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CORRELATION OF SELECTED DISSOLVED SUBSTANCES AND THE DISTRIBUTION OF POTAMOGETON IN NEW ENGLAND

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by

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ABSTRACT

CORRELATION OF SELECTED DISSOLVED SUBSTANCES AND THE DISTRIBUTION OF *POTAMOGETON* IN NEW ENGLAND

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Selected water chemical factors (hydrogen ion concentration, total alkalinity, free carbon dioxide, nitrates, total phosphates, and chlorides) sampled at 321 locations throughout New England suggest that total alkalinity (bicarbonates and carbonates) is the major chemical factor influencing the distribution of *Potamogeton* taxa. The z test and differences between alkalinity means provide a statistical basis for establishing six distinct species clusters. A one-way design analysis of variance indicates that alkalinity is highly significant in the formation of these clusters. Nitrates and chlorides also are of significant value in determining the same clusters, but not nearly as important as total alkalinity. Free carbon dioxide and total phosphates are of little value in the formation of the groups. A one-way design analysis of variance within clusters indicated results similar to those between clusters.

Bicarbonates and carbonates (total alkalinity) dissolved in water are an important source of carbon for photosynthesis, and may therefore be of importance in the distribution of Potamogeton. The clusters formed from the statistical analysis may be utilized to establish a means of classifying New England waters. The highly alkaline waters above 90.0 mg/l $CaCO_3$ are characterized by Potamogeton pectinatus. Alkaline waters ranging between 61.0-90.0 mg/l $CaCO_3$ contain such taxa as P. friesii, P. crispus, P. illinoensis and P. filiformis var. borealis characteristic of northeastern Maine and western New England. The majority of the taxa occur in the moderately alkaline waters (15.1-60.0 mg/l $CaCO_3$) and include the most common species: P. spirillus, P. epihydrus var. ramosus, P. natans, P. gramineus, P. zosteriformis and P. pusillus var. tenuissimus. The acid "soft" waters (0.0-15.0 mg/l $CaCO_3$) characteristic of eastern New England contain such taxa as P. confervoides, P. diversifolius var. trichophyllus and P. oakesianus.

Hydrogen ion concentration (pH) was not utilized in statistical analysis beyond the calculation of correlation coefficients because the coefficients indicated that total alkalinity was the better chemical parameter influencing plant distribution.

The nitrates were highly significant in the determination of the cluster formation but not nearly as significant as total alkalinity. Where the alkalinity is high nitrates are usually high. Bicarbonates, carbonates, and nitrates are soluble in water and are of importance to the plants. Nitrate values were highest in the agricultural regions of New England.

Chlorides also are extremely soluble in water and may influence the plant growth. The Potamogetons that are extremely tolerant of higher chloride content include *Potamogeton perfoliatus* var. *bupleuroides* and *P. pectinatus*. *Potamogeton pusillus* var. *tenuissimus* was also found to be tolerant of higher chlorides along the coast. The distribution of the remaining 29 taxa did not correlate with the chloride content.

Free carbon dioxide and dissolved total phosphates are of low significance in *Potamogeton* distribution. Free carbon dioxide is common throughout New England waters in low amounts, and is a source of some carbon dioxide for photosynthesis, but is of little value in determination of plant distribution. Dissolved phosphates are of little value since they are quickly absorbed by the substrate, hence very little is available to the plants through the water. Phosphate values are greatest in rivers where they are unable to be rapidly absorbed by the substrate. In order to determine the value of phosphorus to *Potamogeton* distribution, a thorough survey of the soils must be undertaken.

This study indicates the importance of water chemistry in the distribution of *Potamogeton* taxa. The water serves as the major source for bicarbonates, carbonates, nitrates, and chlorides. Certain species such as *P. crispus*, *P. friesii*, and *P. nodosus* indicate waters high in nutrients.

INTRODUCTION

New England, with its great abundance of lakes and streams, provides for a wide variety of aquatic plants. The two main drainage areas in the region are the coastal watershed, with the major rivers draining to the Atlantic Ocean, and the St. Lawrence River watershed. The chemical quality of these waters varies due to the general substrate of a specific area, farming runoff, and pollution due to man. Much of the region lacks any calcareous substrate, hence the waters are acidic or neutral. The acidic areas occur mainly in sandy regions of the coastal drainage and granitic regions inland. This includes all of Rhode Island, most of New Hampshire, Maine, Massachusetts, and parts of Connecticut and Vermont. Alkaline areas occur over the limestone regions of northeastern Maine, most of Vermont (especially in the Lake Champlain valley), western Massachusetts in the Housatonic River valley, and in western and southern Connecticut. While working with Potamogeton it became obvious from the many floristic publications (Fernald, 1950; Gleason, 1952; Fassett, 1957), and some monographs on the genus (e.g. Hagstrom, 1916; Fernald, 1932; Ogden, 1943), that specific pondweeds seem to favor acid, alkaline, or brackish waters. A survey of the literature revealed only two studies on the distribution of aquatic plants and water chemistry in the United States.

These were carried out by Steenis (1932) in Wisconsin and Moyle (1945) in Minnesota. My investigations were conducted in an attempt to define the ranges of the species of Potamogeton in New England in relation to the chemical properties of the waters in which they grow.

Morong (1893) recognized 37 species of Potamogeton in North America, 14 of them restricted to this continent. Ascherson and Graebner (1907) recognized 38 species. Only five North American species are not found in the northeastern United States. These are Potamogeton clystocarpus Fernald, P. subsibiricus Hagstrom, P. groenlandicus Hagstrom, P. latifolius (Robbins) Morong, and P. oblongus Viviani (Morong, 1893; Hagstrom, 1916; Fernald, 1950; Haynes, 1974).

In the northeastern United States and southeastern Canada, Gleason (1952) recognized 30 species, while Fernald (1950) recognized 37 species including 52 varieties. The nomenclature in this paper follows that of Fernald (1950), with modifications of some taxa as reported by Kleklowski and Beal (1965), and Haynes (1974). The number of taxa recognized here in the northeastern United States and southeastern Canada is thus reduced to 40, while in New England 37 varieties in 29 species are recognized.

REVIEW OF LITERATURE

The importance of vascular aquatic plants has received much thought and experimentation. Moore (1915) states,

> Aquatic plants have contested for possession of the waters much as the grasses have contended for supremacy on land, until it may be said that the dominant forage crop of our lakes, ponds, and streams is to be found among the pondweeds, the Potamogetons.

Shelford (1921) noted that aquatic rooted vegetation is not an important food source. This was refuted by many (Titcomb, 1909; McAtee, 1911; Moore, 1915; Metcalf, 1931; Kubichek, 1933; Martin and Uhler, 1939; Pond, 1959). It has been noted that some species of *Potamogeton* are extremely important food for wild ducks (Metcalf, 1931; Martin and Uhler, 1939; Kubichek, 1933). *Potamogeton* fruits are a valuable source of food for ducks, coots, geese, grebes, swans, marsh birds, shore birds, and other game birds (Sculthorpe, 1967).

Aquatic macrophytes are of value to fish as food, nesting sites, areas of egg attachment, and protection (Mulligan, 1969). Sculthorpe (1967) reported the foliage of the pondweeds to be of moderate importance as fish food, but of great importance as a food producer, spawning medium, and as a source of shade and shelter. King and Hunt (1967) found that carp feed on *Potamogeton foliosus* but seemed to leave *P. pectinatus* and *P. crispus* alone.

Lowden (1969) indicated that Potamogeton gramineus, P. robbinsii, and P. zosteriformis were being eliminated by the carp. Larger vascular aquatic plants also serve as a mechanical support for algae, which are utilized as a food source by many fish and birds (Pond, 1905).

Oxygenation of water by macrophytes has been noted by Titcomb (1909), Baine and Yonts (1937), and Mulligan (1969). When temperature, currents, and wind action are low, submerged plants contribute most of the oxygen in the water (Baine and Yonts, 1937). Plants are essential for proper aeration of water and are especially important in shallow ponds of limited area (Titcomb, 1909).

Mulligan (1969) indicated that other factors are influenced by benthic macrophytes. These include shading and cooling the sediments of the littoral zone; slowing water currents and movement; providing habitats for sessile organisms; converting inorganic material to organic matter; and holding the soil in place through their root systems.

Water quality has become an increasing concern of the aquatic biologist. Certain plants have been shown to commonly occur in eutrophic or polluted water, e.g. Potamogeton crispus, P. obtusifolius, Butomus umbellatus, Typha latifolia, Vallisneria americana, and Myriophyllum exalbescens (Fassett, 1957; Soulthorpe, 1967; Suominen, 1968; Lind and Cottam, 1969; Harmon and Doane, 1970). Certain other species may be considered to be plants of non-polluted, clear water, e.g. Megalodonta beckii, Najas flexilis, *N. gracillima*, *P. friesii*, and *P. strictifolius* (Stuckey, 1971; Cook *et al.*, 1974; Haynes, 1974).

There is much controversy as to whether the characteristic quality of the substrate or the water is responsible for the distribution of aquatic plants. Gerloff (1969) states,

> Many higher aquatic plants are fixed in position, as are terrestrial species, but they absorb nutrients from both the bottom muds in which they are rooted and the waters surrounding shoot portions.

Pearsall (1920; 1929) found plant distribution to be related to the nature of the substratum. Physical and chemical characters of the muds of lake and stream beds have been found to be closely correlated with the plants on them (Misra, 1938).

The substrate holds some substances more firmly than others. Investigations show that most soils absorbed the oxides, salts of the alkalis, and alkaline earths (Pond, 1959). These are potassium, ammonium, magnesium, sodium, and calcium. The nitrogen, phosphorus, and potassium compounds are also firmly retained in the substrate. Water may or may not contain enough of the above substances in solution to be of aid to vascular plants (Pond, 1959).

Aquatic plants occur in all types of substrata. These include clay, sand, gravel, and loam. The most abundant plant species attain their greatest development upon well-decomposed organic soils and are the least developed in sandy soils (Wilson, 1937; Pond, 1959). The organic soils are characteristic of lakes in an advanced stage of development while sandy lakes whose substrates are poor in the products of vegetative decomposition are considered to be more primitive or youthful (Wilson, 1937).

Dissolved chemicals have been shown to effect plant growth. Nitrates, phosphates, and to some extent, carbon, have been considered to be limiting factors in the growth of most plants (Gerloff, 1969); Mulligan and Baranowski, 1969; Lee, 1973). Carbon dioxide, total alkalinity, and pH have also been considered to be controlling factors in the distribution of many plants (Arber, 1920; Pearsall, 1921; Hicks, 1932; Moyle, 1945; Hodgdon et al., 1952; Spence, 1967). Steemann Nielsen (1944) noted that the bicarbonate ion is the single most important carbon source for plants. Chloride content affects the distribution of these plants in inland brackish lakes and in coastal estuaries. Aquatic plants, which have been found in brackish waters include Najas marina, Potamogeton pectinatus, P. filiformis, P. foliosus, P. perfoliatus, Ruppia maritima, and Zannichellia palustris.

Much work has been conducted on the chemical content of various aquatics. Pond (1905) reported on the chemical differences in the ash of experimental plants that had been rooted in the soil and others simply anchored. He found that nitrogen, potash, and phosphoric acid were not absorbed in sufficient amounts by anchored plants to achieve normal growth. Total chemical composition of aquatic plants, especially Potamogeton, has been tested for by various researchers (Schuette and Alder, 1927; Riemer and Toth, 1969). From the studies of Riemer and Toth (1969) it was found that the percentage of calcium was the highest, followed by nitrogen, potassium, and chlorine, with phosphorus and manganese of lowest concentration. Gerloff (1969) also indicated the content of nitrogen and phosphorus in samples of vascular aquatic plants. He found the percentage of nitrogen as high as 4.68 in Elodea canadensis and the percentage of phosphorus as high as 0.70 in Vallisneria americana.

Boyd (1970) proposed that certain species of plants, e.g. Eichornia crassipes, Justicia americana, Alternanthera philoxeroides, and Typha latifolia may be utilized to absorb nutrients from polluted waters. The plants then would be mechanically harvested thus removing the nutrients. I have observed plankton blooms in lakes in Massachusetts after the removal of vascular aquatics by chemical methods. Such blooms result from the increased availability of nutrients that were previously utilized by the vascular plants (Mulligan, 1969).

Vascular aquatics may become a nuisance when they become too abundant. In the southern United States Pistia stratiotes, Alternanthera philoxeroides, Eichornia crassipes, and Najas guadalupensis are a problem, while in the northern states Myriophyllum spicatum, Potamogeton pectinatus, Elodea canadensis, and Phragmites communis are often over-abundant (Mulligan, 1969). In New England, Myriophyllum heterophyllum, Cabomba caroliniana, and Potamogeton crispus are becoming a problem in some areas.

Control of nuisance plants is a concern of the aquatic biologist. Many types of control are employed, including mechanical removal; biological controls, e.g. the use of grazing fish, such as carp (Cyprinus carpio), or members of the African genus Tilapia to uproot and feed on plants; and fertilization of waters to increase algal blooms, thus shading out submerged macrophytes. The use of herbicides has been found to be the most effective means of control (Mulligan, 1969). From observations in the field, chemicals have become an effective means of control in New England, especially on Myriophyllum spicatum, M. heterophyllum, Cabomba caroliniana, and Potamogeton crispus. In New England Potamogeton does not appear to be a major problem.

SAMPLING PROCEDURES

Field work was conducted during the summers of 1971-1973 at 321 locations throughout New England. The locations are listed and mapped in Appendix I. Many of the sites and regions visited were determined beforehand by consulting the herbaria of the University of New Hampshire, Harvard University, and the New England Botanical Club. In these harbaria, specimens noted by many authors (e.g., St. John, 1916; Fernald, 1932; Ogden, 1943; Voss, 1972) as alkaline ("hard") or acid ("soft") water plants were utilized to determine water-quality regions of New England. This procedure was of particular value for locating rarer plants of such regions.

Plants were collected in plastic bags and brought back to the laboratory to be pressed and dried. These specimens have been distributed to a number of herbaria around the world. A complete list of all specimens and maps of observation sites may be found in Appendix II.

A water sample was also obtained at each location. This sample, where possible, was collected away from the areas of plant concentration and at a similar depth of light penetration as determined with a Kemmerer sampler. In streams and shallow bodies of water, samples were taken just below the surface.

The water samples were analyzed for hydrogen ion concentration (pH), total alkalinity, free carbon dioxide, nitrates, total phosphates, and chlorides. Total alkalinity expressed as milligrams per liter (mg/l) $CaCO_3$ was determined by titration with 0.02N sulfuric acid using phenophthalein and methyl orange as indicators (Theroux et al., 1943; Gotterman, 1969). Free carbon dioxide was tested for by titrating with n/44 sodium hydroxide using phenophthalein as an indicator. The results are recorded as mg/l free carbon dioxide (Theroux et al., 1943). The test for chlorides was the argentometric method (Orland, 1965) and the results are recorded as mg/l chloride. Nitrates, total phosphates, and pH were determined on the Hellige Aqua Analyzer, model No. 950E (Hellige Inc., Garden City, N. Y.). This is a pre-calibrated photoelectric colorimeter. Results were recorded as mg/l nitrate (NO_3) and phosphate (PO_4). To convert the nitrate value to the nitrogen portion of the nitrate multiply nitrate value by 0.2259. The phosphorus portion of the phosphates is obtained by multiplying the phosphate value by 0.3262. These results will be in mg/l.

STATISTICAL PROCEDURE

Means, medians, and ranges of chemical data were calculated for each species found in at least five field locations. Duncan's Multiple Range test was utilized initially to segregate species occurring under similar conditions. The test was abandoned because each pair of adjacent means was always found to be similar.

Correlations were calculated between all pairs of the chemical measures to determine those variables which measured independent parameters. Separations were sought in the data by placing all data into a distribution of differences on a single basis, e.g. alkalinity. The probability that differences between adjacent means will be two standard errors apart is known and points exceeding 0.05 were sought. The means were computed and arranged in descending order. The differences between adjacent means were calculated. Unusually large differences were looked for as dividing points between clusters. No separations were made if the z value of a normal distribution (Steel and Torrie, 1960) had a probability of approximately 0.10 or smaller (Appendix IV). When the means were arranged by descending alkalinity values, six clusters of taxa were determinable. That is to say that between the means within clusters the likelihood of a difference of the magnitude found was greater than 0.10 and that between a specific mean and the next adjacent smaller mean, the probability of such a difference was less than 0.10.

A one-way design analysis of variance was computed on the six clusters that had been determined. This analysis was conducted to test for significant differences among the six clusters on means other than that on which they had been segregated. A second analysis showed that real differences among means of the subsets were present after the partitions were made.

RESULTS

The results of the chemical tests for all areas are found in Table 15, (Appendix III). The means, medians, and ranges of the six chemicals for all taxa are found in Tables 1-6. *Potamogeton filiformis* var. *macounii*, *P. vaginatus*, *P. hillii*, *P. lateralis*, *P. diversifolius* var. *diversifolius* and one hybrid, *P.* X *longiligulatus*, were not found at a sufficient number of locations to make computation of summary data meaningful. When observing the results on Tables 1-6, the range is the most useful information since it includes the extremes where the taxa are found. The median should be utilized rather than the mean, since certain taxa have a few extremely high or low values. Graphs indicating the frequency of occurrence of *Potamogeton* at different hydrogen ion concentrations and alkalinities are found in Figures 50 and 51 (Appendix III). The frequency of occurrence of the taxa along the tested chemical gradients are found in Tables 16-48 (Appendix III).

The data from the areas sampled in New England indicated the great variability that occurs. The pH values ranged between 5.0 and 10.7 (Table 1, Figure 2). Lower values were found in eastern New England; some were in bog ponds. The higher values were all from bodies of water either undergoing a planktonic bloom or choked with vascular vegetation. Two of the three values of 10.0 or above were from small, shallow bodies of water along the coast which

Table 1. Occurrence of New England *Potamogeton* and observed hydrogen ion concentration in lake and stream waters.*

Species	Hydrogen ion concentration Mean	Median	Range	Number Analyses
P. filiformis var. *borealis*	7.8	7.6	7.3 - 9.1	10
P. filiformis var. *macounii*	7.6	7.6	7.5 - 7.7	3
P. vaginatus	7.3	7.3		1
P. pectinatus	8.1	8.0	7.1 - 10.7	26
P. robbinsii	7.2	7.2	6.3 - 8.3	49
P. crispus	7.6	7.6	6.7 - 9.8	31
P. confervoides	6.3	6.5	5.3 - 6.8	11
P. zosteriformis	7.5	7.4	5.8 - 10.2	74
P. foliosus	7.8	7.6	6.5 - 9.8	62
P. friesii	8.0	7.5	7.0 - 9.8	12
P. strictifolius	7.7	7.8	7.0 - 8.4	5
P. pusillus var. *pusillus*	8.1	7.7	7.3 - 10.2	21
P. pusillus var. *gemmiparus*	6.7	6.6	6.3 - 7.1	8
P. pusillus var. *tenuissimus*	7.1	6.9	5.7 - 10.2	143
P. X *longiligulatus*	8.0	7.8	7.7 - 8.4	3
P. hillii	7.3	7.1	7.1 - 7.4	2
P. obtusifolius	7.4	7.3	6.7 - 8.2	18
P. lateralis	6.4	6.4		1
P. vaseyi	7.2	7.2	6.7 - 7.6	11
P. spirillus	7.0	6.8	5.9 - 10.2	78
P. diversifolius var. *diversifolius*	6.6	6.6		1
P. diversifolius var. *trichophyllus*	6.4	6.6	5.4 - 7.0	32
P. epihydrus var. *epihydrus*	7.6	7.4	6.9 - 8.6	15
P. epihydrus var. *ramosus*	6.8	6.7	5.0 - 9.5	154
P. alpinus var. *tenuifolius*	7.3	7.2	6.6 - 9.9	24
P. alpinus var. *subellipticus*	7.4	7.3	6.5 - 9.2	18
P. amplifolius	7.3	7.3	5.7 - 9.8	78
P. pulcher	6.5	6.6	5.6 - 7.5	21
P. nodosus	7.8	7.5	6.8 - 9.5	20
P. gramineus var. *gramineus*	7.3	7.2	5.7 - 9.8	85
P. gramineus var. *maximus*	6.8	6.9	5.0 - 7.6	15
P. gramineus var. *myriophyllus*	7.0	6.9	6.4 - 8.0	17
P. illinoensis	8.3	8.0	6.8 - 10.2	24
P. natans	7.1	6.9	5.0 - 9.8	152
P. oakesianus	6.4	6.6	5.6 - 7.2	33
P. praelongus	7.7	7.5	6.7 - 9.8	39
P. richardsonii	7.6	7.4	6.7 - 10.2	27
P. perfoliatus var. *bupleuroides*	7.3	7.1	6.5 - 9.8	46
total of sampling locations	7.2	7.0	5.0 - 10.7	321

*Taxa with less than five observations are not included in the statistical analysis.

Table 2. Occurrence of New England Potamogeton and observed total alkalinity in lake and stream waters.*

	Total alkalinity mg /l CaCO3			Number Analyses
	Mean	Median	Range	
P. filiformis var. borealis	65.95	63.50	24.0 - 88.0	10
P. filiformis var. macounii	76.00	85.00	55.0 - 88.0	3
P. vaginatus	103.00	103.00		1
P. pectinatus	93.83	92.50	30.0 - 231.5	26
P. robbinsii	23.58	21.00	3.0 - 100.0	49
P. crispus	69.58	76.50	12.0 - 170.0	31
P. confervoides	3.45	3.50	0.5 - 7.0	12
P. zosteriformis	49.34	40.00	4.5 - 123.5	74
P. foliosus	63.20	60.00	14.0 - 137.5	62
P. friesii	71.22	69.50	35.0 - 123.5	11
P. strictifolius	69.50	71.50	55.0 - 90.0	5
P. pusillus var. pusillus	61.02	56.00	25.0 - 114.5	21
P. pusillus var. gemmiparus	8.62	9.00	2.5 - 13.0	8
P. pusillus var. tenuissimus	30.26	16.00	2.5 - 169.0	143
P. X longiligulatus	84.66	90.00	71.5 - 92.5	3
P. hillii	121.75	111.00	111.0 - 132.5	2
P. obtusifolius	47.75	48.00	13.5 - 104.5	18
P. lateralis	13.50	13.50		1
P. vaseyi	21.77	21.00	7.0 - 45.0	11
P. spirillus	15.70	11.00	2.5 - 57.5	78
P. diversifolius var. diversifolius	2.00	2.00		1
P. diversifolius var. trichophyllus	6.19	4.50	1.5 - 21.0	32
P. epihydrus var. epihydrus	53.76	57.50	9.0 - 100.0	15
P. epihydrus var. ramosus	17.67	11.00	2.0 - 132.5	154
P. alpinus var. tenuifolius	33.58	19.50	4.0 - 115.0	24
P. alpinus var. subellipticus	49.80	49.00	10.0 - 104.5	18
P. amplifolius	29.16	23.00	3.5 - 123.5	78
P. pulcher	9.59	8.50	3.0 - 38.0	21
P. nodosus	72.75	62.00	5.0 - 231.5	20
P. gramineus var. gramineus	31.96	20.50	2.5 - 123.5	85
P. gramineus var. maximus	15.50	12.50	3.0 - 55.0	15
P. gramineus var. myriophyllus	18.73	16.50	3.5 - 78.0	17
P. illinoensis	67.95	65.50	20.0 - 123.5	24
P. natans	33.92	17.00	2.5 - 132.5	152
P. oakesianus	7.19	5.00	2.0 - 20.0	33
P. praelongus	46.25	36.00	8.0 - 123.5	39
P. richardsonii	43.61	36.00	13.5 - 107.0	27
P. perfoliatus var. bupleuroides	29.76	19.50	5.0 - 137.5	46
total of sampling locations	35.23	20.00	0.5 - 231.5	321

*Taxa with less than five observations are not included in the statistical analysis.

