultant for Florida Poison Control Centers.

She is author of numerous articles and scientific papers on tropical and subtropical plants, survival manuals for the Armed Forces, wall charts, Golden Nature Guides, tests on forensic medicines, and many books, the most recent the *Atlas of Medicinal Plants of Middle America,* a massive compendium of information about plants with medicinal and other uses.

Under a grant from the National Institutes of Health she conducted an investigation into the causes of esophageal cancer, is a member of the Toxicology Section of the Pan American Medical Association, of the Association for Tropical biology, American Association for the Advancement of Science, and many others; and is serving her third term on the Board of Trustees of the Fairchild Tropical Garden.

For her extensive research into the uses and misuses of plants, their edibility, poisonous qualities, or potential usefulness, and extensive dissemination of general knowledge of plants through lectures, papers, pamphlets and books, we are pleased to make Julia F. Morton an Honorary Member of the Rochester Academy of Science.

DAVID PIMENTEL
HONORARY MEMBER
1982

David Pimentel, Professor of Insect Ecology and Agricultural Sciences in the Department of Entomology, Cornell University, was born in Fresno, California, and educated in Massachusetts. After serving in the U.S. Air Force, he earned his Bachelor of Science degree at the University of Massachusetts at Amherst, and his Doctoral degree at Cornell University.

His extensive research involves basic population ecology, ecological and economic aspects of pest control, energy use in the food system, biomass energy systems, and natural resources management and environmental policy. He has served on many commissions, boards, and advisory councils on the state and federal level, and is chairman of the Environmental Studies Board of the National Academy of Sciences; chairman of the Biomass Energy Panel and member of the Energy Research Advisory Board of the Department of Energy; chairman of Land Productivity Panel of the Office of Technology Assessment, U.S. Congress; and member of the Research Advisory Committee of USAID, Department of State.

Dr. Pimentel is a world traveler, lecturer, consultant, and prolific author. He has published over 200 scientific papers and nine books. His honors are extensive and numerous.

For his massive research in many ecological areas, his contributions to his country, and to the education of the public in his chosen field, we are pleased to make David Pimentel an Honorary Member of the Rochester Academy of Science.

MELVIN JOHN WENTLAND
FELLOW
1983

Melvin Wentland was born in Milwaukee, Wisconsin and earned his bachelor's and master's degree from Marquette University in that city. He earned his doctoral degee, with specialties in botany and horticulture, from the University of Wisconsin at Madison. His work there involved research on seed dormancy.

In 1964 he joined the staff of the Biology Department at St. John Fisher College in Rochester, and was chairman of the department for nine years. Currently he is Professor of Biology there, and has developed a highly successful adult education program in horticulture that has served the community for 14 years.

He has been a lecturer at the Rochester Museum and Science Center in their adult ecology program, and is frequently called upon as a speaker for garden clubs. His series of garden tips has been heard on a local radio station, and he has served as a judge at the Wyoming County Fair. The adult education program of the Wyoming County Extension Service has benefited from his fine teaching abilities.

Dr. Wentland's research studies include: effects of laser radiation on seed germination; causes of seed dormancy; and ecological studies. An important study, with his former student Bruce Gilman, 'Vegetation of the Thousand Acre Swamp, Penfield, New York,' is in press and will appear in the Proceedings of the Academy.

Melvin's ideas assisted in establishing the Scientific Papers Session of the Academy in 1974. He served as co-chairman of the first meeting held at the State University College, Geneseo, New York, and was chairman of the third session at Fisher in 1976. It is appropriate that he will serve as co-chairman of the 10th session to be held at Fisher in November, 1983.

Melvin lives in Pavilion, New York where he presently is a member of the School Board. He enjoys golf and also gardening on his home farm where he lives with his wife and four children.

As a stimulating teacher of botany and horticulture, for his contributions to plant physiology and local ecology, and for his many valuable services to the community and to the Academy, we are proud to elect Melvin John Wentland a Fellow of the Rochester Academy of Science.

ANNE F. CLARRIDGE
FELLOW
1983

'To him who in the love of Nature holds
Communion with her visible forms, she
speaks a various language'

So wrote William Cullen Bryant many years ago. For much of her life Anne Clarridge has listened to that 'various language' and one of her chief concerns has been to translate and transmit it to others. She cannot remember when she has not had a consuming interest in natural history. A graduate of the University of Massachusettes where her major was Biological Field Study, she came to Rochester as a housewife and mother. Family responsibilities not withstanding, the instincts and talents of a true naturalist have surfaced and found expression in many ways.

Her activities at the Rochester Museum and Science Center extend over many years. Currently she serves there as a part time instructor in Natural Science. For several years she was on the staff of Naturalists at Mendon Ponds Park, where her early morning bird walks were especially enjoyed by many.