Table 3. Occurrence of New England Potamogeton and observed free carbon dioxide concentration in lake and stream waters.*

Species	Free carbon dioxide mg /1 Mean	Median	Range	Number Analyses
P. filiformis var. borealis	1.30	1.00	0.0 - 3.0	10
P. filiformis var. macounii	1.33	1.00	0.0 - 3.0	3
P. vaginatus	4.00	4.00		1
P. pectinatus	1.65	0.00	0.0 - 9.0	26
P. robbinsii	2.16	1.50	0.0 - 7.5	49
P. crispus	2.35	1.00	0.0 - 12.0	31
P. confervoides	3.31	2.50	1.0 - 10.0	11
P. zosteriformis	2.98	2.00	0.0 - 27.5	74
P. foliosus	2.58	1.00	0.0 - 27.5	62
P. friesii	2.59	1.50	0.0 - 12.0	12
P. strictifolius	4.30	1.00	0.0 - 12.0	5
P. pusillus var. pusillus	1.48	0.50	0.0 - 9.0	21
P. pusillus var. gemmiparus	2.75	1.50	1.0 - 6.0	8
P. pusillus var. tenuissimus	2.58	2.00	0.0 - 12.5	143
P. X longiligulatus	5.83	8.50	0.0 - 9.0	3
P. hillii	12.50	10.00	10.0 - 15.0	2
P. obtusifolius	2.19	1.50	0.0 - 7.0	18
P. lateralis	4.00	4.00		1
P. vaseyi	3.77	1.00	1.0 - 27.5	11
P. spirillus	2.63	2.00	0.0 - 27.5	78
P. diversifolius var. diversifolius	1.00	1.00		1
P. diversifolius var. trichophyllus	3.43	2.50	0.5 - 14.0	32
P. epihydrus var. epihydrus	1.60	1.00	0.0 - 27.5	15
P. epihydrus var. ramosus	3.16	2.50	0.0 - 27.5	154
P. alpinus var. tenuifolius	2.39	2.00	0.0 - 7.0	24
P. alpinus var. subellipticus	3.22	1.50	0.0 - 14.0	18
P. amplifolius	2.22	1.50	0.0 - 9.0	78
P. pulcher	4.30	3.50	1.0 - 14.0	21
P. nodosus	2.45	1.50	0.0 - 9.0	20
P. gramineus var. gramineus	2.33	1.50	0.0 - 27.5	85
P. gramineus var. maximus	2.17	2.00	0.0 - 4.5	15
P. gramineus var. myriophyllus	2.21	1.50	0.0 - 7.5	17
P. illinoensis	1.08	0.00	0.0 - 7.5	24
P. natans	3.13	2.50	0.0 - 18.5	152
P. oakesianus	3.34	2.50	1.0 - 9.5	33
P. praelongus	1.40	1.00	0.0 - 7.0	39
P. richardsonii	1.87	2.00	0.0 - 4.5	27
P. perfoliatus var. bupleuroides	2.03	1.50	0.0 - 7.5	46
total of sampling locations	3.08	2.00	0.0 - 27.5	321

*Taxa with less than five observations are not included in the statistical analysis.

Table 4. Occurrence of New England Potamogeton and observed nitrate concentration in lake and stream waters.*

Species	Nitrates mg /l Mean	Median	Range	Number Analyses
P. filiformis var. borealis	13.08	4.00	0.5 - 32.5	10
P. filiformis var. macounii	1.33	1.00	0.0 - 3.0	3
P. vaginatus	20.00	20.00		1
P. pectinatus	6.65	4.50	1.5 - 15.5	26
P. robbinsii	5.54	5.00	0.8 - 19.5	49
P. crispus	8.96	7.70	2.0 - 24.0	31
P. confervoides	3.45	3.50	1.7 - 6.5	11
P. zosteriformis	6.08	4.60	0.0 - 24.0	74
P. foliosus	7.89	5.30	0.0 - 32.5	62
P. friesii	8.78	6.60	4.3 - 20.0	12
P. strictifolius	2.88	2.50	1.5 - 5.0	5
P. pusillus var. pusillus	7.13	5.00	1.0 - 17.4	21
P. pusillus var. gemmiparus	2.50	2.40	1.7 - 3.3	8
P. pusillus var. tenuissimus	4.84	3.30	0.0 - 24.0	143
P. X longiligulatus	6.50	2.50	1.5 - 15.5	3
P. hillii	5.00	2.00	2.0 - 8.0	2
P. obtusifolius	4.96	4.00	0.0 - 11.5	18
P. lateralis	3.30	3.30		1
P. vaseyi	5.25	5.50	0.5 - 10.5	11
P. spirillus	4.35	3.10	0.5 - 13.0	78
P. diversifolius var. diversifolius	6.00	6.00		1
P. diversifolius var. trichophyllus	4.15	3.30	1.2 - 8.7	32
P. epihydrus var. epihydrus	4.27	4.30	0.0 - 8.3	15
P. epihydrus var. ramosus	4.24	3.10	0.0 - 17.5	154
P. alpinus var. tenuifolius	5.08	4.30	0.5 - 15.0	24
P. alpinus var. subellipticus	6.52	4.00	0.0 - 18.0	18
P. amplifolius	4.91	3.30	0.5 - 22.0	78
P. pulcher	4.78	3.10	0.0 - 10.0	21
P. nodosus	5.66	4.50	1.5 - 15.5	20
P. gramineus var. gramineus	5.60	3.50	0.0 - 24.0	85
P. gramineus var. maximus	3.76	3.10	2.5 - 6.0	15
P. gramineus var. myriophyllus	5.94	5.30	1.0 - 17.5	17
P. illinoensis	6.63	4.30	1.0 - 24.0	24
P. natans	5.27	3.80	0.0 - 24.0	152
P. oakesianus	4.74	3.20	0.0 - 13.0	33
P. praelongus	6.58	4.80	0.0 - 24.0	39
P. richardsonii	5.78	5.00	0.0 - 4.5	27
P. perfoliatus var. bupleuroides	5.27	4.30	0.8 - 17.4	46
total of sampling locations	5.47	4.00	0.0 - 32.5	321

*Taxa with less than five observations are not included in the statistical analysis.

Table 5. Occurrence of New England Potamogeton and observed total phosphate concentration in lake and stream waters.*

Species	Total phosphates mg /1 Mean	Median	Range	Number Analyses
P. filiformis var. borealis	.19	.04	.02 - .78	10
P. filiformis var. macounii	.09	.09	.02 - .16	3
P. vaginatus	.25	.25		1
P. pectinatus	.23	.18	.02 - 1.65	26
P. robbinsii	.13	.10	.00 - .45	49
P. crispus	.25	.16	.02 - 1.12	31
P. confervoides	.12	.08	.02 - .30	11
P. zosteriformis	.16	.12	.00 - 1.00	74
P. foliosus	.15	.10	.00 - .78	62
P. friesii	.24	.18	.02 - .58	12
P. strictifolius	.19	.12	.09 - .48	5
P. pusillus var. pusillus	.15	.10	.02 - .41	21
P. pusillus var. gemmiparus	.22	.10	.08 - .60	8
P. pusillus var. tenuissimus	.17	.10	.00 - 1.12	143
P. X longiligulatus	.16	.17	.12 - .23	3
P. hillii	.08	.06	.06 - .10	2
P. obtusifolius	.14	.10	.00 - .60	18
P. lateralis	.12	.12		1
P. vaseyi	.13	.15	.02 - .20	11
P. spirillus	.17	.11	.00 - 1.12	78
P. diversifolius var. diversifolius	.10	.10		1
P. diversifolius var. trichophyllus	.16	.10	.02 - .60	32
P. epihydrus var. epihydrus	.14	.12	.02 - .32	15
P. epihydrus var. ramosus	.15	.10	.00 - 1.12	154
P. alpinus var. tenuifolius	.12	.10	.00 - .23	24
P. alpinus var. subellipticus	.11	.06	.00 - .20	18
P. amplifolius	.14	.10	.00 - 1.00	78
P. pulcher	.18	.10	.20 - .60	21
P. nodosus	.26	.20	.02 - 1.65	20
P. gramineus var. gramineus	.12	.10	.00 - .78	85
P. gramineus var. maximus	.12	.12	.01 - .60	15
P. gramineus var. myriophyllus	.10	.10	.00 - .21	17
P. illinoensis	.16	.10	.00 - .58	24
P. natans	.16	.12	.00 - 1.00	152
P. oakesianus	.14	.10	.02 - .45	33
P. praelongus	.13	.10	.00 - .58	39
P. richardsonii	.12	.09	.00 - .41	27
P. perfoliatus var. bupleuroides	.14	.10	.00 - .60	46
total of sampling locations	.15	.10	.00 - 1.65	321

*Taxa with less than five observations are not included in the statistical analysis.

Table 6. Occurrence of New England Potamogeton and observed chloride concentration in lake and stream waters.*

Species	Chlorides mg /l Mean	Median	Range	Number Analyses
P. filiformis var. borealis	10.6	7.1	2.2 - 24.0	10
P. filiformis var. macounii	2.3	2.2	2.2 - 2.7	3
P. vaginatus	13.1	13.1		1
P. pectinatus	408.2	13.1	3.3 - 4095.0	26
P. robbinsii	19.5	10.4	1.1 - 174.7	49
P. crispus	25.7	13.1	4.4 - 123.4	31
P. confervoides	8.2	3.8	1.6 - 25.1	12
P. zosteriformis	15.9	9.8	2.2 - 245.7	74
P. foliosus	16.9	10.4	2.2 - 123.4	62
P. friesii	17.3	10.9	4.4 - 84.6	11
P. strictifolius	9.0	6.0	2.7 - 22.9	5
P. pusillus var. pusillus	11.9	10.9	4.4 - 26.2	21
P. pusillus var. gemmiparus	9.7	8.4	2.2 - 18.0	8
P. pusillus var. tenuissimus	73.5	10.9	1.6 - 4095.0	143
P. X longiligulatus	15.4	20.7	2.7 - 22.9	3
P. hillii	10.1	8.2	8.2 - 12.0	2
P. obtusifolius	16.7	7.6	1.6 - 84.6	18
P. lateralis	245.7	245.7		1
P. vaseyi	8.7	8.2	3.3 - 13.1	11
P. spirillus	20.1	8.7	1.7 - 234.8	78
P. diversifolius var. diversifolius	1.6	1.6		1
P. diversifolius var. trichophyllus	26.3	8.7	1.6 - 202.0	32
P. epihydrus var. epihydrus	14.3	8.2	2.2 - 84.6	15
P. epihydrus var. ramosus	16.0	8.7	1.6 - 191.0	154
P. alpinus var. tenuifolius	9.0	5.5	1.6 - 84.6	24
P. alpinus var. subellipticus	6.3	6.6	1.6 - 12.0	18
P. amplifolius	10.6	7.6	1.6 - 84.6	78
P. pulcher	27.8	16.5	3.8 - 107.0	21
P. nodosus	13.8	10.9	2.7 - 62.8	20
P. gramineus var. gramineus	10.9	6.0	1.6 - 84.6	85
P. gramineus var. maximus	8.1	3.8	1.6 - 48.1	15
P. gramineus var. myriophyllus	9.8	7.6	2.2 - 52.4	17
P. illinoensis	12.9	9.8	3.3 - 37.1	24
P. natans	16.8	8.7	1.6 - 245.7	152
P. oakesianus	43.3	7.6	1.6 - 873.6	33
P. praelongus	9.3	7.6	2.2 - 33.3	39
P. richardsonii	11.0	7.6	1.6 - 84.6	27
P. perfoliatus var. bupleuroides	135.1	10.9	1.6 - 3822.0	46
total of sampling locations	65.4	10.4	1.6 - 4095.0	321

*Taxa with less than five observations are not included in the statistical analysis.

were high in chlorides. The median value for all sampled areas was 7.0. Waters containing Potamogeton pectinatus and P. illinoensis had the highest median pH of 8.0, and P. confervoides was the lowest at 6.5.

Alkalinity ranged between 0.5 and 231.5 mg/l $CaCO_3$ (Table 2, Figure 4). Again, the lower values were from eastern New England, especially in bog ponds. The lowest, 0.5 mg/l $CaCO_3$ was from a sphagnum bog pond in central New Hampshire. Other low values occurred in north central Massachusetts. Most of the high values were found in the western border regions of New England; Aroostook County, Maine; northern Vermont; and a few clay-pit ponds in Cambridge, Massachusetts. The highest value encountered was 231.5 mg/l $CaCO_3$ from Dead Creek, Vermont. The median alkalinity for all sites was 20.0 mg/l $CaCO_3$. Potamogeton pectinatus obtained the highest median value of 92.5 mg/l $CaCO_3$ and the lowest mean was P. confervoides at 3.5 mg/l $CaCO_3$.

Free carbon dioxide occurred from 0.0 to 27.5 mg/l (Table 3). Many sites had a 0.0 mg/l phenophthalein reading which was found wherever the pH was approximately 8.4--the point where the concentrations of free CO_2 and carbonates are in equilibrium (Hutchinson, 1951). Thirteen values were 10.0 mg/l free CO_2 or more; of these, ten were from streams, rivers or swamps. The lower values were from ponds and lakes. The median value for all sites was 2.00 mg/l free CO_2. The highest median occurred at 3.50 mg/l for Potamogeton pulcher, and the lowest median was 0.0 mg/l for

P. pectinatus and P. illinoensis. Potamogeton illinoensis had the lower mean value.

Nitrate values were from 0.0 to 32.5 mg/l (Table 4). Most of the higher nitrate values come from agricultural regions or from well populated areas. A pond located at the edge of a potato field in Aroostook County, Maine, had the highest value. The overall median value was 4.0 mg/l. Potamogeton crispus was found in water with the highest median value of 7.7 mg/l, while P. pusillus var. gemmiparus had the lowest value of 2.4 mg/l.

Phosphate values were between 0.0 mg/l and 1.65 mg/l, with a median of 0.10 mg/l (Table 5). All values over 1.00 mg/l came from streams and brooks. Values of 0.30 mg/l and above occurred in twelve streams and brooks, while ten were from lakes and ponds. Many of those ponds and lakes were from agricultural areas where they were bordered by corn and potato fields. Potamogeton filiformis var. borealis had the lowest median value at 0.04 mg/l while P. nodosus had the highest median value at 0.20 mg/l.

Chloride values had a large distribution due to brackish water ponds which were sampled along the coast. The highest value sampled was 4095.0 mg/l while the lowest was 1.6 mg/l (Table 6). The highest value from inland non-brackish waters was 245.7 mg/l. Potamogeton confervoides and P. gramineus var. myriophyllus had the lowest median value of 3.8 mg/l. Potamogeton pulcher at 16.5 mg/l was the highest, while P. pectinatus at 13.1 mg/l was the next highest. These values are misleading since P. pectinatus and P. perfoliatus var. bupleuroides were found at values higher than 3822 mg/l in brackish ponds along the coast.

Duncan's Multiple Range test for pH and alkalinity indicates statistically by adjacent lines (Figures 1 and 3) the expected average values of plants which may be found together. Because these are average and not extreme values, more plants actually are found occurring in the field (Figures 2 and 4) than indicated by Duncan's test. Observing field and statistical results, one can see that the Potamogetons of extremely high or low values do not occur in the same bodies of water, but taxa of mid-range values may occur together. Plants found in waters of high and low pH shown in Figure 1 are found together in Lake Quonnipaug, Connecticut, where P. pulcher and P. illinoensis occur at a pH of 6.8. Alkalinity comparisons between test results and field observations indicate that the first point where the extremes in Duncan's test occur is, again, in Lake Quonnipaug, Connecticut. At an alkalinity of 56.0 mg/l $CaCO_3$ P. illinoensis and P. spirillus are found together. Potamogeton gramineus var. maximus and P. strictifolius were reported in Warden Pond, Vermont, at 55.0 mg/l $CaCO_3$.

The results of the correlations shown in the matrix (Table 7) indicate that alkalinity and pH measures were relatively independent and that alkalinity provides a better measure than pH. Hydrogen ion concentration (pH) may be altered by a number of factors, e.g. plankton and aquatic macrophytes (Steenis, 1932; Ruttner, 1963), and therefore was discarded in favor of alkalinity. The matrix shows a higher correlation of the variables with pH except with CO_2. Since a lower correlation indicates the same source of variation is not being measured, alkalinity is statistically better, as well as being more stable temporarily than pH. Ruttner (1952) notes pH as a constantly changing factor influenced by photosynthesis. Alkalinity was chosen because tests were not taken at the same time of day under the same weather conditions and pH was found to be the poorer variable statistically.

The tests of the difference between means based on alkalinity (Table 8) indicate the clusters formed. Graphically, the clusters of taxa based on alkalinity and the other test variables are illustrated in Figures 5-9. These clusters are indicated by the vertical lines. Figures 10-15 show that the variables other than alkalinity do not form clusters. Results from the analysis of variance between clusters (Tables 49-54, Appendix V), indicate that alkalinity is the major factor from all tested variables responsible for separating the groups of taxa and is not due to chance. Nitrates are the next most significant, while phosphates and carbon dioxide are of low statistical significance. Only when the brackish water values are included do chlorides contribute to clustering of the Potamogeton.

The effect of the six chemical variables on the taxa within clusters (Tables 55-60, Appendix V) indicates results similar to those between clusters (Tables 49-54,

Appendix V). Taxon distribution influenced by alkalinity is highly significant. Nitrate concentrations are found to have some effect on the distribution of the different taxa. Carbon dioxide and total phosphate analysis indicates low statistical significance.

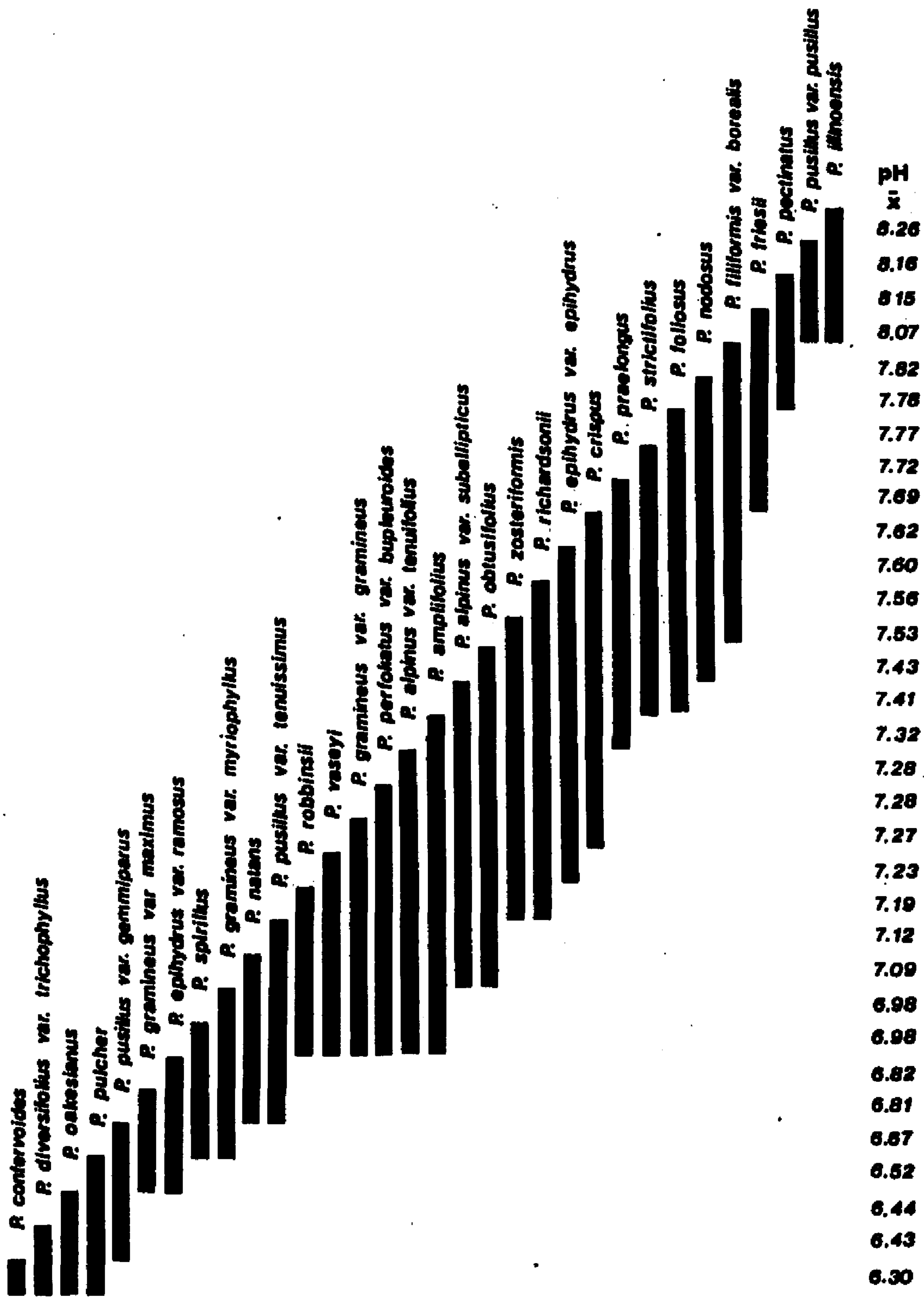


Figure 1. Duncan's multiple range test--hydrogen ion concentration (pH).

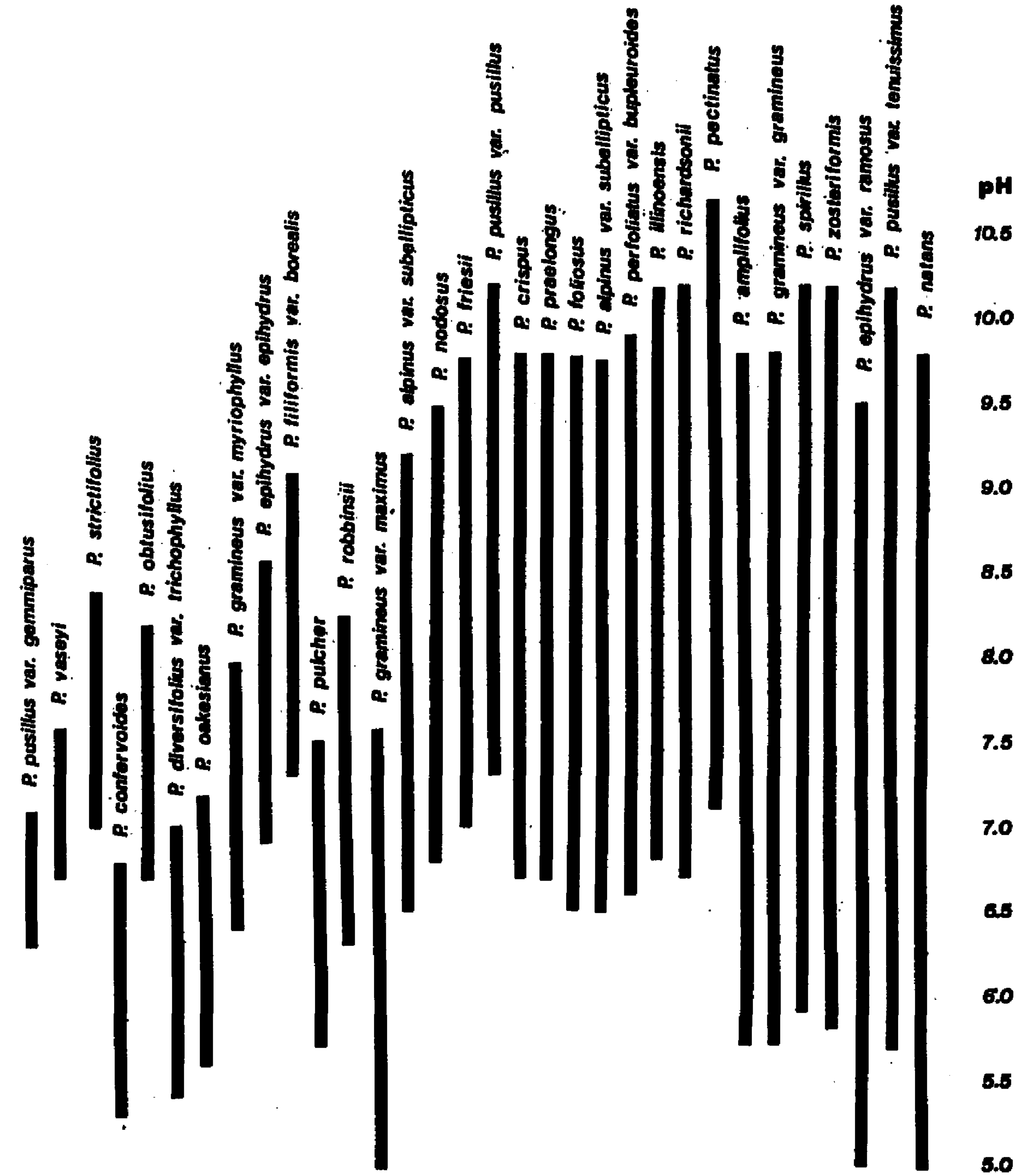


Figure 2. Hydrogen ion concentration (pH) range of <u>Potamogeton</u> taxa from New England waters.

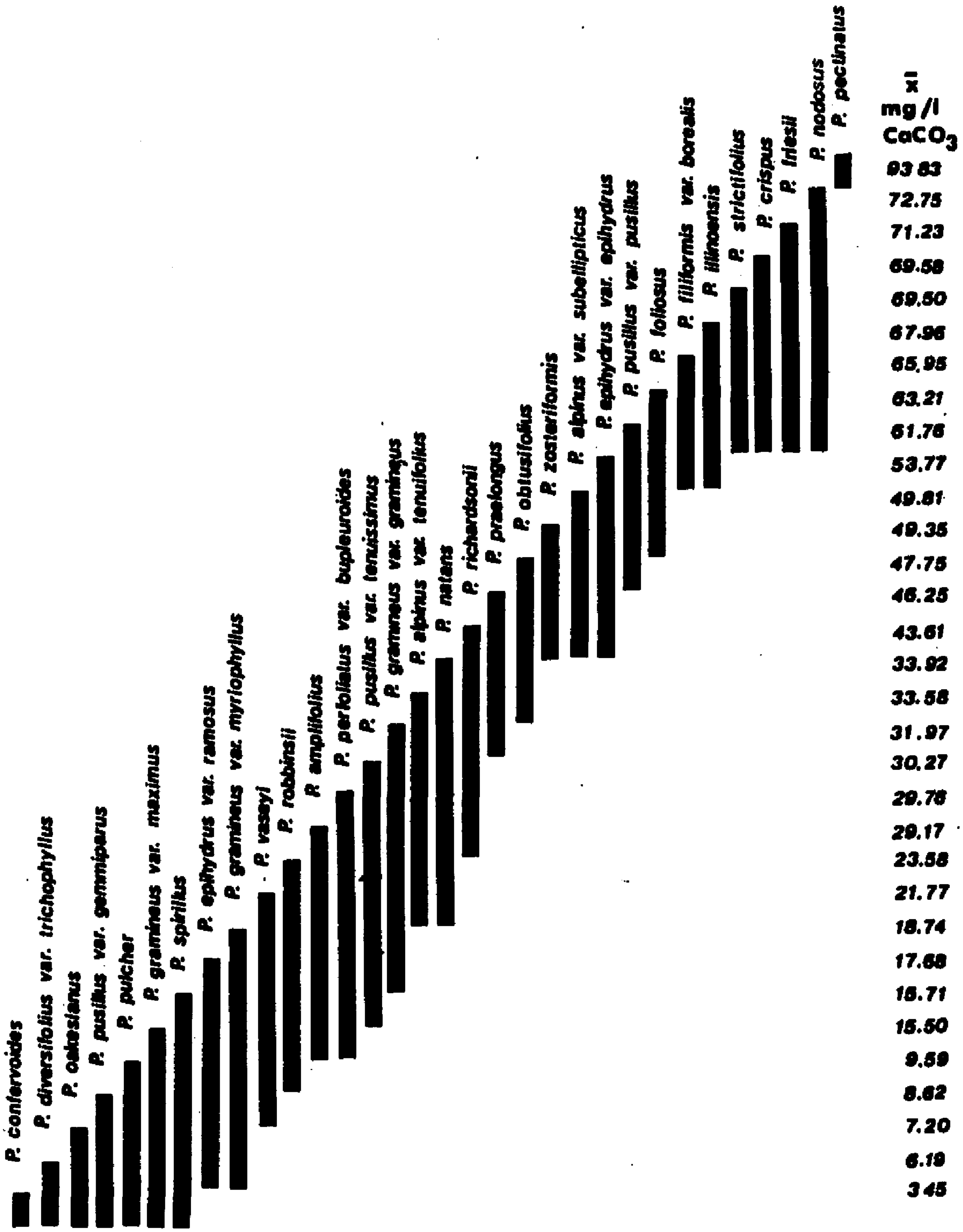


Figure 3. Duncan's multiple range test--total alkalinity.

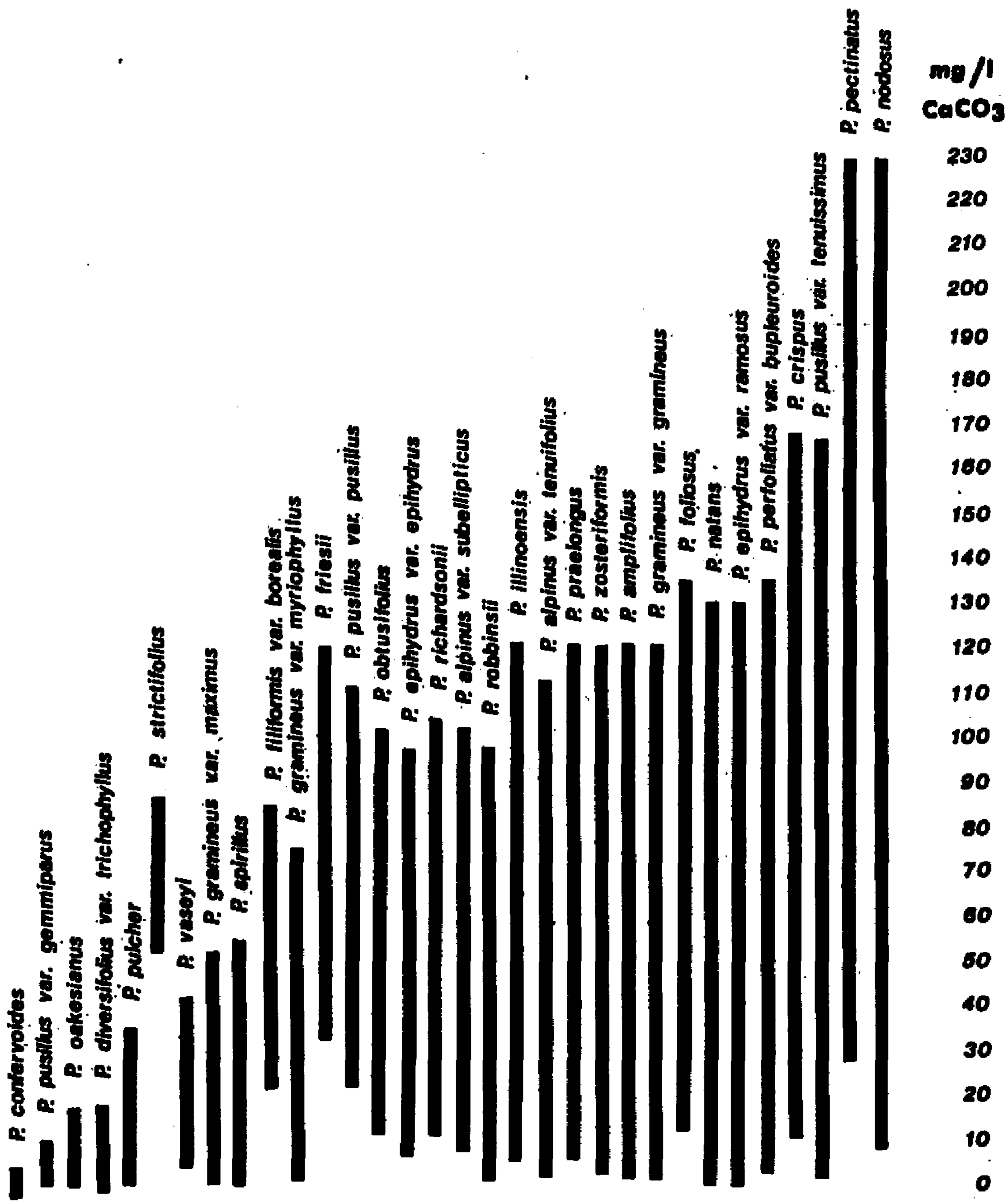


Figure 4. Total alkalinity range of Potamogeton taxa from New England waters.

Table 7. Correlation matrix

	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
pH	1.00	.85	.02	.64	.41	-.04
$CaCO_3$		1.00	.29	.54	.34	-.01
CO_2			1.00	.06	.40	.32
NO_3^-				1.00	.26	.15
PO_4^{-3}					1.00	.48
Cl^-						1.00

Table 8. Clusters of *Potamogeton* taxa based upon total alkalinity--differences between means.

$\bar{x}$* mg/l	$\bar{x}-\bar{x}_2$	Species
93.827		*P. pectinatus*
72.750	21.077	*P. nodosus*
71.227	1.523	*P. friesii*
69.581	1.646	*P. crispus*
69.500	.081	*P. strictifolius*
67.958	1.542	*P. illinoensis*
65.950	2.008	*P. filiformis* var. *borealis*
63.210	2.740	*P. foliosus*
61.762	1.448	*P. pusillus* var. *pusillus*
53.767	7.995	*P. epihydrus* var. *epihydrus*
49.806	3.961	*P. alpinus* var. *subellipticus*
49.345	.461	*P. zosteriformis*
47.750	1.595	*P. obtusifolius*
46.250	1.500	*P. praelongus*
43.611	2.639	*P. richardsonii*
33.921	9.690	*P. natans*
33.583	.338	*P. alpinus* var. *tenuifolius*
31.965	1.618	*P. gramineus* var. *gramineus*
30.269	1.695	*P. pusillus* var. *tenuissimus*
29.761	.508	*P. amplifolius*
29.167	.594	*P. perfoliatus* var. *bupleuroides*
23.582	5.585	*P. robbinsii*
21.773	1.809	*P. vaseyi*
18.735	3.038	*P. gramineus* var. *myriophyllus*
17.679	1.056	*P. epihydrus* var. *ramosus*
15.705	1.974	*P. spirillus*
15.500	.205	*P. gramineus* var. *maximus*
9.595	5.905	*P. pulcher*
8.625	.970	*P. pusillus* var. *gemmiparus*
7.197	1.428	*P. oakesianus*
6.193	1.003	*P. diversifolius* var. *trichophyllus*
3.454	2.739	*P. confervoides*

*Values computed to thousandths, tested to tenths.

Figure 5. Distribution of means--total alkalinity vs. hydrogen ion concentration (pH).

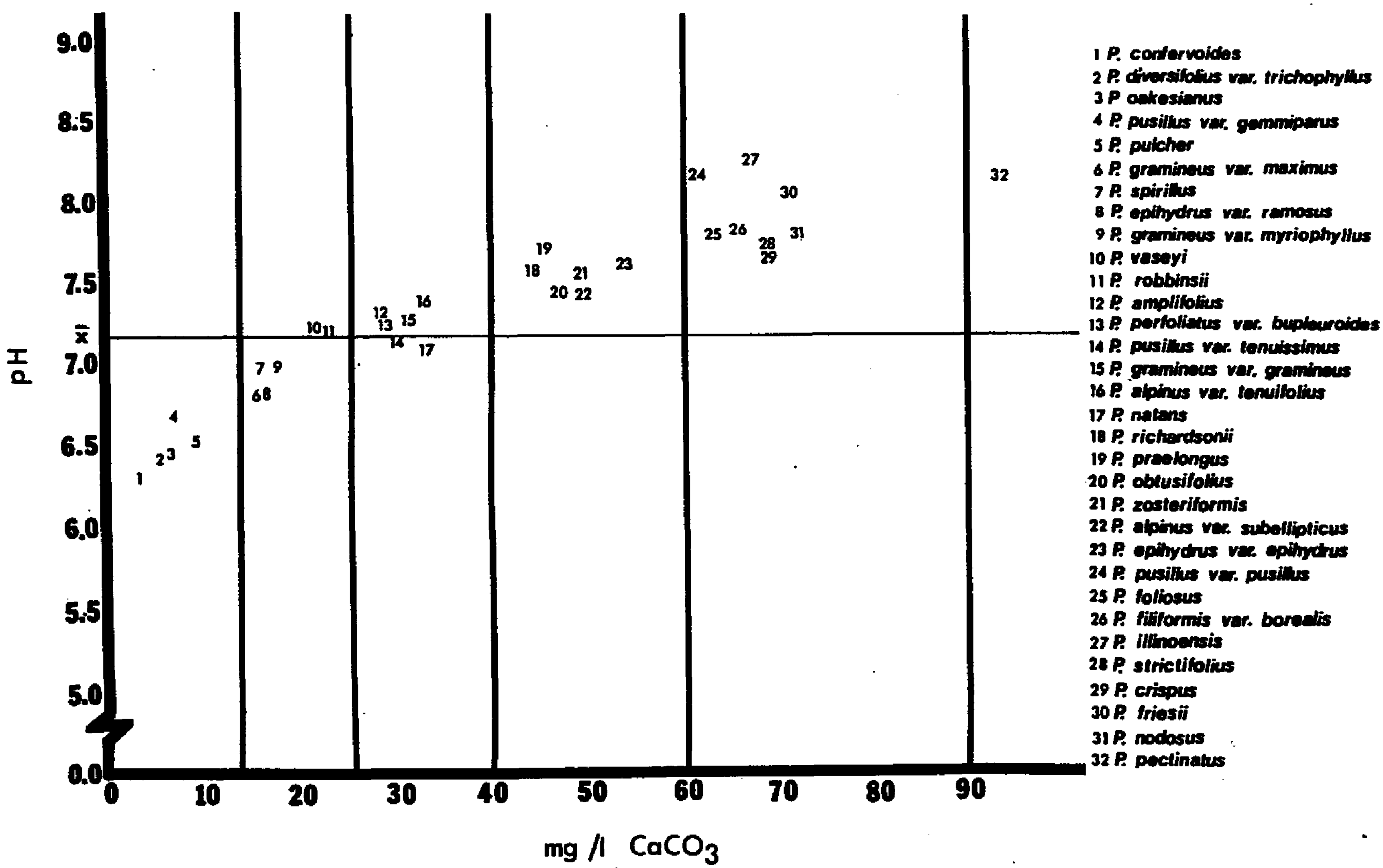
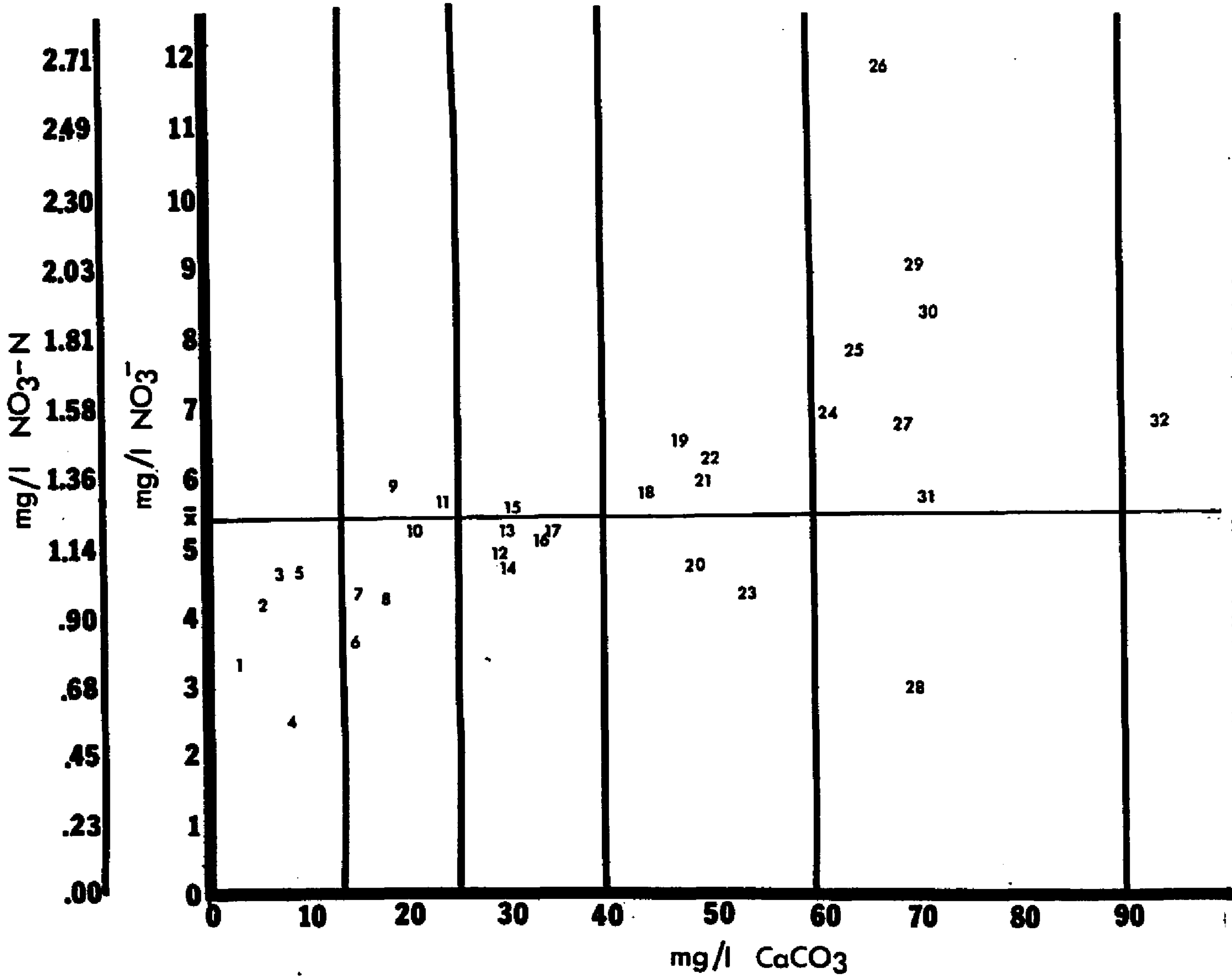

pH
9.0
8.5
8.0
7.5
x̄
7.0
6.5
6.0
5.5
5.0
0.0
0
10
20
30
40
50
60
70
80
90
mg /l $CaCO_3$
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

Figure 6. Distribution of means--total alkalinity vs. nitrates.



1 *P. confervoides*
2 *P. diversifolius* var. *trichophyllus*
3 *P. oakesianus*
4 *P. pusillus* var. *gemmiparus*
5 *P. pulcher*
6 *P. gramineus* var. *maximus*
7 *P. spirillus*
8 *P. epihydrus* var. *ramosus*
9 *P. gramineus* var. *myriophyllus*
10 *P. vaseyi*
11 *P. robbinsii*
12 *P. amplifolius*
13 *P. perfoliatus* var. *bupleuroides*
14 *P. pusillus* var. *tenuissimus*
15 *P. gramineus* var. *gramineus*
16 *P. alpinus* var. *tenuifolius*
17 *P. natans*
18 *P. richardsonii*
19 *P. praelongus*
20 *P. obtusifolius*
21 *P. zosteriformis*
22 *P. alpinus* var. *subellipticus*
23 *P. epihydrus* var. *epihydrus*
24 *P. pusillus* var. *pusillus*
25 *P. foliosus*
26 *P. filiformis* var. *borealis*
27 *P. illinoensis*
28 *P. strictifolius*
29 *P. crispus*
30 *P. friesii*
31 *P. nodosus*
32 *P. pectinatus*

Figure 7. Distribution of means--total alkalinity vs. chlorides.

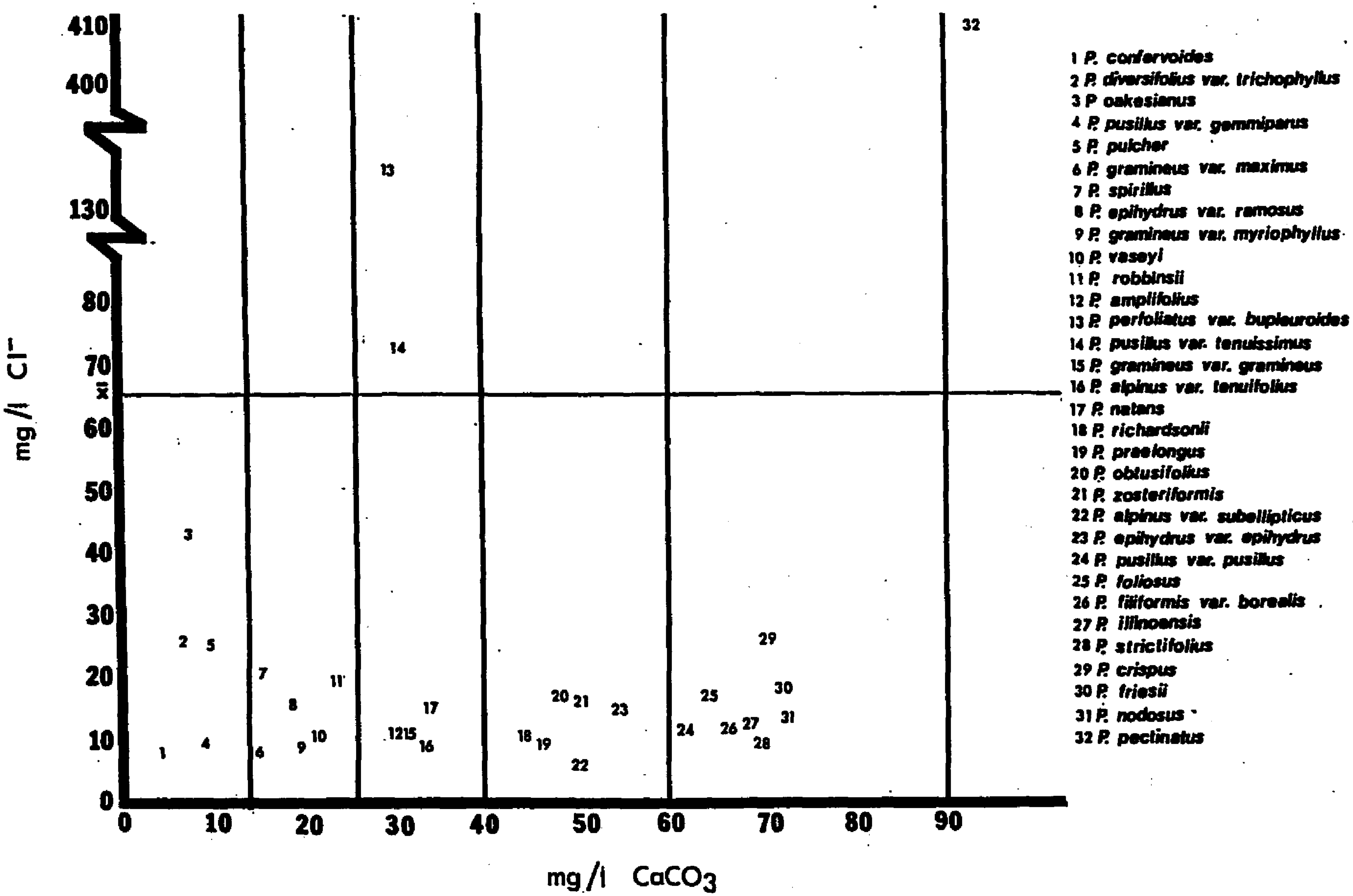

mg/l Cl⁻
mg/l CaCO3
x̄
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

Figure 8. Distribution of means--total alkalinity vs. total phosphates.