An accomplishment of which she is particularly and rightly proud is the founding and organizing of the group now known as the Weekly Outdoor Walkers. Every week for the past twelve years this group has visited places of interest in the Rochester area, most of which she explored and researched personally. Her talents and abilities in interpreting nature's 'visible forms' continue to enhance those visits.

She has served two terms as president of the Academy's Ornithology Section (Genesee Ornithological Society) and she continues to be active in various capacities there. She is a Botanical Consultant for Life Line and its Poison Control Center. She was Director of the first Campfire Girls Day Camp at Mendon Ponds. Her services in bringing the lore and love of nature to Cub Scouts, Boy Scouts, Girl Scouts, Senior Citizens and others are too many to be detailed here.

For her exceptional abilities as a naturalist and for her zeal in translating and transmitting nature's 'various language,' we are proud to name Anne F. Clarridge a Fellow of the Rochester Academy of Science.

ROBERT HOLMES PLASS
FELLOW
1983

Robert Holmes Plass is a native Rochesterian who was graduated from Brighton High School and received his B.A. and Edm. degrees from the University of Rochester. Following a year of secondary level teaching in the Social Studies Department of Medina High School in Medina, New York he returned to Rochester and served for six years as a research analyst on the Technical Staff of the Rochester City Planning Commission. He transferred to the Paper Sensitizing Division of Eastman Kodak Company in 1956 and retired in March of this year after twenty-six years with the Development Department.

For many years Bob has maintained a keen interest in various areas of photography and has used his camera to record the world of travel and the many aspects of nature. Other fields of interest include work with youth groups in the YMCA and Boy Scout organizations, church activities and Masonry.

Bob Plass became a member of the Academy in October, 1974 with a primary interest in the Astronomy Section. He was appointed Academy Membership Chairman and has held this position for the past six years. Bob and his suitcase containing all the Academy membership records have become fixtures at Academy Board meetings. Other Academy posts he has held include that of Director and Academy delegate to the Rochester Council of Scientific Societies.

Bob and his wife Carol, who is also a member of the Astronomy Section, live in Irondequoit and have two grown children. They are expecting their first grandchild in May.

For his service to the Academy and to the community, we are proud to name Robert Holmes Plass a Fellow of the Rochester Academy of Science.

YNGVAR W. ISACHSEN
HONORARY MEMBER
1983

Dr. Isachsen is Principle Scientist with the New York State Geological Survey in Albany, New York. He holds the academic rank of Adjunct Professor of Geology and has taught geology courses at Rennselaer Polytechnic Institute at Troy, State University Center at Albany, Lafayette College, and SUNY College at Plattsburg.

He received his Bachelor's degree from Syracuse University, N.Y.; Master's from Washington University in St. Louis, Missouri; and his Doctorate from Cornell University, New York. Dr. Isachsen's career record includes: District Geologist on the Columbia Plateau for the U.S. Atomic Energy Commission (4 years). He has also been on special assignment in Colombia, South America, for the Atomic Energy Commission and to Turkey for the United Nations.

Dr. Isachsen is currently conducting field and geophysical investigations in relation to brittle deformation, mylonite formation, Paleo-stress analysis and geodynamics of contemporary vertical movements. He is also known for his research on the geology and seismic investigations of New York's strata, especially the history of the Adirondacks.

For his significant research into the geology of New York State, and his contributions to our understanding of one of our great natural resources, the Rochester Academy of Science is proud to name Dr. Yngvar W. Isachsen an Honary Member.

RICHARD DAVID HAMELL
FELLOW
1984

Richard David Hamell is a native of Rochester, receiving his education from Monroe Community College, State University College at Brockport, where he received a BS in Geology, and most recently at the University of Rochester, where he earned an MS in Stratigraphy in 1982. He has been on the staff at MCC for over 10 years, and is currently the Technical Assistant in the Department of Geosciences and Advisor to the Geology Club.

Richard joined the Academy in 1973 and has served as Vice President and President of the Mineral Section, Vice President and Corresponding Secretary of the Academy, and currently is President elect of the Academy. He is also Vice President of the Fossil Section, which he helped to bring into the Academy in 1981. He has served both the Mineral and Fossil Sections as teacher, lecturer, auctioneer, Educational Chairman and field trip leader.

In his capacity as Academy Corresponding Secretary, Richard has arranged to computerize the Academy Mailing list and printing of mailing labels. He is also instrumental in the current efforts to have the Eurypterid named as the official state fossil.

For the many ways in which he has shared his knowledge, talent, and leadership with the Academy and his other associates we are happy to name Richard Hamell a Fellow of the Rochester Academy of Science.