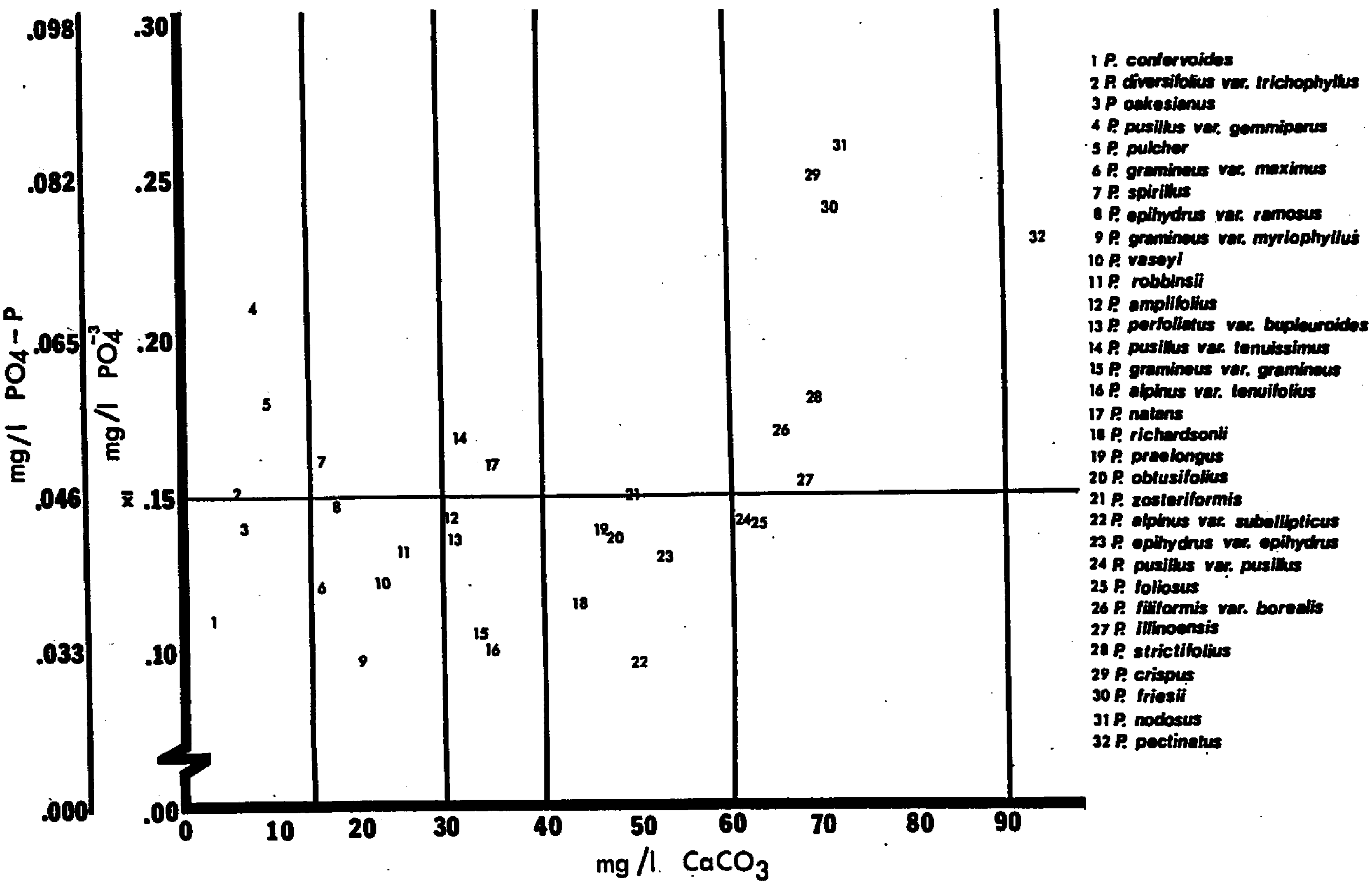

.098
.082
.065
.046
.033
.000
mg/l PO4 – P
.30
.25
.20
.15
.10
.00
mg/l PO4^-3
x̄
0
10
20
30
40
50
60
70
80
90
mg/l CaCO3
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

Figure 9. Distribution of means--total alkalinity vs. free carbon dioxide.

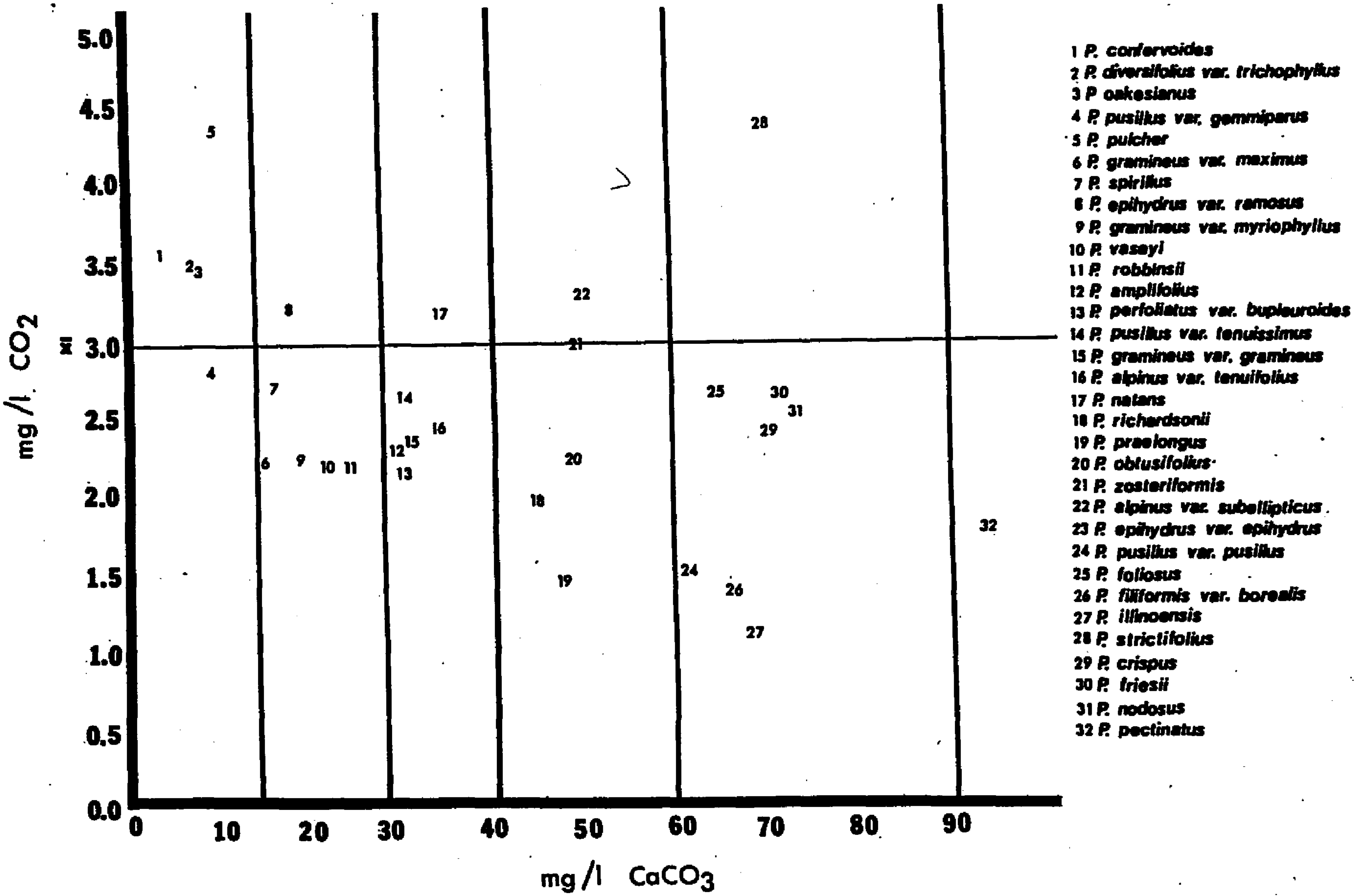

5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
mg/l CO2
0
10
20
30
40
50
60
70
80
90
mg/l CaCO3
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

Figure 10. Distribution of means--free carbon dioxide vs. nitrates.

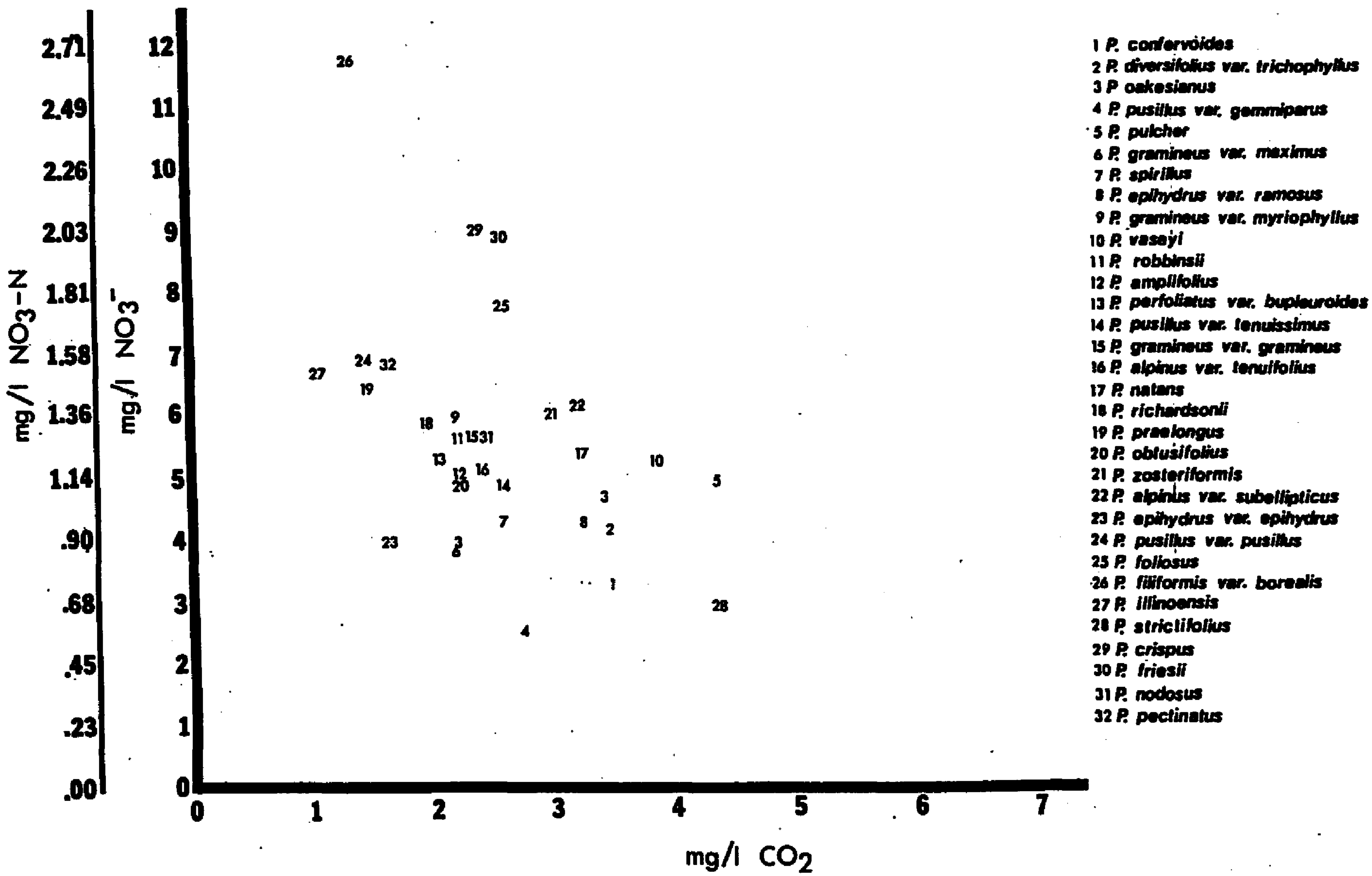

mg/l NO_3–N
mg/l NO_3^-
mg/l CO_2
2.71
2.49
2.26
2.03
1.81
1.58
1.36
1.14
.90
.68
.45
.23
.00
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P. oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

Figure 11. Distribution of means--free carbon dioxide vs. total phosphates.

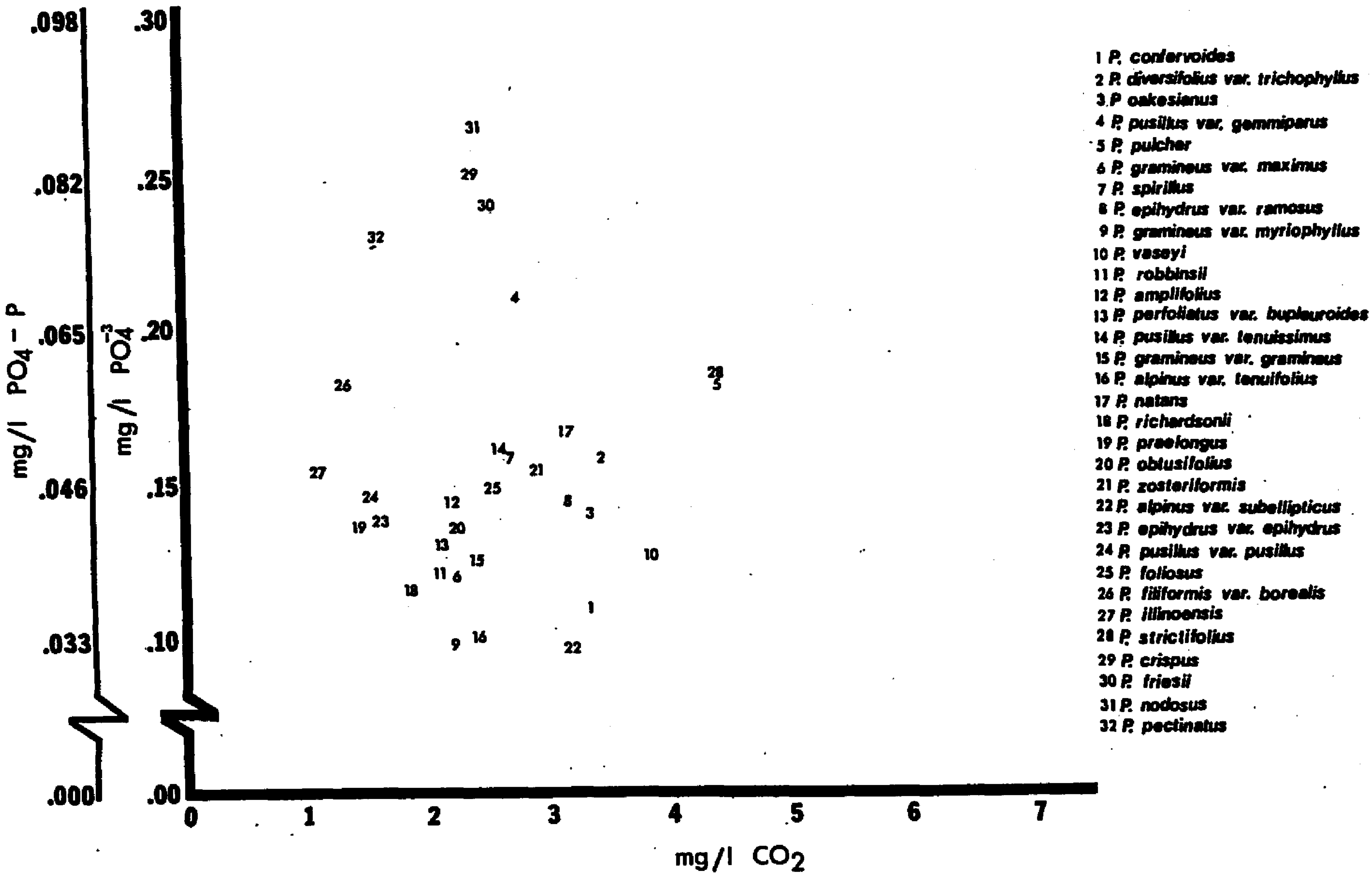

mg/l PO4 - P
mg/l PO4-3
mg/l CO2
.098
.082
.065
.046
.033
.000
.30
.25
.20
.15
.10
.00
0
1
2
3
4
5
6
7
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P. oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

Figure 12. Distribution of means--chlorides vs. free carbon dioxide.

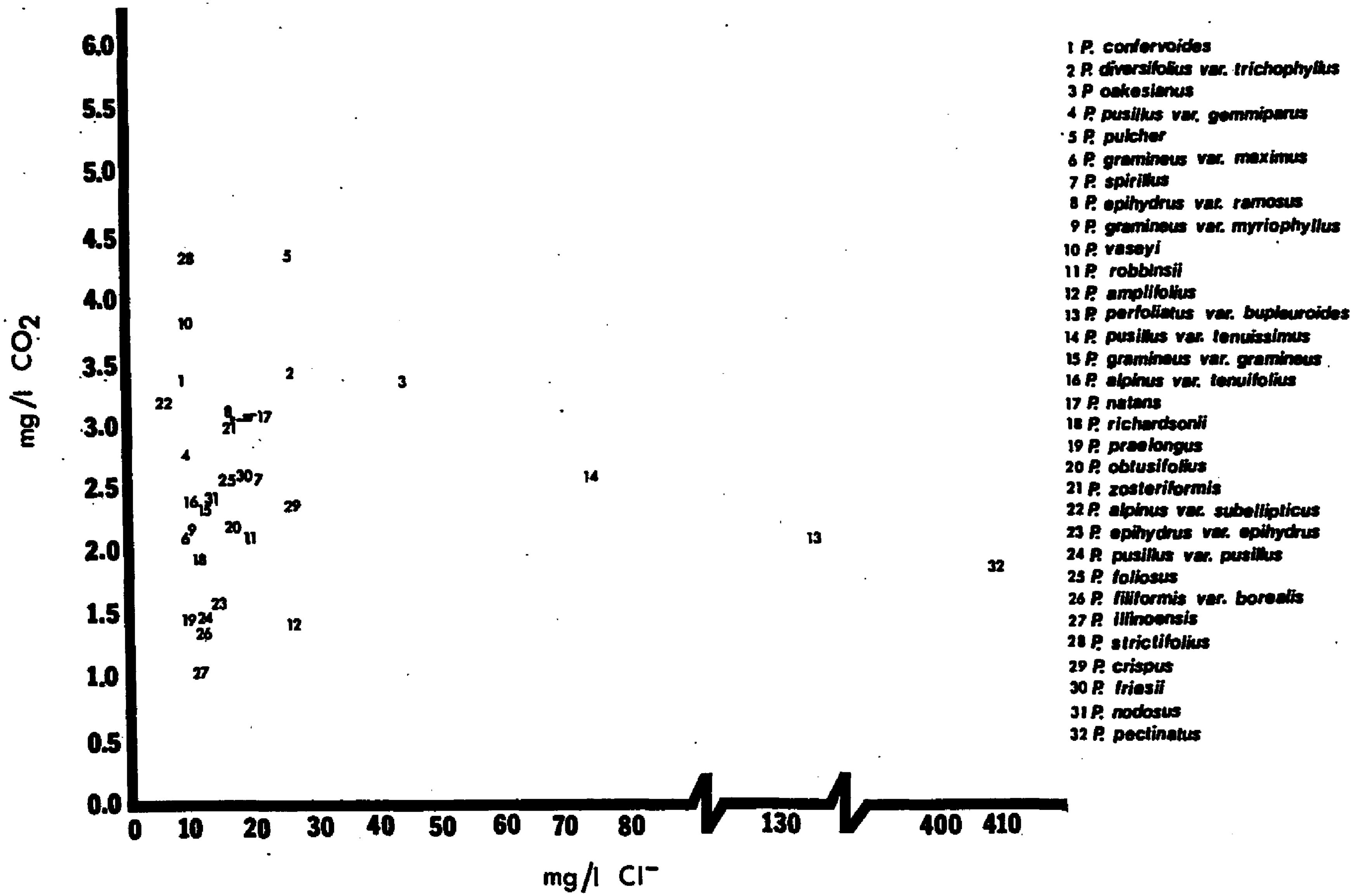
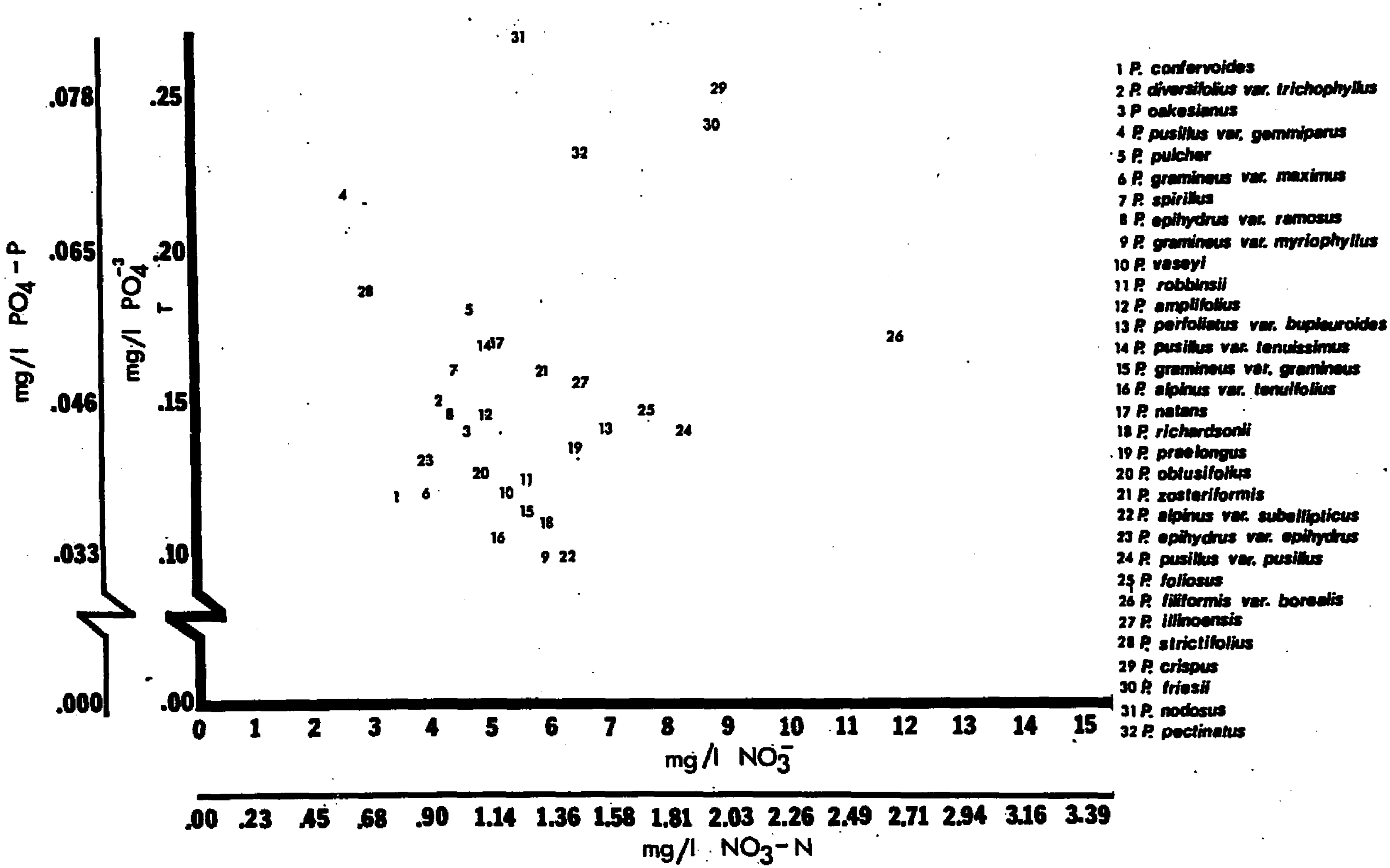
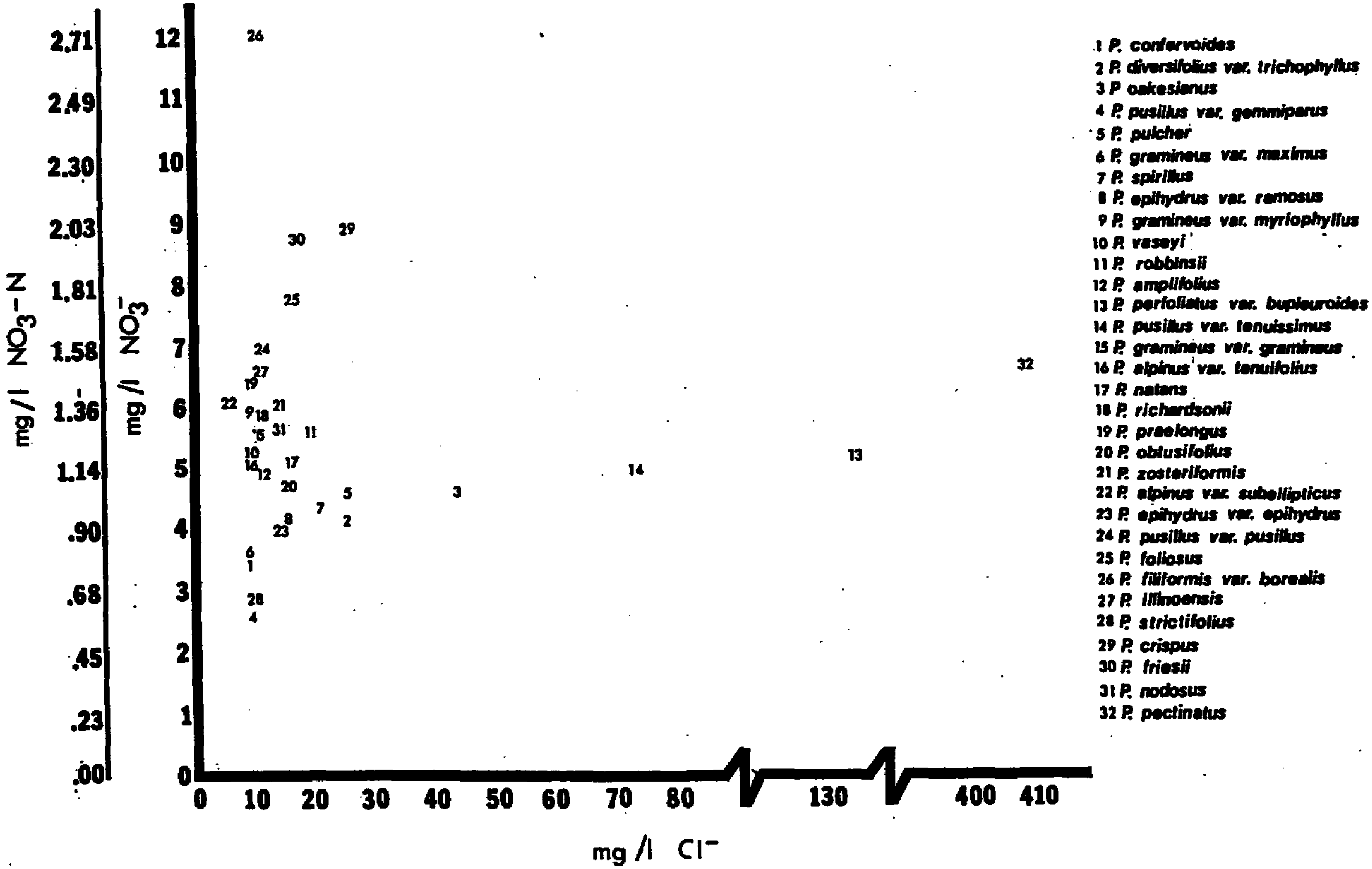

mg/l CO_2
mg/l Cl^-
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
60
70
80
130
400
410
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P. oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

Figure 13. Distribution of means--nitrates vs. total phosphates.



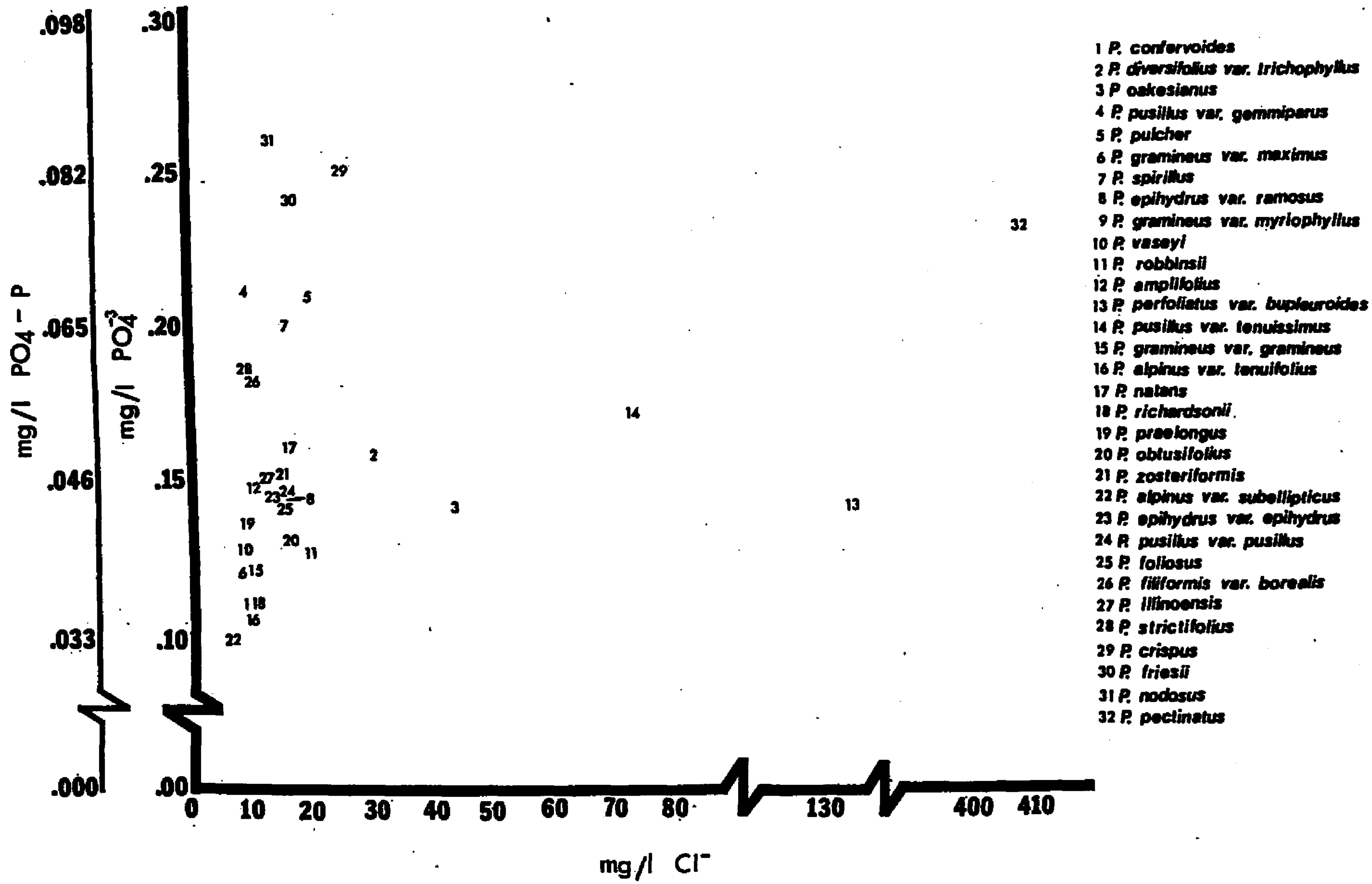
mg/l PO4 − P
.078
.065
.046
.033
.000
mg/l PO4 −3 T
.25
.20
.15
.10
.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
mg/l NO3−
.00 .23 .45 .68 .90 1.14 1.36 1.58 1.81 2.03 2.26 2.49 2.71 2.94 3.16 3.39
mg/l NO3−N
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P. oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

Figure 14. Distribution of means--chlorides vs. nitrates.



mg /l NO3-N
mg /l NO3
mg /l Cl-
2.71
2.49
2.30
2.03
1.81
1.58
1.36
1.14
.90
.68
.45
.23
.00
0
1
2
3
4
5
6
7
8
9
10
11
12
0 10 20 30 40 50 60 70 80 130 400 410
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P. oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

Figure 15. Distribution of means--chlorides vs. total phosphates.


mg/l PO4 - P
.098
.082
.065
.046
.033
.000
mg/l PO4-3
.30
.25
.20
.15
.10
.00
0 10 20 30 40 50 60 70 80 130 400 410
mg/l Cl-
1 P. confervoides
2 P. diversifolius var. trichophyllus
3 P oakesianus
4 P. pusillus var. gemmiparus
5 P. pulcher
6 P. gramineus var. maximus
7 P. spirillus
8 P. epihydrus var. ramosus
9 P. gramineus var. myriophyllus
10 P. vaseyi
11 P. robbinsii
12 P. amplifolius
13 P. perfoliatus var. bupleuroides
14 P. pusillus var. tenuissimus
15 P. gramineus var. gramineus
16 P. alpinus var. tenuifolius
17 P. natans
18 P. richardsonii.
19 P. praelongus
20 P. obtusifolius
21 P. zosteriformis
22 P. alpinus var. subellipticus
23 P. epihydrus var. epihydrus
24 P. pusillus var. pusillus
25 P. foliosus
26 P. filiformis var. borealis
27 P. illinoensis
28 P. strictifolius
29 P. crispus
30 P. friesii
31 P. nodosus
32 P. pectinatus

DISCUSSION

Waters tested in this study were found to have a mean total alkalinity of 35.23 mg/l $CaCO_3$ (median 20.00 mg/l $CaCO_3$) which may be misleading since alkaline regions were extensively visited to obtain plants. The values otherwise would have been much lower. The North Atlantic drainage basin has a mean bicarbonate value of 12.2 mg/l (Martin, 1973). This basin is undefined but probably includes most of New England. The value of 12.2 mg/l is the lowest value from all the cited basins. The St. Lawrence drainage has a mean bicarbonate value of 118.5 mg/l and all waters of the United States a mean of 90.0 mg/l (Martin, 1973). Statistical means for the major watershed studied in New England (Table 9 and Figure 16) indicate that the alkaline regions occur in western New England and the St. John River drainage of Aroostook County, Maine. A comparison of these values with plant distribution maps (Figures 18-49, Appendix II) indicates a marked affect of alkalinity on the distribution of Potamogeton in New England.

Aquatic systems have been classified by Pearsall (1930), (Table 10); Spence (1967), (Table 11); Steenis (1932), (Table 12); and Moyle (1945), (Table 13). Pearsall's classification of waters dealt with phytoplankton relationships to water chemistry, while Steenis, Moyle, and Spence

Table 9. Mean alkalinities of major New England watersheds (present study, cf. Figure 16).

1.	Androscoggin River	5.30 mg/l
2.	Saco River	5.40
3.	Thames River	6.66
4.	Rhode Island-southeastern Massachusetts	7.90
5.	Kennebec and Penobscot Rivers	8.95
6.	Merrimac River	9.58
7.	New Hampshire seacoast	18.47
8.	eastern Massachusetts	22.21
9.	Connecticut River	30.55
10.	coastal ponds and streams	33.14
11.	St. John River	46.20
12.	Hudson River	60.73
13.	St. Lawrence River	66.41
14.	Housatonic River	78.11

Figure 16. Mean alkalinities of major New England watersheds (present study, cf. Table 9).

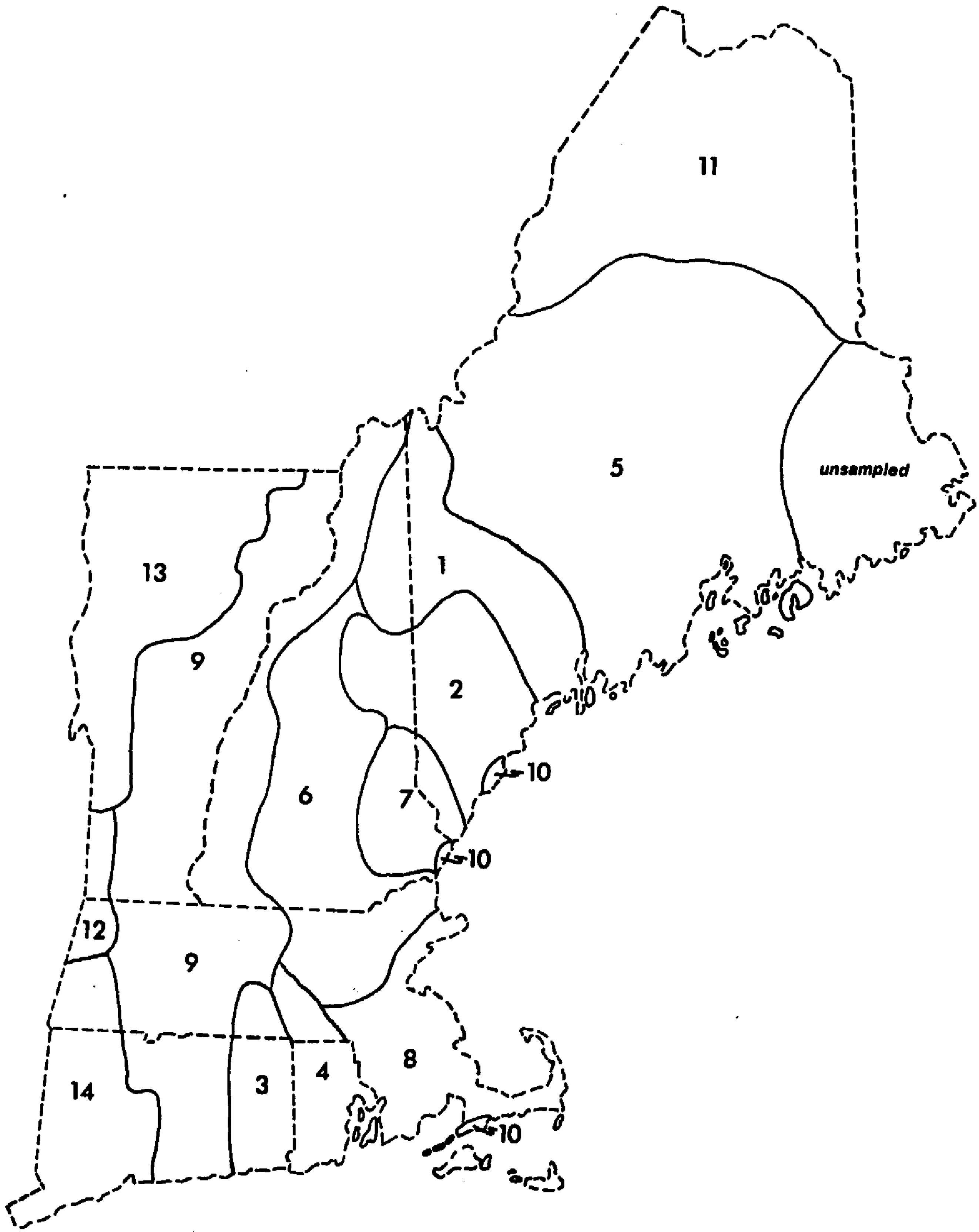

11
5
unsampled
1
13
9
2
10
6
7
10
12
9
8
14
3
4
10

Table 10. Classification of English waters*

Group	Carbonate hardness mg/l	pH	PO_4^{-3}	SiO_2
I	4.0	6.9	+0.00 (high)	+1.0 (high)
IIa	6.0-10.0	6.9	low	low
IIb	10.0	7.2	low	low

*Pearsall (1930)

Table 11. Classification of Scottish lochs**

Classification	Alkalinity mg/l $CaCO_3$
poor	<15.0
moderately rich	15.0-60.0
rich	>60.0

**Spence (1967)

Table 12. Classification of Wisconsin waters[*]

Classification	mg/l fixed CO_2
very soft	0.0- 5.0
soft	5.0-10.0
medium	10.0-20.0
medium hard	20.0-30.0
hard	>30.0

[*]Steenis (1932)

Table 13. Classification of Minnesota waters with *Potamogeton* taxa.[a]

Group I Soft-water flora

total alkalinity <40.0 mg/l $CaCO_3$
SO_4^- <5.0 mg/l
pH 6.8-7.5

---

subgroup I

total alkalinity-generally 40.0 mg/l $CaCO_3$
SO_4^- <5.0 mg/l
pH <7.5

P. spirillus

---

subgroup II seldom in water of:

total alkalinity >150.0 mg/l $CaCO_3$
pH >7.7

P. epihydrus
P. gramineus var. *graminifolius* (*P. gramineus* var. *gramineus*
P. alpinus

Group II Hard-water flora

total alkalinity 90.0-150.0 mg/l $CaCO_3$
SO_4^- 5.0-40.0 mg/l
pH 8.0-8.8

---

subgroup I

total alkalinity commonly greater than 40.0 mg/l $CaCO_3$
SO_4^->50 mg/l

* *P. amplifolius*
* *P. friesii*
* *P. gramineus* var. *graminifolius* f. *myriophyllus* (*P. gramineus* var. *myriophyllus*)
* *P. illinoensis*
P. natans
P. pusillus (*P. pusillus* var. *pusillus*)
P. strictifolius

* not from waters less than 90.0 mg/l $CaCO_3$

Table 13. (Continued)

subgroup II usually lacking in water <30.0 mg/l $CaCO_3$ occur commonly in waters of SO_4^- >50.0 mg/l *P. nodosus* ‡ *P. foliosus* ‡ *P. richardsonii* ‡ *P. pectinatus* ‡ in waters greater than 250.0 mg/l SO_4^-
subgroup III grows best in hard water but may range into both soft and alkali waters poor growth in waters of alkalinity <20.0 mg/l $CaCO_3$ or with SO_4^- >300.0 mg/l *P. praelongus* *P. zosteriformis*
Group III Alkali-water flora do not occur in waters of less than 50.0 mg/l SO_4^- frequent in waters with SO_4^- >125.0 mg/l pH 8.4–9.0 *P. pectinatus*

[a]adapted from Moyle (1945)

worked with macrophytes. These classifications dealt mainly with pH and alkalinity.

Total alkalinity, free carbon dioxide, hydrogen ion concentration

Three factors--total alkalinity, free carbon dioxide, and hydrogen ion concentration (pH)--are not independent. In the environment carbon dioxide occurs in three major states: free or dissolved CO_2, half bound CO_2 in the form of the bicarbonate ion (HCO_3^-), and the bound form as carbonates ($CO_3^=$). The precipitated carbonate salt is either $MgCO_3$ or $CaCO_3$ with the latter the more important in New England. Dissolved $CO_3^=$ is the dominant carbon ion when pH is high. Hutchinson (1957) indicates that below pH 5.0 only free CO_2 is of quantitative importance; between pH 7.0 and 9.0 the bicarbonate is of greatest importance, with the carbonate ion significant above a pH of 9.5. In most waters of New England, free carbon dioxide and the bicarbonate ion are the major forms of dissolved carbon. During the present study only ten of the sites were found to have a pH of 9.5 or above. Carbonate ion was present in a number of locations in the alkaline regions and in some of the coastal ponds, with the highest value being 63.0 mg/l $CO_3^=$.

A question remains whether free CO_2, pH or total alkalinity is a predominant factor influencing *Potamogeton* distribution. In this study, total alkalinity (carbonates and bicarbonates expressed as $CaCO_3$) has the highest correlation with *Potamogeton* distribution in New England.

This parameter is the only factor of the six tested that will allow for clustering near the 0.10 level (Table 8). The five other parameters allow for only slight clustering which proves to be of no value. Figures 5 through 15 show the relationships of the different chemical parameters. Plainly alkalinity can be seen as the only factor which causes a spacing out of the taxa across the mean values, indicating a correlation with plant distribution (Figures 5-9). The other factors (Figures 10-15) show bunching of the taxa, indicating that there is no correlation with the distribution of the species.

The analysis of variance between and within clusters shows the statistical significance of the relationships of the different chemical factors on the distribution of the taxa (Tables 49-60, Appendix V). From these results, alkalinity data are seen to be a major statistical factor in the formation of the clusters, with nitrates and chlorides showing lesser influence, and free carbon dioxide and phosphates being of little value (Figures 5-9).

The clusters (Table 8) indicate a basis for the classification of New England waters (Table 14). Since the pondweeds are ubiquitous, they may be the best indicators of the alkalinity of the water. In many cases, plants which may possibly be located in any region may be predicted if the approximate alkalinity and the area to be sampled is known. Many _Potamogeton_ species may occur over a wide range of alkalinities (Figure 4) encompassing many groups and subgroups of the classification (Table 14). The statistical

Table 14. Classification of New England waters determined by clusters of Potamogeton taxa most commonly found in them.

Group I--acid "soft" waters--alkalinity 0.0-15.0 mg/l

P. confervoides
P. diversifolius var. trichophyllus
P. oakesianus
P. pusillus var. gemmiparus
P. pulcher

Group II-- moderately alkaline waters--alkalinity 15.1-60.0 mg/l

Subgroup IIa--alkalinity 15.1-25.0 mg/l

P. gramineus var. maximus
P. spirillus
P. epihydrus var. ramosus
P. gramineus var. myriophyllus
P. vaseyi
P. robbinsii

Subgroup IIb--alkalinity 25.1-40.0 mg/l

P. perfoliatus var. bupleuroides
P. amplifolius
P. pusillus var. tenuissimus
P. gramineus var. gramineus
P. alpinus var. tenuifolius
P. natans

Subgroup IIc--alkalinity 40.1-60.0 mg/l

P. richardsonii
P. praelongus
P. obtusifolius
P. zosteriformis
P. alpinus var. subellipticus
P. epihydrus var. epihydrus

Group III--alkaline waters--alkalinity 60.1-90.0 mg/l

P. pusillus var. pusillus
P. foliosus
P. filiformis var. borealis
P. illinoensis
P. strictifolius
P. crispus
P. friesii
P. nodosus

Group IV--highly alkaline waters--alkalinity above 90.0 mg/l

P. pectinatus

---

means indicate the possibility of this classification which is similar to that of Spence (1967), (Table 11), except that he included acid water plants which occurred in water up to 25.0 mg/l $CaCO_3$. Spence did not break up any groups into subgroups.

Group I. Acid "soft" waters

Group I in New England includes Potamogeton of "soft" waters with a range of 0.0-15.0 mg/l $CaCO_3$, but under extreme circumstances ranging to 40.0 mg/l with a mean less than 10.0 mg/l $CaCO_3$.

Potamogeton confervoides is a plant of peaty ponds and soft water regions along the New England coastal plain. High altitude ponds of low alkalinity also contain this species. This is the only pondweed to be found in sphagnum bog ponds in this study. The highest alkalinity encountered was 7.0 mg/l $CaCO_3$. Potamogeton diversifolius var. trichophyllus was abundant in the sandy-bottom ponds of eastern New England where only one location occurred with an alkalinity above 15.0 mg/l $CaCO_3$. Potamogeton oakesianus was located at two areas where the alkalinity was above 15.0 mg/l, the highest being 19.5 mg/l $CaCO_3$. Potamogeton pulcher is the species which is most often found above the "soft" water limits of 15.0 mg/l, although it is commonly found in the acid coastal plain of New England. Three locations were found with an alkalinity above 15.0 mg/l, the highest being 38.0 mg/l $CaCO_3$. In the alkaline region of Cheboygan County, Michigan, a pond with an alkalinity of 34.0 mg/l contained this plant along with other acid water plants such as Eriocaulon septangulare. Potamogeton pusillus var. gemmiparus is found in this group and tends to support the opinions of some botanists that this is an ecological variety. The narrower foliage may be a growth form due to the low alkalinity or high acidity of the water. In either case, the lower values of bicarbonate present may lead to the development of the extremely fine foliage. Steenis (1932) and Moyle (1945) did not include any of the species from Group I (Table 14) except P. diversifolius var. trichophyllus (P. capillaceus Poir.) which Steenis reported as occurring in very soft water. Potamogeton confervoides has been reported from Wisconsin in regions of lower alkalinity in recent years.