VANDALL THOMAS KING
FELLOW
1984

Vandall Thomas King received his B.S. in Earth Science at the University of Maine in his home state in 1972. He taught high school earth science and did research for the University of Maine for several years before coming to the Rochester area. He earned an MA in Geological science from SUNY Buffalo in 1980.

Since joining Wards Natural Science Establishment as mineralogist in 1979, he has become increasingly active in the Academy Mineral Section. A mineral collector since 1959, Vandall epitomizes the modern mineralogist, scholarly but eager to share his knowledge. He is known throughout the mineral collecting world and is sought as a speaker and author. He has provided several Mineral Section programs, sometimes on very short notice.

Since 1980 he has taught a series of mineralogy courses to members. Most recently he has interested members in micromounting of minerals. Last summer he sponsored a Micro-Mount Conference at Monroe Community College which was attended by club members and several Canadian micro-mounters. His classes are highly recommended by both beginners and experienced collectors. When the continuation of the Mineralogical Symposium seemed doubtful, Vandall stepped in as Co-Chairman and proceeded to plan the 1984 Symposium with dispatch, adding a paper session as a new feature.

Vandall's interests range throughout the natural world. He is currently a tutor at Empire State College and consultant and major contributor to the national magazine *Rocks and Minerals*.

For his contributions to the mineral world outside and within the Academy, we are pleased to name Vandall King a Fellow of the Rochester Academy of Science.

MUNRO WILL
FELLOW
1984

Munro Will insists that he is not a scientist. His attitude toward the biological aspects of natural history can be one of supreme indifference. To him the established taxonomic arrangement of American birds—the so-called "checklist order"—means only that he must follow it strictly in preparing his bird reports to the statistician of the Genesee Ornithological Society. Yet this non-scientist faithfully submits those reports month after month.

This non-scientist somehow manages to survey and monitor a ten-kilometer-square area in the Naples vicinity for the New York State Breeding Bird Atlas, arousing in the process the interests and enthusiasm of a number of residents there. And this non-scientist has an exceptionally keen ear for birdsong. His collection of birdsong records and tapes, some of them his own work, is perhaps unequalled anywhere in the area. An avid photographer for many ears, his collection of beautiful bird and flower slides runs into many thousands. All of this adds up to a vast reservoir of resources, which he generously makes available, not only for Academy use for also in the form of slide shows and programs for other groups such as garden clubs and the Burroughs-Audubon Nature Club, where he is an executive councillor and a former secretary.

Local history, the old Erie Canal, and the Bristol Hills countryside are interests that have fascinated him for much of his life. As a part time instructor at the Gannett School of Science and Man he has conducted River Rambles, Canal Tours, Waterfall Discovery Expeditions and Fall Foliage Tours, as well as indoor courses in those subjects and in bird and flower lore. In the mere eight years since becoming a member, Munro Will has contributed much to the day-to-day and behind-the-scenes activities of our century-old Academy. Officially he has served four years as Recording Secretary of the Ornithology Section (GOS) and has held that same position in the Botany-Entomology Section since 1977. Unofficially he makes available any of his excellent projection and recording equipment whenever and wherever it is needed. Unofficially he reports Botany-Entomology and Ornithology Section affairs at Academy board meetings. Unofficially he goes miles out of his way to transport people and equipment to meetings and field trips.

For his contributions to the dissemination of knowledge about the natural history of the area in the vicinity of Rochester and for his distinguished services to this organization, we take pride in naming Munro Will a Fellow of the Rochester Academy of Science.

EVELYN NEWMAN WISHART
FELLOW
1984

Evelyn Newman Wishart was born in Bergen, NY and received her education in Rochester, graduating from the University of Rochester with a BA in Geology in 1927. After graduating, she worked four years in the Geology Department and the Natural History Museum at the University River Campus. She drafted diagrams for a book on Petrology by Dr. Harold Alling, and also made illustrations for a Biology textbook.

During this time, her future husband, James Wishart, was earning his PhD at Princeton. They were married in December 1931 and Evelyn's professional career ended in favor of family responsibilities. She raised three children and had time to be active in church and scout activities.

Although active in the Mineral Section for many years, Evelyn most recently became involved in Academy affairs when she was persuaded to become Recording Secretary in 1979. She still holds this office, consistently attending Board meetings and translating the sometimes difficult to follow proceedings to a written record. She is currently a member of the Mineral and Botany Sections and enjoys outdoor activities of both the Academy and the Sections.

For her faithful service to the Academy and her constant support of its activities, we are proud to name Evelyn Wishart a Fellow of the Rochester Academy of Science.

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