Group II. Moderately alkaline waters

Sub-group IIa

Moyle (1945) in Minnesota found Potamogeton spirillus to be the pondweed of the softest water and included it in the soft-water sub-group I of his classification. He included it with the soft water plants Eriocaulon septangupare and Lobelia dortmanna. Generally in New England, P. spirillus and P. epihydrus var. ramosus are considered plants of low alkalinity, but the range of both extends into harder waters, e.g. 49.5 and 57.0 mg/l for P. spirillus and many above 60.0 mg/l for P. epihydrus var. ramosus. Two of the three varieties of P. gramineus are in this group with P. gramineus var. gramineus in the next group. This may indicate an ecological difference, but the range has a width of only 25.0 mg/l for all varieties. Moyle (1945) reported P. gramineus var. graminifolius f. myriophyllus (P. gramineus var. myriophyllus) from waters above 40 mg/l. This is considerably higher than found in New England except for one location (78.0 mg/l). If this variety can tolerate extremes of alkalinity, it seems that the alkalinity of the water is not a factor that may be responsible for ecological differences.

Sub-group IIb

Four of the most commonly encountered taxa in this group are Potamogeton natans, P. gramineus var. gramineus, P. pusillus var. tenuissimus, and P. amplifolius. These plants are found throughout New England over the alkalinity range. Moyle (1945) includes P. natans and P. gramineus in his hard-water sub-group II. These plants he notes are common over the total alkalinity range in Minnesota. Ogden (1943) notes P. amplifolius as a plant of both alkaline and acid waters. Spence (1967) refers to P. gramineus as a ubiquitous plant. These statements hold true for these two plants in New England. The other two common pondweeds found throughout New England are in the medium alkalinity sub-group IIb. They are P. epihydrus var. ramosus and P. robbinsii.

Sub-group IIc

Sub-group IIc of the moderately alkaline waters includes many of the hard-water plants of Moyle (1945), e.g.

Potamogeton richardsonii, P. praelongus, and P. zosteriformis. In New England, plants of this sub-group are usually located in harder waters but occasionally occur in waters of low alkalinity. Four of the plants in this group are found more often in northern New England. These are P. richardsonii, P. alpinus var. subellipticus, P. obtusifolius, and P. epihydrus var. epihydrus. Many of these plants occur at lower alkalinities in the northern regions than in the southern regions. This may be just a coincidence. All of the taxa except P. obtusifolius are more northerly throughout their normal range in the United States and Canada and occur in any waters within the range.

Group III. Alkaline waters

Potamogeton of alkaline group III were found almost exclusively in western New England and northern Maine, in the drainages of the Housatonic, St. Lawrence, Hudson, St. John rivers, and from regions of the Connecticut River (Table 14). Moyle (1945), Pfeiffer (1967), McCombe and Wile (1971), and Unni (1971) found P. crispus from waters of high nutrients and high alkalinity. In Middlesex County, Massachusetts, P. crispus was commonly found in many bodies of water, expecially close to metropolitan Boston. In five locations in this area, P. crispus was found in waters with high nutrient levels but with an alkalinity of 20.0 mg/l or less. This plant evidently needs high alkalinity and/or high nutrient levels to survive.

Potamogeton nodosus is generally found in flowing water (Ogden, 1943). Moore and Clarkson (1967) found P. nodosus common in acid streams but not reproducing sexually. Clapham et al. (1962) indicate that in England it is found in deeper water, along gravelly shores or in slow-flowing alkaline waters. Moyle (1945) found it in waters of alkalinity 41.2-312.0 mg/l. In New England, P. nodosus is common in the Lake Champlain valley, especially in pasture streams and rivers of slow current. In eastern New England it is usually found in rivers in swift current and in alkalinities below 15.0 mg/l. This pondweed appears to favor a swift current if a higher alkalinity is not available, possibly because flowing waters are constantly delivering nutrients to the plants. The submersed leaves in the flowing streams are generally larger than those from quiet waters. The greater leaf surface possibly provides a greater area for nutrient absorption.

The remaining taxa in alkaline group III were mostly from waters of western New England. Three of these, Potamogeton filiformis, P. foliosus, and P. friesii, were also from northern Maine. Potamogeton pusillus var. pusillus, the third variety of this species, is found in this group. Wiegand and Eames (1925) indicate that P. pusillus var. pusillus is a plant chiefly of brackish or limey water, unlike the variety tenuissimus that inhabits acid waters. It appears that in New England P. pusillus var. gemmiparus is of acid water, var. tenuissimus mainly of acid but also in alkaline and brackish waters, and var. pusillus of moderately alkaline to alkaline waters. Spence (1967) indicated that P. filiformis and P. lucens of Europe, the latter being closely related to P. illinoensis of North America, were from calcareous lochs with alkalinities ranging from 35.0-157.0 mg/l. This is within the range of P. illinoensis found in New England.

Group IV. Highly alkaline waters

Potamogeton pectinatus was statistically isolated to group IV (Table 14), at high alkalinities. This species occurs in alkaline and brackish waters of New England. The two areas where it was found below an alkalinity of 40 mg/l were brackish ponds along the coast. Many authors (e.g. Metcalf, 1931; Moyle, 1945; Owens and Edwards, 1962; Spence, 1967) have indicated that the locale of this plant is one of extremely high alkalinity. In North Dakota, Metcalf (1931) found P. pectinatus mainly in brackish waters and did not consider it to be a fresh-water indicator. Potamogeton pectinatus in Minnesota occurs in waters with alkalinities ranging from 31.8 to 376.0 mg/l, and is considered a plant of hard and alkali waters (Moyle, 1945).

The ranges of the alkalinities for New England taxa were found to compare favorably with those of Moyle (1945) from Minnesota. Certain New England taxa tolerated alkalinity ranges as low as, or lower than, their Minnesota counterparts, especially Potamogeton robbinsii, P. zosteriformis, P. friesii, P. obtusifolius, and P. natans. Potamogeton nodosus and P. crispus occurred at much lower alkalinities than previously reported. Taxa not reported from Minnesota or in insufficient numbers to be reported by Moyle were studied in New England. Plants of the acid water group I (Table 14) may not have occurred in Minnesota since its waters are not of such low alkalinities. A few species of this group have been reported from Wisconsin and Michigan where low alkalinities occur.

Carbonates and bicarbonates are extremely important to plants. Rodhe (1949) indicated that calcium and bicarbonate ions were abundant in Swedish waters. Steemann Nielsen (1954) found bicarbonate ions to be the most important carbon source for aquatic plants. In Finland, _Potamogeton filiformis_, _P_. _pectinatus_, and _P_. _pusillus_ are not found in streams where bicarbonate ions are low. They occur there only in brackish waters where the bicarbonate ions are high. These three species in New England were found in the two groups of highest alkalinity, indicating the value of the bicarbonate ion in the occurrence of these plants. Lathwell _et al_. (1969) state: "the carbonate system, along with providing the necessary carbon for plant growth, provides buffering and neutralizing effects in the water system."

The amount of carbon dioxide accessible to aquatic plants is of greater importance than pH for the distribution of submersed plants associated with alkaline waters (Steemann Nielsen, 1944). This carbon dioxide, which is accessible in alkaline waters, is mostly in the form of bicarbonate since free carbon dioxide is not abundant in alkaline waters. Steenis (1932) notes that Potamogeton is most abundant in calcareous and alkaline waters and on soft organic muds and marl.

Hydrogen Ion Concentration

The hydrogen ion concentration has been suggested by many as an aquatic factor affecting plant distribution. Hicks (1932) found that hydrogen ion concentration is extremely important in many of the chemical reactions taking place within plant structures and may influence the growth, reproduction, abundance, and distribution of the Lemnaceae. The pH values will vary with dissolved soil constituents, temperature, presence of buffers, time of year, rainfall amounts, and decay of organic matter. Hicks concludes by stating, "the pH concentration, though not always a limiting factor in our waters, is often an important one in affecting growth and distribution."

Iverson (1929), as noted by Steemann Nielsen (1944), found in Denmark that there is a relation between the pH of the lakes and their vegetation. It was indicated that this distribution may also be due to other factors varying along with pH, possibly the lime and nutrient content of the water. Sjörs (1950) supported Iverson's findings by indicating that there seems to be a correlation between pH and vegetation composition, but this composition may not be strictly determined by pH. Pearsall (1930) found a positive correlation of pH and carbonate hardness.

Moyle (1945) believed that pH is of greater importance than the carbonate salts for soft water flora. This might possibly be the case since at low pH the hydrogen ions are abundant, thus increasing the conductivity of water. This is similar to the high conductivity found in waters of higher pH where many other ions, including OH^- are abundant. Steemann Nielsen (1954), after a study of plant distribution in brackish water regions of southern Finland, indicated that in such habitats pH cannot be of major importance for distribution since hydrogen ion concentration does not contribute to the carbon source in the water which is used in photosynthesis. Decreased pH in various rivers resulting from discharge of sulfuric acid from mining operations was shown by Moore and Clarkson (1967) to be of no statistical significance in controlling the abundance or distribution of vascular aquatic plants; instead the substrate was the important factor.

The correalation coefficients (Table 7) indicate that pH is a factor of value in the study but is not as important as total alkalinity. The close grouping of taxa within clusters (Fugure 5) indicates the close relationship between the two factors. No clusters based upon pH could be determined to occur anywhere near the 0.10 z value level. This also indicates that pH is not as good a parameter as total alkalinity in influencing Potamogeton distribution. Steenis (1932) and Ruttner (1953), as stated previously, have noted that plankton and aquatic macrophytes alter the pH. Cowles and Schwitalla (1923) noted that areas abounding in aquatic vegetation had a pH change of 0.6 during the day. As the dissolved CO_2 is utilized during photosynthesis, the pH of the water will increase. The areas of high pH values sampled in New England were mainly shallow bodies of water choked with vegetation.

The waters in which the most commonly collected species were found had the broadest range in pH. Plants which occur over this broad range (Figure 3) were *Potamogeton epihydrus* var. *ramosus*, *P. natans*, *P. pusillus* var. *tenuissimus*, *P. gramineus* var. *gramineus*, *P. amplifolius*, *P. spirillus*, and *P. zosteriformis*. All of these taxa may be found at most collection sites in New England. The plants found in the narrowest pH range are generally "acid" water plants which include: *P. pusillus* var. *gemmiparus*, *P. confervoides*, *P. diversifolius* var. *trichophyllus*, and *P. oakesianus*. In contrast, *P. vaseyi* and *P. strictifolius* are more common in basic waters.

Hodgdon *et al.* (1952) indicated that *Potamogeton confervoides* is definitely an acid-water plant (pH 6.4). I found *P. confervoides* in acid regions, but believe that the low carbonate readings are more important than pH in determining its distribution. This species may occur in waters of high sulfuric acid content since it is often found in bog pond waters. Hutchinson (1957) indicates that in bogs and bog lakes low pH values are often due to the formation of sulfuric acid by the percolating of water through peat that often contains significant amounts of pyrites (FeS_2).

Free Carbon Dioxide

Carbon dioxide is considered to be an important factor affecting the distribution of vascular aquatic plants. The effect of carbon dioxide in its different forms on plants has been of interest to many researchers. Carbon dioxide is readily soluble in water and may occur as dissolved (free) CO_2 forming the bicarbonate (HCO_3^-) and carbonate ($CO_3^=$) ions. Free CO_2 and bicarbonates are utilized by plants as the CO_2 source for photosynthesis.

Steemann Nielsen (1944) stated, after looking over past experiments,

> I had come to suspect that the quantity of the carbon dioxide accessible to the plants more than pH was the factor of real importance for the distribution of submersed plants associated with alkaline waters in Denmark.

The form of CO_2 Steemann Nielsen is probably referring to is the bicarbonate form since the waters are referred to as being alkaline. Whether CO_2 or HCO_3^-, either form is of value to the plants for photosynthesis. Submerged vegetation amounts may be controlled by local concentrations of carbon dioxide, but the type of plant growing in any habitat is unconnected to the CO_2 content of the water (Pearsall, 1920).

The test for free carbon dioxide (conducted on New England waters) indicated very little influence of carbon dioxide concentration on Potamogeton distribution. The analysis of variance between clusters (Table 50, Appendix V) and among clusters (Table 56, Appendix V), indicated a low statistical significance. The individual taxa within clusters (Figure 9) are spaced far apart, indicating a poor relationship between the free CO_2 and alkalinity data. Free CO_2 is found in most New England waters and is of value as a source of CO_2 for photosynthesis but does not affect the distribution of the taxa.

Nitrogen and Phosphorus

Nitrogen and phosphorus are two of the major nutrient sources of the aquatic environment. Both occur naturally in waters and the chief sources of them are in flowing water, rain, and decomposition of organic material from mud and debris at the bottom of lakes (Domogalla et al., 1962). Man-generated sources of nitrogen and phosphorus are also of value for increasing amounts of these chemicals. These sources are domestic sewage, runoff from cultivated land, urban land, and land on which animals are kept (Steward, 1970).

Nitrogen and phosphorus have been considered as factors limiting aquatic plant growth. Steward (1970) indicated that nitrogen and phosphorus levels are usually limiting for aquatic plant growth because naturally occurring concentrations of the remaining elements are usually not low enough to be limiting. Phosphorus was found to be the key element limiting aquatic plant production in most lakes, and there are very few lakes where nitrogen and other elements are the limiting factors to algal growth (Lee, 1973). Gerloff (1969) studied limiting factors and found that in lake waters to which nitrate, phosphate, and iron had been added, as much plant growth resulted as with the addition of all the essential elements. He concluded that nitrogen was the primary limiting factor. Mackenthun (1962) concluded that nitrogen may be the most critical factor limiting algal production, since phosphorus is stored in the plankton as excess and may be ten times the actual amount needed. Blackburn et al. (1968), indicated that phosphorus is often considered the most critical factor in the maintenance of the aquatic environment. Phosphorus is removed from the water and absorbed by the substratum where it is available for the plants (Hepher, 1958). Boyd (1967) concluded that the uptake of nutrients by the roots of hydrophytes had an important effect upon plant distribution. The phosphorus is contained in the substrate, hence is abundant during all seasons. This might tend to support the belief that it is not a limiting factor in submersed weed growth.

Nitrogen in the nitrate form is one of the most important compounds for plant growth. In the nitrate form nitrogen is very soluble and is quickly leached out of the soils into the ground or surface waters. Some waters contain high amounts of nutrients without extensive plant growth. Recent evidence indicates that nitrogen may be limiting in some cases, especially during the summer when dissolved nitrogen concentrations are low. Certain macrophytes, especially Elodea, remove much nitrogen from the water in the ammonia form, but also remove small amounts of nitrates. At levels of 0.1 mg/l nitrate-nitrogen, excessive algal blooms are known to occur. Since nitrogen usually exceeds concentrations which cause eutrophication, it is not usually a limiting factor (Martin and Goff, 1972).

Nitrate amounts are greater in the water, while phosphate amounts are greater in the substrate (Peltier and Welch, 1970; Martin and Goff, 1972). Misra (1938) indicates that waterlogged soils do not usually produce any nitrates. Nitrates are not formed under extreme reducing and anaerobic conditions, thus aquatic plants utilize the ammonia in the soils. Peltier and Welch (1969) in reviewing Butcher (1933), note that rooted plants obtain mineral salts from the soil and not from the water.

The relative importance of nitrogen and phosphorus on plant distribution and growth is a subject of debate. As previously noted, Boyd (1967) believed that nutrient uptake by roots affected distribution. Comparisons on the amounts of nitrogen and phosphorus with distribution of Najas sp. showed no direct relationship with nitrogen and phosphorus (Peltier and Welch, 1970). Mulligan et al. (unpublished manuscript) indicated an increase in populations of phytoplankton and macrophytes, but did not indicate that the nitrogen and phosphorus had an effect on their distribution. Mulligan and Baranowski (1969) found that high nutrient levels produced best phytoplankton growth but little vascular plant growth.

Certain species of Potamogeton have been found under conditions of extreme amounts of nitrogen and phosphorus. Suominen (1968) considered P. obtusifolius, P. crispus, P. friesii, and P. lucens to be plants of eutrophic lakes, indicating high nutrient content of the water. Mulligan and Baranowski (1969) found optimal growth conditions for P. crispus occurred at 0.072 mg/l inorganic nitrogen and 0.020 mg/l phosphorus. These values are low and are unrealistic averages of nitrogen and phosphorus for P. crispus found in New England. The means in New England are approximately 2.0 mg/l NO_3-N and 0.0816 mg/l PO_4-P. Owens and Edwards (1962) reported the phosphate readings from 12.0-14.0 mg/l phosphate for water containing P. crispus. The higher amounts of nitrates and phosphates available to plants in New England are from water affected by man, either from ponds and lakes in farming regions or from streams and rivers. Nitrates are particularily high in ponds bordering potato fields in the agricultural areas of Aroostook County, Maine. Phosphates, as noted in the results, are highest in rivers. This is likely due to the fact that phosphates are normally contained in the substrate, but in rivers they are constantly being added and, with the moving water, have less chance of being absorbed by the soil.

Dissolved phosphates in the water samples are of such low statistical significance indicating that they may be of little value in affecting Potamogeton distribution. The phosphates are quickly absorbed by the substrate, hence the amount in the water is usually low. This may be due to rapid turnover between the water and substrate or possibly to a rapid uptake by the plants. A similar study testing the same chemical factors in the substrate might help clarify the problem as to whether the water or the substrate most influences aquatic plant distribution.

Potamogeton filiformis var. *borealis* was found in waters with the highest mean value of 11.77 mg/l NO_3 but with a lower median of 4.00 mg/l NO_3. High values for this plant are due to the few sites in Aroostook County that are receiving runoff from the potato fields. These few values are increasing the average, so here the median is probably more indicative of the habitat of *P. filiformis* var. *borealis*. *Potamogeton crispus*, mentioned by many as a plant of more polluted waters, is definitely found in waters rich in nitrates and, if the median is considered, is from the water of the highest nitrate amounts.

The nitrate content of water increases as carbonate hardness increases (Pearsall, 1921, 1930). Areas where waters are rich in nitrates occur in regions of soft rocks and alkaline soil. The nitrate-rich waters flow through land almost entirely under cultivation. In Britain unattached taxa, e.g. *Lemna* and *Stratiotes*, are confined to calcareous waters rich in nitrates (Pearsall, 1921). Hutchinson (1957) indicated that the nitrification process is sensitive to pH and occurs less rapidly or not at all in acid waters.

The clusters formed by alkalinity (Tables 8, 14) were also influenced by the nitrate content. Since nitrates are more common in waters of higher carbonate concentration, the carbonates may be responsible for the significant results in the relationship between nitrate content of the water and *Potamogeton* distribution. The seven taxa found at the highest mean nitrate levels are plants of the high alkalinity group (Tables 8, 14). These results tend to support the relationship of high nitrates and high alkalinity. Since nitrates are dissolved in the water and are available to plants, it would seem that this would account for the higher values in the water and would be a factor of importance for the plants.

Chlorides

Brackish or saline members of *Potamogeton* usually mentioned in the literature are *P. pectinatus*, *P. filiformis* var. *borealis*, *P. foliosus*, and *P. perfoliatus* var. *bupleuroides* (Morong, 1893; Wiegand and Eames, 1925; Ogden, 1966, 1974; Munz, 1970). Taxa which also have been found in waters of higher salinity are *P. pusillus* var. *pusillus*, *P. crispus*, *P. friesii*, *P. vaginatus*, *P. natans*, *P. zosteriformis*, and *P. gramineus* var. *maximus* (Wiegand and Eames, 1925; Metcalf, 1931; Fassett, 1957; Clapham *et al*., 1962; Ogden, 1966, 1974; Spence, 1967).

Metcalf (1931) carried on extensive studies of the brackish or saline waters of North Dakota. His studies included the following taxa of brackish waters, and he indicated the highest salt concentration of the waters in which they were found: *Potamogeton zosteriformis* (501 mg/l), *P. natans* (519 mg/l), *P. friesii* (519 mg/l), *P. gramineus* var. *maximus* (809 mg/l), *P. perfoliatus* (1431 mg/l), *P. foliosus* (2512 mg/l), and *P. pectinatus* (35,873 mg/l).

Potamogeton pectinatus was found occurring in waters of such high salt content that it is not considered a fresh water indicator in North Dakota. Teeter (1957) found P. foliosus to occur in waters with a salt content up to 10,000 mg/l with 2000-4000 mg/l as optimal. Potamogeton pectinatus was found in waters up to 12,600 mg/l with the least growth at 7000 mg/l total salts.

Teeter (1957) also found that vegetative growth, seed germination, and seed production of Potamogeton pectinatus were inhibited by increasing sodium chloride concentrations, while growth and reproduction were stimulated by concentrations in the range of 2500-3500 mg/l. Optimal vegetative growth occurred in fresh water while tuber growth was best in a saline solution of 3000 mg/l. Bourn (1934) indicated concentrations of 24% sea water stimulated growth of P. foliosus. The optimal salt concentration for growth was between 4% and 12%. Martin and Uhler (1939) found that P. perfoliatus var. bupleuroides extends downstream in the Potomac River to the point where Zostera marina reaches its upper limits at a concentration of 8500-9000 mg/l NaCl.

Brackish or saline waters in New England are confined to coastal areas. Tidal creeks harbor some Potamogeton species, mainly P. perfoliatus var. bupleuroides, associated with Zannichellia palustris. Brackish ponds along the coast on the inland side of dunes often have a high salt content. Ruppia maritima is often found in these ponds along with P. pectinatus. These saline ponds are frequently clogged with algae and aquatic macrophytes. Extremely high pH is characteristic due to large algal populations photosynthesizing. The highest chloride content found was 4095 mg/l. Holden (1961), in Scotland, found that the chloride concentration varied with the distance of the loch from the coast. This would seem to apply in New England except for a few bodies of water which may be contaminated by road salt.

The highest chloride concentration encountered away from the coast was in a small pond along a highway in Lancaster, New Hampshire, where the content was 245.0 mg/l chloride. This pond probably receives much road salt from the highway which is heavily salted during the winter. The median value for chlorides from all waters tested was 10.4 mg/l which is higher than indicated by Martin (1973) for the North Atlantic drainage (4.47 mg/l) or the St. Lawrence drainage (7.97 mg/l). The mean for the United States is 9.0 mg/l chloride.

Taxa clusters (Tables 8, 14) based upon alkalinity were shown to have great significance in relation to chlorides, when observing results between the clusters (Table 53, Appendix V) and within clusters (Table 59, Appendix V). If the brackish water values (505 mg/l) are deleted from the analysis of variance between clusters (Table 54, Appendix V) insignificant results occur. The brackish water values discarded were from the data of <u>Potamogeton</u> <u>pectinatus</u>, <u>P</u>. <u>perfoliatus</u> var. <u>bupleuroides</u>, <u>P</u>. <u>pusillus</u> var. <u>tenuissimus</u>, and P. oakesianus. The nine brackish water locations for the above species determined whether the differences in the analysis results between chlorides were highly significant or insignificant as a factor influencing Potamogeton distribution.

Potamogeton pusillus var. tenuissimus and P. perfoliatus are found in the same cluster--Group IIb (Table 14). Both species are extremely tolerant of chlorides (Table 6) and carbonates (Table 2), while P. pectinatus (Table 14) is a plant of either high alkalinity or high chloride content. With all of these taxa, the presence of P. pusillus var. tenuissimus, P. perfoliatus var. bupleuroides and P. Pectinatus in the coastal water is probably due to the higher nutrients occurring in the brackish water, supporting the thoughts of Steemann Nielsen (1954). Insufficient data prevents a judgement being made on the possible affect of low alkalinity-high chloride content of waters on plant distribution.

A point that should be remembered is that the results from this study are statistically determined and in some cases offer excellent results to help further the knowledge of aquatic plant distribution. Plants in the field may often be found in habitats which seem completely alien to them but seem to do quite well, hence many exceptions exist. Certain other factors which may be of value for plant distribution might be tested in New England. These should include sulfates, iron, nitrites, ammonia, and conductivity. Conductivity may be of value since it takes into account all the dissolved ions present in water. Potamogeton distribution was greatly influenced by alkalinity of the water, but may also utilize carbon sources within the soil. An analysis of carbon sources from both soil and water would be of great value for further understanding of the affects on plant distribution. Water from different areas in the United States should be tested to get a full understanding of water chemicals and their affect on Potamogeton distribution. More testing, which began in the summer of 1975 in Michigan, should continue to help clarify the chemical factors influencing the distribution of Potamogeton throughout the world. Laboratory experimentation where plants may be grown under controlled conditions will also help to determine the value of dissolved and substrate chemicals to survival and growth of the Potamogetons.

CONCLUSIONS

1. There is a highly significant relationship between *Potamogeton* distribution and the total alkalinity of the water in which the taxa are found. Clusters of *Potamogeton* determined by statistical analysis may be utilized to classify New England's fresh waters as indicated below:

Group I--acid "soft" waters--alkalinity 0.0-15.0 mg/l $CaCO_3$.

Group II--moderately alkaline waters--alkalinity 15.1-60.0 mg/l.

IIa--alkalinity 15.1-25.0 mg/l.

IIb--alkalinity 25.1-39.0 mg/l.

IIc--alkalinity 39.1-60.0 mg/l.

Group III--alkaline waters--alkalinity 60.1-90.0 mg/l.

Group IV--highly alkaline waters--above 90.0 mg/l.

2. Hydrogen ion concentration has an influence on *Potamogeton* distribution but alkalinity was determined to be more influential.

3. Nitrates dissolved in water were found to affect *Potamogeton* distribution. Dissolved nitrates were found to be highly significant in affecting plant distribution due to the chemical relationship between nitrates and total alkalinity.

4. Chloride content is a chemical factor affecting distribution mainly of *Potamogeton pectinatus*, *P. perfoliatus* var. *bupleuroides* and possibly *P. pusillus* var. *tenuissimus*, but it does not appear to greatly affect the remaining taxa.

5. Phosphates in the water apparently have no influence on *Potamogeton* distribution. This is probably true because phosphates are contained in the substrate and not dissolved in great amounts in the water. An analysis of the soil would help to clarify the value of phosphorus.

6. Free (dissolved) carbon dioxide was found to have little or no effect on *Potamogeton* distribution.

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APPENDICES

APPENDIX I

Sampling Locations

Wilson, L. R. 1939. Rooted Aquatic plants and their relation to the limnology of freshwater lakes. Problems of lake biology. Amer. Assoc. Adv. Sci. Publ. 10. 107-122.

Sampling Locations

MAINE: AROOSTOOK CO.: SquaPan Lake, Ashland; Whitehead Lake, Bridgewater; Butterfield Lake, Caswell; ditch along road to Butterfield Lake (46°59'28"N., 67°54'6"W.), Caswell; Gerrard Pond, Caswell; Pierce Lake, Caswell; man-made pond near Pierce Lake, Caswell; Masters Daggett Brook, Caswell; Butterfield Brook, Caswell; Eagle Lake, Eagle Lake; Fish River near Eagle Lake, Eagle Lake; Fischer Lake, Fort Fairfield; Howard Brook near Monson Lake; Fort Fairfield; Monson Lake, Fort Fairfield; Nadeau Pond stream, Fort Fairfield; Page Pond, Fort Fairfield; south Nadeau Pond, Fort Fairfield; stream draining Page Pond (46°42'17"N., 67°50'26"W.), Fort Fairfield; stream at north end of Lindsey Lake (46°40'42"N., 67°47'56"W.), Fort Fairfield; Black Lake, Fort Kent; south branch, Meduxnekeag River, Hodgdon; small farm pond on east side of U. S. Route 1 approximately one mile north of Houlton town line, (46°10'9"N., 67°50'34"W.), Littleton; Prestile Stream pond, Mars Hill; Gentle Lake, Monticello; Jewel Pond, Monticello; Gentle Lake stream, Monticello; Daigle Pond, New Canada; Mosquito Brook, Portage Lake; Portage Lake, Partage Lake; Echo Lake, Presque Isle; swamp along Route 10 (46°40'16"N., 68°59'15"W.), Presque Isle; Brishlotte Pond, St. Agatha; Madawaska Lake, T16-R4; Long Lake, T17-R4 (Sinclair); Mud Lake, T17-R4 (Sinclair); Caribou Lake, Washburn; Pettingill Stream pond west of Presque Isle town line (68°3'30"N., 46°45'13"W.), Washburn; Red River near

St. Froid Lake, Winterville; St. Froid Lake, Winterville; PENOBSCOT CO.: Pushaw Lake, Orono; FRANKLIN CO.: Beaver Pond, Township D; Gull Pond, T2-R2 (Dallas); Haley Pond, T2-R2 (Dallas-Rangeley); Long Pond (44°53'30"N., 70°35'21"W.), T2-R1 (Sandy River); Long Pond stream, T2-R1 (Sandy River); OXFORD CO.: Cold Brook, (T4-R3); Charles River, Fryeburg Harbor; old course, Saco River, Fryeburg Harbor; horseshoe pond along old course of Saco River, North Fryeburg; KENNEBEC CO.: Belgrade Stream, Belgrade; Echo Lake, Mt. Vernon; Maranacook Lake, Readfield; Tingley Brook, Readfield; Torsey Lake, Readfield; Lake Annabessacook, Winthrop; CUMBERLAND CO.: pond at Duck Point Campground (43°34'1"N., 70°23'0"W.), Scarborough; Dunstan River, Scarborough; Stuart Brook above dam, Scarborough; YORK CO.: Etherington Pond, Biddeford; pond on west side of road at Fortunes Rock along Old Pond Road south of Lord's Pond (43°26'0"N., 70°21'5"W.), Biddeford; Lord's Pond, Biddeford; Shoreup Brook, Eliot; Long Pond, Saco; Great Works River, South Berwick; Little Ossipee River backwater, Waterboro.

NEW HAMPSHIRE: COOS CO.: Clarksville Pond, Clarksville; Lombard Pond, Colebrook; Fish Pond, Columbia; Lime Pond, Columbia; Island Brook, Dummer; Androscoggin River, Errol; Baker Pond, Lancaster; Martin Meadow Pond, Lancaster; oxbow pond off Connecticut River on north side of Route 2 ½ mile east of Vermont border (44°29'50"N., 71°35'0"W.), Lancaster; East Inlet stream, Pittsburg; East Inlet Pond, Pittsburg; Connecticut River at Bench Mark 1880, Pittsburg; Moose Falls on Connecticut River, Pittsburg;

West Inlet stream, Pittsburg; pond on south side of Route 2 approximately 1½ miles west of Maine border (44°24'29"N., 71°2'6"W.), Shelburne; Cross farm pond, Stewartstown; Back Pond, Stewartstown; CARROLL CO.: Church Pond outlet, Albany; Lake Pequaket, Conway; Conway Lake, Eaton; Province Lake, Effingham-Wakefield; Hoyt Brook, Freedom; Shaw Pond, Freedom; Square Brook, Freedom; Berry Bay-Ossipee Lake, Freedom; Silver Lake, Madison; Cooks Pond, Madison; Lake Kanasatka, Moultonboro; Meadow Brook, Moultonboro; Moultonboro Bay-Lake Winnipesaukee, Moultonboro; Shannon Brook, Lake Winnipesaukee, Moultonboro; stream flowing into Moultonboro Bay on east side near Lees Mills, Lake Winnipesaukee (43°43'50"N., 71°23'9"W.), Moultonboro; swamp south of Squam Lake along Bean Road (43°45'4"N., 71°29'13"W.), Moultonboro; Lake Wakondah, Moultonboro; Bearcamp River, Ossipee; Big Dan Hole Pond, Ossipee-Tuftonboro; Branch Brook, Ossipee; Connor Pond, Ossipee; Little Dan Hole Pond, Ossipee; Ossipee Lake, Ossipee-Effingham-Freedom; Pine River, Ossipee; small pond at Brown's Ridge Road and Route 16 (43°38'32"N., 71°4'4"W.), Ossipee; stream north of Bearcamp River at Ossipee Lake (43°47'57"N., 71°9'26"W.), Ossipee; swamp near north end of Duncan Lake (43°42'57"N., 71°6'38"W.), Ossipee; Taylor Pond, Sandwich; Bearcamp Pond, Sandwich; Chocorua Lake, Tamworth; Horseshoe Pond (43°47'57"N., 71°6'38"W.), Tamworth; Little Lake, Tamworth; Nineteen Mile Brook, Tuftonboro; Twenty Mile Brook, Tuftonboro; pond south of Dorr Pond at settlement of Woodman (43°38'11"N., 70°58'55"W.), Wakefield; pond south of Round Pond east of Route 16, near

Ossipee town line (43°38'11"N., 71°3'23"W.), Wakefield; Stump Pond, Wakefield; Beaver Pond along south side of Route 25 (43°40'0"N., 71°8'37"W.), Wolfeboro; Wiley Brook pond, Wolfeboro; GRAFTON CO.: Newfound Lake, Hebron; Lily Pond, Livermore; Ogontz Lake, Lyman; Post Pond, Lyme; STRAFFORD CO.: Winkley Pond, Barrington; Cocheco River, Dover; Beard's Creek, Durham; Johnson Creek, Durham; Lamprey River, Durham; Mill Pond, Durham; Bellamy River below dam, Madbury; Branch River, Milton; Northeast Pond, Milton; Isinglass River, Rochester; Fresh Creek, Rollinsford; BELKNAP CO.: Merrymeeting Marsh, Alton; Wickwas Lake, Meredith; beaver pond on north side of Upper Bay Road (43°22'54"N., 71°32'22"W.), Sanbornton; MERRIMACK CO.: Danbury Bog Pond, Danbury; SULLIVAN CO.: Blow-Me-Down Pond, Cornish; ROCKINGHAM CO.: Meadow Pond, Hampton Beach; Taylor Brook Pond, Hampton-Hampton Falls; Pow-Wow Pond, Kingston; CHESHIRE CO.: Connecticut River, Hinsdale.

VERMONT: ESSEX CO.: Island Pond, Brighton; Nulhegan Pond, Brighton; Spectacle Pond, Brighton; Wallace Pond, Canaan; Neal Pond, Lunenberg; ORLEANS CO.: Crystal Lake, Barton; Pensioner Pond, Charleston; Barton River backwater, Irasburg; Seymour Lake, Morgan; Bald Hill Pond, Westmore; Long Pond, Westmore; FRANKLIN CO.: Alder Run, Franklin; GRAND ISLE CO.: Dillenbeck Bay, Alburg; Lake Champlain, North Hero; swamp on east side of Route 2 north of village (44°49'24"N., 73°16'42"W.), North Hero; CALEDONIA CO.: Harvey Lake, Barnet; Sarah Moor Pond, Barnet; Warden Pond, Barnet; Little Eligo Pond, Hardwick; Center

Pond, Newark; Newark Pond, Newark; swamp south of Keiser Pond (44°22'54"N., 72°10'25"W.), Peacham; Ewell Pond, Peacham; Fosters Pond, Peacham; Keiser Pond, Peacham-Danville; Martins Pond, Peacham; Peacham Pond, Peacham; Bean Pond, Sutton; south Dolloff Pond, Sutton; CHITTENDEN CO.: Lake Iroquois, Hinesburg; Mallets Bay-Lake Champlain, Colchester; Pond Brook, Colchester; Shelburne Pond, Shelburne; ORANGE CO.: Lake Morey, Fairlee; Lake Fairlee, West Fairlee; WASHINGTON CO.: Joes Brook, Cabot; Joes Pond, Cabot; ADDISON CO.: East Branch Dead Creek, Addison; McCuen Slang, Addison; East Branch Dead Creek, Bridport; Lake Champlain near Otter Creek, Ferrisburg; Dead Creek, Ferrisburg; Hawkins Bay-Lake Champlain, Ferrisburg; Lewis Creek, Ferrisburg; Little Otter Creek, Ferrisburg; Otter Creek, Ferrisburg; South Slang, Ferrisburg; swamp on west side of Otter Creek (44°12'36"N., 73°19'11"W.), Ferrisburg; Lake Dunmore, Leicester-Salisbury; Fern Lake, Leicester; Cedar Lake, Monkton; East Creek, Orwell; ditch along Swamp Road, Salisbury; stream across Route 22A (43°51'48"N., 73°18'37"W.), Shoreham; Richville Pond, Shoreham Center; stream across Whiting-Shoreham Center Road (43°51'48"N., 73°13'28"W.), Whiting; WINDSOR CO.: Evarts' Pond (Lake Runnemede), Windsor; Mill Pond, Windsor; RUTLAND CO.: Hubbardton River, Benson; Sunrise Lake, Benson; Glen Lake, Castleton; Lake Bamoseen, Hubbardton-Castleton; Black Pond, Hubbardton; Breese Pond, Hubbardton; Lake Hortonia, Hubbardton; swamp on west side of Moscow Road (43°41'7"N., 73°3'37"W.), Hubbardton; Lake St. Catherine, Poultney;

Jones Mill Pond, Rutland; Burr Lake, Sudbury; Little Pond, Wells; WINDHAM CO.: Lily Pond, Vernon; BENNINGTON CO.: Battenkill River, Arlington; Barber Pond, Pownel; South Stream, Pownal.

MASSACHUSETTS: ESSEX CO.: Shawsheen River, Andover; Lily Pond, Gloucester; Beck Pond, Hamilton; Chadwicks Lake, Haverhill; Colonial Pond, Lynnfield; Pleasant Pond, Wenham; MIDDLESEX CO.: small pond by recreation area at Upper Mystic Lake (42°26'28"N., 71°0'53"W.), Arlington; Winter Pond, Arlington; marsh across from dump (32°35'14"N., 71°15'23"W.), Billerica; Fresh Pond, Cambridge; pond by greenhouse on Fresh Pond golf course (42°23'21"N., 71°9'14"W.), Cambridge; pond on Fresh Pond golf course (42°23'21"N., 71°9'27"W.), Cambridge; Concord River at Route 225, Carlisle-Concord; Russell Mill Pond, Chelmsford; Assabet River, Concord; Concord River, Concord; Sudbury River, Concord; Mill Pond, Littleton; Mystic River, Medford; Fisk Pond, Natick; pond at southwest corner of junction of Route 135 and Speen Street (42°23'2;"N., 71°22'39"W.), Natick; Sucker Pond, Framingham; Sudbury River, Framingham; Icehouse Pond, Hopkinton; North Pond, Hopkinton; Whitehall Reservoir, Hopkinton; Charles River, Newton; SUFFOLK CO.: Neponset River, Readville; NORFOLK CO.: Houghton's Pond, Canton; Ponkapoag Pond, Canton; Charles River, Dover; Trout Brook, Dover; Hemenway Pond, Milton; Ames Long Pond, Stoughton; PLYMOUTH CO.: Agawam River, Wareham; Agawam River at tidal exchange, Wareham; Mill Pond, Wareham; BARNSTABLE CO.: Nobska Pond, Falmouth; Oyster Pond, Falmouth; Red

Brook, Falmouth; small pond at Quisett Beach (41°32'8"N., 70°38'31"W.), Falmouth; WORCESTER CO.: Still River, Bolton; Brookfield River, East Brookfield; stream between Quabog Pond and Quacumquasit Pond (42°10'57"N., 72°4'12"W.), East Brookfield-Brookfield; Lake Ripple, Grafton; Silver Lake, Grafton; Hopedale Pond, Hopedale; Lake Nipmuc, Mendon; Mill Pond, Milford; Walker Pond, Sturbridge; Pratt Pond, Upton; inlet at northeast corner of Lake Chauncy, Westborough; Lake Chauncy, Westborough; Hocomonco Pond, Westborough; pond west of Wyman Lake on Route 140, Westminster; FRANKLIN CO.: Lake Rohunta, Orange; Laurel Lake, Erving; Millers River, Erving; BERKSHIRE CO.: Mill Pond, Egremont; Prospect Lake, Egremont; Fountain Pond, Great Barrington; Mansfield Pond, Great Barrington; Pontosuc Lake, Lanesborough; Goose Pond, Lee; Laurel Lake, Lee-Lenox; Wood's Pond-Housatonic River, Lenox; Lake Buel, Monterey; Lake Garfield, Monterey; Harmon Pond, New Marlborough; northern end of Onota Lake, Pittsfield; outlet to Onota Lake, Pittsfield; Cone Brook, Richmond; Richmond Pond, Richmond; Schenab Brook, Sheffield; Stockbridge Bowl, Stockbridge; Lily Brook, Stockbridge; Card Pond, West Stockbridge; Cranberry Pond, West Stockbridge; Shaker Mill Pond, West Stockbridge; Bridge's Pond, Williamstown.

RHODE ISLAND: PROVIDENCE CO.: Abbott Run Brook, Cumberland; Sneech Pond, Cumberland; Todds Pond, North Smithfield; WASHINGTON CO.: Tucker Pond, South Kingstown; Warden Pond, South Kingstown, Pawcatuck River, Bradford; stream along Route 1A, Westerly.

CONNECTICUT: MIDDLESEX CO.: Black Pond, Middlefield; Coginchaug River, Middlefield; Crystal Lake, Middletown; NEW HAVEN CO.: Graniss Pond, East Haven; Lake Quonnipaug, North Guilford; LITCHFIELD CO.: Dog Pond, Goshen; West Side Pond, Goshen; Bantam Lake, Morris; Lake Washinee, Salisbury; Wononskopomuc Lake, Salisbury; Indian Lake, Sharon; Mudge Pond, Sharon; marsh at north end of Hatch Pond (41°52'1"N., 73°28'1"W.), Sharon.

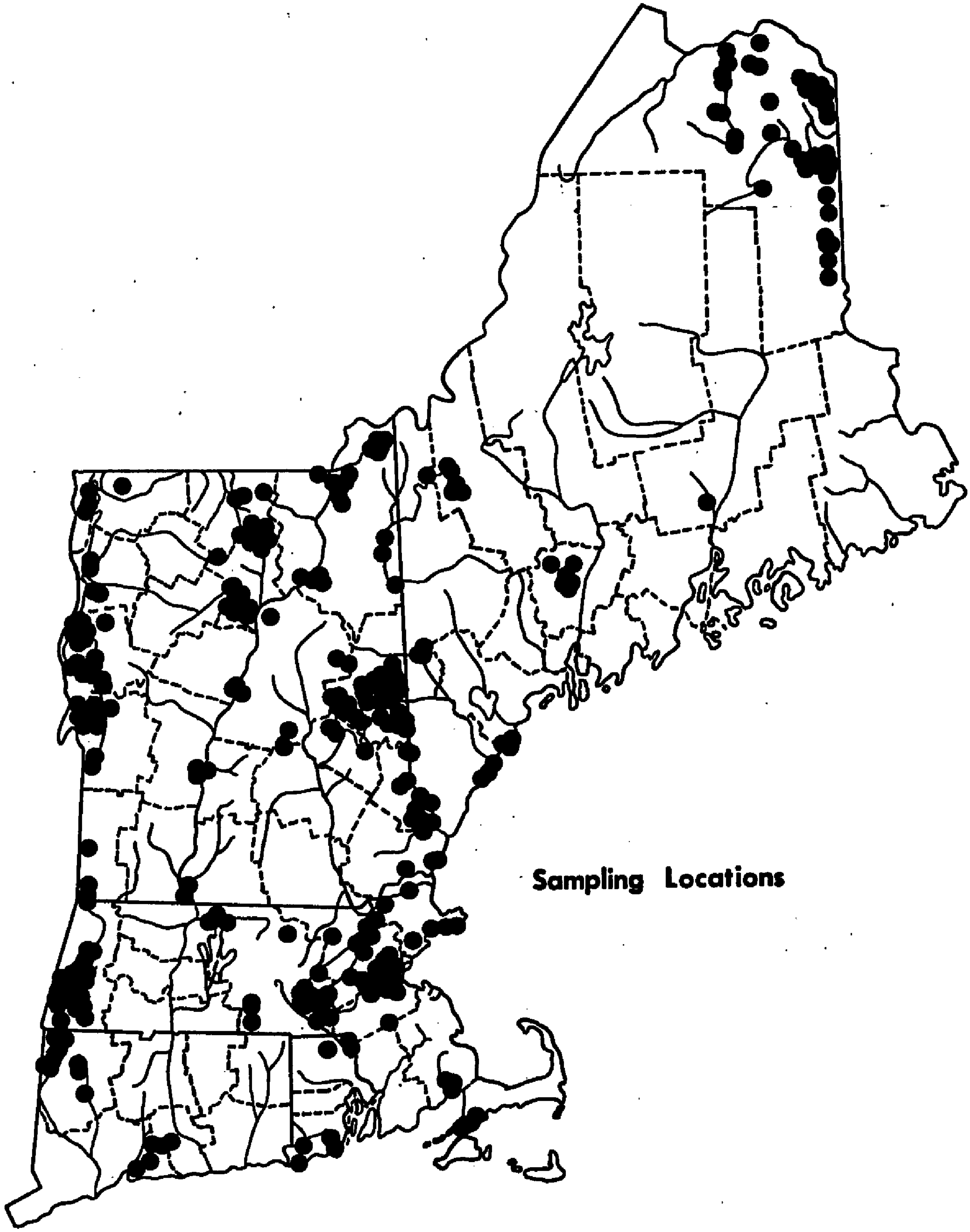


Figure 17. Sampling locations in New England.

APPENDIX II

Collection Sites for *Potamogeton* Taxa

Collection Sites for *Potamogeton* Taxa

Listed below are all collection sites of plants utilized in this study. Dates are included with all citations to indicate when chemical samples were taken. Specimens have been distributed to twenty-six herbaria as indicated by the following acronyms after Lanjouw and Stafleu (1964) and the Advisory Committee for Systematic Resources in Botany (1974): BOSC, CS, DAO, FSU, ISU, MAINE, MASS, MICH, MIN, MTMG, NEBC, NHA, NLU, NYS, OS, RENO, SPH, UCSB, UWM, VT, WVA, Z. Additional acronyms were created for herbaria not included in the above references, as follows: CHSC--Chico State College, California, KNSC--Keene State College, New Hampshire, SPC--Sri Pratap College, Kashmir, India, and WCH--private herbarium of William Countryman, Norwich University, Vermont. Water samples were collected at a few sites where *Potamogeton* could not be collected due to inaccessibility, hence no acronym is found following the collection citation.

Potamogeton filiformis Pers. var. *borealis* St. John: MAINE: AROOSTOOK CO.: Butterfield Lake, Caswell, 19 July 1973, 7779, (BOSC, NHA); Pierce Lake, Caswell, 1 August 1972, 4470, (BOSC, DAO, MAINE, MICH, NEBC, RENO, SPC, Z); pond by Pierce Lake, Caswell, 1 August 1972, 4586, (BOSC, NEBC, NHA, SPH); Page Pond, Fort Fairfield, 18 July 1973, 7734, (BOSC, CS, MAINE, NEBC, NHA, WVA); Caribou Lake, Washburn.

17 July 1973, 4666, (BOSC, NEBC, NHA). NEW HAMPSHIRE: COOS CO.: Lombard Pond, Colebrook, 7 August 1972, 6219, (BOSC, MICH, MTMG, NEBC, NHA). VERMONT: CALEDONIA CO.: Harvey Lake, Barnet, 23 August 1973, 8726, (BOSC, CHSC, NEBC, NHA, UCSB, WCH); Warden Pond, Barnet, 15 August 1972, 4369, (BOSC, MICH, NEBC, NHA, WCH); Ewell Pond, Peacham, 5 August 1973, 8434, (BOSC, MICH, NEBC, NLU, WCH); Keiser Pond, Peacham, 5 August 1973, 8436, (BOSC, NEBC).

Potamogeton filiformis Pers. var. macounii Morong: VERMONT: CALEDONIA CO.: Warden Pond, Barnet, 15 August 1972, 6421, (BOSC, NHA); Ewell Pond, Peacham, 15 August 1973, 8426, (BOSC, FSU, MICH, MTMG, NEBC, NHA, WCH); Keiser Pond, Peacham, 5 August 1973, 8455, (BOSC, NEBC, WCH).

Potamogeton vaginatus Turcz.: MAINE: AROOSTOOK CO.: Prestile Stream Pond, Mars Hill, 18 July 1973, 7798, (BOSC, MAINE, NEBC, NHA).

Potamogeton pectinatus L.: MAINE: YORK CO.: pond on west side of road at Fortunes Rock, at Old Pond Road south of Lord's Pond, Biddeford, 10 August 1972. NEW HAMPSHIRE: SULLIVAN CO.: Blow-Me-Down Pond, Cornish, 24 July 1972, 4463, (BOSC, MICH, NEBC, NHA). VERMONT: ADDISON CO.: Cedar Lake, Monkton, 31 July 1973, 8185, (BOSC, FSU, NEBC, NHA); East Branch Dead Creek, Addison, 1 August 1973, 8230, (BOSC, NEBC); McCuen Slang, Addison, 1 August 1973, 8186, (BOSC, MICH, NHA); East Branch Dead Creek, Bridport, 1 August 1973, 8280, (BOSC, ISC, NEBC, UCSB); Dead Creek, Ferrisburg, 18 July 1973, 5473, (BOSC, NEBC, SPC, Z); Lewis Creek, Ferrisburg, 18 July 1972; stream across Route 22A, Shoreham, 1 August 1973; stream across Whiting-Shoreham Center Road, Whiting, 30 July 1973, 8300, (BOSC, NEBC, NHA). WINDSOR CO.: Mill Pond, Windsor, 24 July 1972. RUTLAND CO.: Breese Pond, Hubbardton, 30 July 1973, 8140, (BOSC, NEBC); Lake Hortonia, Hubbardton, 19 July 1972. MASSACHUSETTS: BARNSTABLE CO.: Nobska Pond, Falmouth, 12 September 1972, 4490, (BOSC, MICH, MTMG, NEBC, NHA, SPH); small pond along Quisett Beach, Falmouth, 12 September 1972, 6956, (BOSC, NHA, Z). BERKSHIRE CO.: Mill Pond, Egremont, 15 June 1973, 7289, (BOSC, ISC); Laurel Lake, Lenox-Lee, 26 June 1972, 4503, (BOSC, ISC, NEBC, NHA); Pontosuc Lake, Pittsfield, 2 July 1973, 7403, (BOSC, MASS); Lily Brook, Stockbridge, 6 September 1972, 4673, (BOSC, NEBC); Stockbridge Bowl, Stockbridge, 16 September 1973; Shaker Mill Pond, West Stockbridge, 15 June 1973, 7319, (BOSC). CONNECTICUT: LITCHFIELD CO.: Lake Washinee, Salisbury, 26 June 1972, 4764, (BOSC, UWM); Lake Washining, Salisbury, 26 June 1972, 4510, (BOSC, NEBC); Wononpakook Lake, Salisbury, 9 August 1973, 8574, (BOSC, CS, NLU, WVA); Wononskopomuc Lake, Salisbury, 15 June 1973, 7326, (BOSC, CHSC); Mudge Pond, Sharon, 6 September 1972, 6891, (BOSC).

Potamogeton robbinsii Oakes: MAINE: AROOSTOOK CO.: Long Lake, T17-R4, 2 August 1972, 6002, (BOSC, MTMG); Pettingill Stream pond west of Presque Isle town line, Washburn, 2 August 1972, 5911, (BOSC, NHA). FRANKLIN CO.: Gull Pond, Dallas (T2-R2), 30 August 1972, 6756, (BOSC). OXFORD CO.: old course, Saco River, Fryeburg Harbor, 16 July 1972, 5384, (BOSC, MIN, RENO, SPC). KENNEBEC CO.: Belgrade Stream, Belgrade, 26 August 1972, 6611, (BOSC); Echo Lake, Mt. Vernon, 26 August 1972, 6696, (BOSC); Maranacook Lake, Readfield, 26 August 1972, 6663, (BOSC, ISC); Torsey Lake, Readfield, 3 August 1972, 6174, (BOSC). NEW HAMPSHIRE: COOS CO.: Baker Pond, Lancaster, 15 August 1972, 6372, (BOSC). CARROLL CO.: Province Lake, Effingham-Wakefield, 22 July 1971, 3759, (BOSC, NEBC, NHA); Berry Bay-Ossipee Lake, Freedom, 4 August 1971, 3466, (BOSC); Hoyt Brook, Freedom, 1 September 1972; Moultonboro Bay-Lake Winnipesaukee, Moultonboro, 19 August 1972; Lake Kanasatka, Moultonboro, 18 August 1971, 3707, (BOSC, NHA); Lake Wakondah, Moultonboro, 17 August 1971, (BOSC, NHA). GRAFTON CO.: Ogontz Lake, Lyman, 7 July 1972, 3476, (BOSC, KNSC). BELKNAP CO.: Wickwas Lake, Meredith, 19 August 1972. STRAFFORD CO.: Mill Pond, Durham, 11 July 1972. VERMONT: ESSEX CO.: Spectacle Pond, Brighton, 7 July 1972, 5092, (BOSC); Neal Pond, Lunenberg, 15 August 1972, 6403, (BOSC). GRAND ISLE CO.: Lake Champlain, North Hero, 31 July 1973, 8314, (BOSC). CHITTENDEN CO.: Mallets Bay-Lake Champlain, Colchester, 31 July 1973, 8110, (BOSC, NHA). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8809, (BOSC, ISC, NEBC); Joes Pond, Cabot, 23 August 1973, 8673, (BOSC, NEBC, NHA). ORANGE CO.:

Lake Morey, Fairlee, 24 July 1972, 5782, (BOSC, CS). RUTLAND CO.: Sunrise Lake, Benson, 1 August 1973, 8238, (BOSC); Glen Lake, Castleton, 30 July 1973, 8304, (BOSC); Lake Bamoseen, Hubbardton, 19 July 1972, 5645, (BOSC, SPC, Z); Breese Pond, Hubbardton, 30 July 1973, 8135, (BOSC). MASSACHUSETTS: ESSEX CO.: Beck Pond, Hamilton, 9 August 1972, 6269, (BOSC); Chadwicks Lake, Haverhill, 17 September 1973; Pleasant Pond, Wenham, 30 September 1972, 3098, (BOSC). MIDDLESEX CO.: small pond by recreation area at Upper Mystic Lake, Arlington, 22 September 1971, 3526, (BOSC); Fisk Pond, Natick, 3 October 1971. NORFOLK CO.: Ponkapoag Pond, Canton, 29 September 1971, 3244, (BOSC). WORCESTER CO.: stream between Quabog Pond and Quacumquasit Pond, East Brookfield-Brookfield, 18 June 1971, 2927, (BOSC, NEBC, NHA); Lake Ripple, Grafton, 25 June 1972, 4924, (BOSC, NHA); Lake Chauncy, Westborough, 20 June 1972, 4351, (BOSC); Hocomonco Pond, Westborough, 20 June 1972, 4391, (BOSC, CS, NEBC, NHA, SPH). BERKSHIRE CO.: Goose Pond, Lee, 2 July 1973, 7477, (BOSC); Lake Buel, Monterey, 8 June 1971, 3030, (BOSC); Lake Garfield, Monterey, 26 June 1972, 4815, (BOSC); Harmon Pond, New Marlborough, 2 July 1973, 7464, (BOSC, MASS, NLU); Cranberry Pond, West Stockbridge, 6 September 1972, 6878, (BOSC). CONNECTICUT: MIDDLESEX CO.: Black Pond, Middlefield, 8 August 1973, 8523, (BOSC, UCSB). NEW HAVEN CO.: Lake Quonnipaug, North Guilford, 8 August 1973, 8493, (BOSC, NEBC, NHA, WVA). LITCHFIELD CO.: Dog Pond, Goshen, 9 August 1973, 8600, (BOSC, NEBC); West Side Pond, Goshen, 9 August 1973, 8620, (BOSC); Bantam Lake, Morris, 9 August 1973, 8528, (BOSC, CHSC).

<u>Potamogeton</u> <u>crispus</u> L.; VERMONT: CHITTENDEN CO.: Lake Iroquois, Hinesburg, 31 July 1973, 8347, (BOSC); Shelburne Pond, Shelburne, 31 July 1973, 8146, (BOSC). ADDISON CO.: Dead Creek, Ferrisburg, 18 July 1972; Lake Champlain at the mouth of Otter Creek, Ferrisburg, 18 July 1972, 5561, (BOSC, NHA); Otter Creek, Ferrisburg, 18 July 1972, 5543, (BOSC, DAO, NEBC). RUTLAND CO.: Lake Bamoseen, Hubbardton, 19 July 1972, 4568, (BOSC, NEBC). MASSACHUSETTS: MIDDLESEX CO.: pond by greenhouse on Fresh Pond golf course, Cambridge, 28 September 1972, 7135, (BOSC, CS, NEBC, NHA, SPH); pond on Fresh Pond golf course, 5 September 1973, 8937, (BOSC, NEBC, NHA, NLU); Concord River at Route 225, Carlisle-Concord, 22 September 1971, 3555, (BOSC); Assabet River, Concord, 5 October 1971, 3275, (BOSC); Concord River, Concord, 10 June 1971, 3007, (BOSC); Sudbury River, Framingham, 3 October 1971, 3194, (BOSC); Mill Pond, Littleton, 16 September 1972, 7019, (BOSC); Fisk Pond, Natick, 3 October 1971. BERKSHIRE CO.: Prospect Lake, Egremont, 2 July 1973, 2450, (BOSC); Mill Pond, Egremont, 15 June 1973, 7284, (BOSC, MASS); Pontosuc Lake, Lanesborough, 2 July 1973, 7391, (BOSC, NEBC); Laurel Lake, Lee-Lenox, 26 June 1972; Wood's Pond--Housatonic River, Lenox, 2 July 1973, 7352, (BOSC, UCSB); Lake Buel, Monterey, 8 June 1971, 3034, (BOSC,

KNSC, NEBC, NHA); Lake Garfield, Monterey, 26 June 1972; north end of Onota Lake, Pittsfield, 2 July 1973, 7425, (BOSC); Richmond Pond, Richmond, 15 June 1973, 7220, (BOSC, CS, MASS, NEBC); Lily Brook, Stockbridge, 6 September 1972, 4676, (BOSC, NEBC); Stockbridge Bowl, Stockbridge, 26 June 1972, 3057, (BOSC, NEBC, NHA); Card Pond, West Stockbridge, 6 September 1972, 6845, (BOSC, ISC, MTMG, NEBC); Shaker Mill Pond, West Stockbridge, 15 June 1973, 7339, (BOSC, MASS, MICH, NEBC). CONNECTICUT: LITCHFIELD CO.: Lake Washinee, Salisbury, 26 June 1972, 4787, (BOSC, NEBC, UWM); Lake Washining, Salisbury, 26 June 1972, 4754, (BOSC, MIN, MEBC); Wononpakook Lake, Salisbury, 9 August 1973, 8514, (BOSC, NEBC); Mudge Pond, Sharon, 6 September 1972, 4681, (BOSC, NEBC, NHA).

Potamogeton confervoides Reichenb.: NEW HAMPSHIRE: COOS CO.: small unnamed pond on south side of Route 2, approximately 1½ miles west of Maine border, Shelburne, 26 August 1973, 8932, (BOSC, CS, NEBC, NHA, SPH, WVA). CARROLL CO.: Church Pond outlet, Albany, 28 August 1972; Cooks Pond, Madison, 23 July 1971, 1779, (BOSC); Connor Pond, Ossipee, 29 July 1971, 1820, (BOSC, NHA); Bearcamp Pond, Sandwich, 25 August 1971, 2409, (BOSC); Taylor Pond, Sandwich, 30 July 1972, 4468, (BOSC, MICH, NEBC, Z); Chocorua Lake, Tamworth, 21 July 1971, 1638, (BOSC, KNSC). GRAFTON CO.: Lily Pond, Livermore, 28 August 1972, 6804, (BOSC, MICH, MIN, NEBC, NHA, SPC). STRAFFORD CO.: Winkley Pond, Barrington, 21 August 1971, 2012, (BOSC, NHA). MASSACHU-

SETTS: FRANKLIN CO.: Laurell Lake, Erving, 25 July 1973, 8085, (BOSC, FSU, MASS, MTMG, NEBC). NORFOLK CO.: Ames Long Pond, Stoughton, 14 June 1972, 4307, (BOSC, NEBC, NHA).

Potamogeton zosteriformis Fernald: MAINE: AROOSTOOK CO.: Whitefield Lake, Bridgewater, 20 July 1973, 7990, (BOSC, NEBC); Fischer Lake, Fort Fairfield, 18 July 1973, 7747, (BOSC, UCSB); Howard Brook near Monson Lake, Fort Fairfield, 18 July 1973, 7719, (BOSC); Monson Lake, Fort Fairfield, 18 July 1973, 7752, (BOSC, NEBC, WVA); Prestile Stream pond, Mars Hill, 18 July 1973, 7785, (BOSC, NEBC); Jewel Pond, Monticello, 3 August 1972, 4630, (BOSC, NEBC, NHA); Daigle Pond, New Canada, 2 August 1972; Portage Lake, Portage Lake, 19 July 1973, 7888, (BOSC, NEBC, NHA); Echo Lake, Presque Isle, 19 July 1973, 4685, (BOSC, NEBC); Long Lake, T17-R4 (Sinclair), 2 August 1972, 4610, (BOSC, NEBC, NHA, UCSB); Mud Lake, T17-R4 (Sinclair), 2 August 1972, 6075, (BOSC, MTMG, NEBC, NHA); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973. PENOBSCOT CO.: Pushaw Lake, Orono, 20 July 1973, 8040, (BOSC, FSU, MTMG). OXFORD CO.: old course, Saco River, Fryeburg Harbor, 16 July 1972, 4458, (BOSC, MICH, NEBC, SPC, Z). KENNEBEC CO.: Belgrade Stream, Belgrade, 26 August 1972, 4655, (BOSC, CHSC, NEBC, NHA); Maranacook Lake, Readfield, 20 August 1972, 4657, (BOSC, NEBC); Tingley Brook, Readfield, 26 August 1972, 6620, (BOSC, CS, NEBC, NHA); Lake Annabessacook, Winthrop, 26 August 1972, 6682, (BOSC). NEW HAMPSHIRE: COOS CO.: Baker Pond, Lancaster, 15 August 1972, 6375, (BOSC, CS, NEBC, NHA); oxbow pond off Connecticut River on north side of Route 2, ¼ mile east of Vermont border, Lancaster, 15 August 1972, 6384, (BOSC, NHA). CARROLL CO.: Lake Kanasatka, Moultonboro, 18 August 1971, 5158, (BOSC, KNSC, NHA, RENO, SPC); Moultonboro Bay-Lake Winnipesaukee, Moultonboro, 19 August 1972, 6546, (BOSC, NHA); stream flowing into Moultonboro Bay on east side near Lees Mill, Lake Winnipesaukee, Moultonboro, 19 August 1972, 4651, (BOSC, NEBC, NHA). BELKNAP CO.: Merrymeeting Marsh, Alton, 19 August 1972, 6496, (BOSC). CHESHIRE CO.: Connecticut River, Hinsdale, 25 July 1971, 8101, (BOSC). VERMONT: FRANKLIN CO.: Alder Run, Franklin, 31 July 1973, 8203, (BOSC). GRAND ISLE CO.: Dillenbeck Bay-Lake Champlain, Alburg, 31 August 1973, 8257, (BOSC); Lake Champlain, North Hero, 31 July 1973, 8325, (BOSC). CALEDONIA CO.: Little Eligo Pond, Hartwick-Greensboro, 5 August 1973, 8389, (BOSC); Ewell Pond, Peacham, 5 August 1973, 8420, (BOSC, MICH); Keiser Pond, Peacham-Danville, 5 August 1973, 8470, (BOSC); Bean Pond, Sutton, 4 August 1973, 8437, (BOSC); Bald Hill Pond, Westmore, 23 August 1973, 8736, (BOSC). CHITTENDEN CO.: Mallets Bay-Lake Champlain, Colchester, 31 July 1973; Lake Iroquois, Hinesburg, 31 July 1973, 8353, (BOSC). ORANGE CO.: Lake Morey, Fairlee, 24 July 1972, 5772, (BOSC, CS, NEBC, NHA, SPH). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8794, (BOSC); Joes Pond, Cabot, 23 August 1973. ADDISON CO.: Lake Champlain at mouth of Otter Creek, Ferrisburg, 18 July 1972, 4555, (BOSC, NEBC);

Dead Creek, Ferrisburg, 18 July 1972, 4545, (BOSC, NEBC, NHA); Little Otter Creek, Ferrisburg, 18 July 1972, 5485, (BOSC, NHA); Otter Creek, Ferrisburg, 18 July 1972, 4550, (BOSC, NEBC); South Slang, Ferrisburg, 18 July 1972, 4539, (BOSC, NEBC, NHA); swamp on west side of Otter Creek, Ferrisburg, 18 July 1972, 5573, (BOSC); Cedar Lake, Monkton, 31 July 1973, 8194, (BOSC); East Creek, Orwell, 1 August 1973, 8289, (BOSC); Richville Pond, Shoreham Center, 30 July 1973, 8155, (BOSC). RUTLAND CO.: Glen Lake, Castleton, 30 July 1973, 8312, (BOSC); Breese Pond, Hubbardton, 30 July 1973, 8136, (BOSC); Lake Bamoseen, Hubbardton-Castleton, 19 July 1972, 5641, (BOSC, NEBC, UWM); Lake Hortonia, Hubbardton, 19 July 1972, 4573, (BOSC, NEBC, NHA); Lake St. Catherine, Poultney, 30 July 1973, 8168, (BOSC); Jones Mill Pond, Rutland, 19 July 1972, 4558, (BOSC, NEBC, NHA); Burr Lake, Sudbury, 19 July 1972, 5600, (BOSC, DAO, NEBC); Little Pond, Wells, 30 July 1973, 8183, (BOSC). BENNINGTON CO.: South Stream, Pownal, 30 July 1973, 8126, (BOSC). MASSACHUSETTS: ESSEX CO.: Colonial Pond, Lynnfield, 1 October 1972, 7142, (BOSC). MIDDLESEX CO.: Concord River at Route 225, Carlisle-Concord, 22 September 1971, 3410, (BOSC, NEBC, NHA). BERKSHIRE CO.: Mill Pond, Egremont, 21 June 1971, 2849, (BOSC, NEBC, NHA); Prospect Lake, Egremont, 2 July 1973, 7448, (BOSC); Fountain Pond, Great Barrington, 6 September 1972, 4667, (BOSC, NEBC, NHA); Wood's Pond--Housatonic River, Lenox, 2 July 1973, 7225, (BOSC, CHSC, MASS, NHA);

Lake Buel, Monterey, 8 June 1971, 3036, (BOSC, NHA); north end of Onota Lake, Pittsfield, 2 July 1973, 7422, (BOSC); outlet to Onota Lake, Pittsfield, 2 July 1973, 7375, (BOSC, NEBC); Richmond Pond, Richmond, 15 June 1973, 7207, (BOSC, MASS, NEBC); Cranberry Pond, West Stockbridge, 6 September 1972, 6882, (BOSC, CS); Shaker Mill Pond, West Stockbridge, 15 June 1973, 7343, (BOSC, NEBC, NHA, NLU). CONNECTICUT: MIDDLESEX CO.: Black Pond, Middlefield, 8 August 1973, 8583, (BOSC, NEBC). LITCHFIELD CO.: Lake Washinee, Salisbury, 26 June 1972, 4786, (BOSC, NEBC, Z); Lake Washining, Salisbury, 26 June 1972, 4514, (BOSC, NEBC); Wononskopomuc Lake, Salisbury, 15 June 1973, 7273, (BOSC, NEBC); Indian Lake, Sharon, 21 June 1971, 2971, (BOSC, NHA).

Potamogeton foliosus Raf.: MAINE: AROOSTOOK CO.: Whitefield Lake, Bridgewater, 20 July 1973; Gerrard Pond, Caswell, 1 August 1972, 4585, (BOSC, NEBC); Pierce Lake, Caswell, 1 August 1972; man-made pond near Pierce Lake, Caswell, 1 August 1972, 4587, (BOSC, NEBC, NHA); Fischer Lake, Fort Fairfield, 18 July 1973, 7444, (BOSC, NEBC); Monson Lake, Fort Fairfield, 18 July 1973, 7729, (BOSC, NEBC, NHA); Page Pond, Fort Fairfield, 18 July 1973, 7942, (BOSC, CHSC); stream draining Page Pond, Fort Fairfield, 18 July 1973, 7759, (BOSC); Nadeau Pond stream, Fort Fairfield, 1 August 1972, 5843, (BOSC, CS, NHA); South Nadeau Pond, Fort Fairfield, 19 July 1973, 7784, (BOSC); Black Lake, Fort Kent, 2 August 1972, 4624, (BOSC, NEBC, NHA); Prestile Stream pond, Mars Hill, 18 July 1973, 7796, (BOSC, MICH); Gentle Lake, Monticello, 20 July 1973, 8008, (BOSC, NEBC); Gentle Lake stream, Monticello, 20 July 1973, 7969, (BOSC); Jewel Pond, Monticello, 3 August 1972, 4629, (BOSC, NEBC, NHA); Daigle Pond, New Canada, 2 August 1972, 4617, (BOSC, NEBC); Echo Lake, Presque Isle, 19 July 1973, 4693, (BOSC); swamp along Route 10, Presque Isle, 18 July 1973, 7758, (BOSC); Mud Lake, T17-R4 (Sinclair), 2 August 1972, 4612, (BOSC, NEBC, NHA); Caribou Lake, Washburn, 17 July 1973, 7673, (BOSC, WVA); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 7649, (BOSC, NLU). CUMBERLAND CO.: pond at Duck Point campground, Scarborough, 13 July 1972, 5255, (BOSC, NEBC, SPC, Z0. NEW HAMPSHIRE: COOS CO.: Fish Pond, Columbia, 7 August 1972, 6181, (BOSC, NEBC, NHA, NYS). VERMONT: ORLEANS CO.: Barton River backwater, Irasburg, 9 August 1971, 2050, (BOSC, KNSC, NHA); Long Pond, Westmore, 9 August 1971, 2032, (BOSC, NEBC, NHA). FRANKLIN CO.: Alder Run, Franklin, 31 July 1973, 8215, (BOSC). CALEDONIA CO.: Harvey Lake, Barnet, 23 August 1973, 8718, (BOSC, NEBC, WVA); Warden Pond, Barnet, 15 August 1972, 4649, (BOSC, ISC, NEBC, NHA); Center Pond, Newark, 23 August 1973, 8667, (BOSC, NEBC, NHA); Ewell Pond, Peacham, 5 August 1973, 8454, (BOSC, ISC, MICH, NEBC, NHA); Keiser Pond, Peacham-Danville, 5 August 1973. CHITTENDEN CO.: Lake Iroquois, Hinesburg, 3 July 1973, 8362, (BOSC). ORANGE CO.: Lake Morey, Fairlee, 24 July 1972, 5747, (BOSC, NEBC, SPH); Lake Fairlee, West Fairlee, 24 July 1972, 4582, (BOSC, NEBC, NHA). ADDISON CO.: Lake Champlain at mouth of Otter Creek, Ferrisburg, 18 July 1972, 5555, (BOSC, DAO, MIN, NEBC); swamp on west side of Otter Creek, Ferrisburg, 18 July 1972. WINDSOR CO.: Evarts' Pond (Lake Runnemede), Windsor, 24 July 1972, 4310, (BOSC). RUTLAND CO.: Lake Hortonia, Hubbardton, 19 July 1972, 4572, (BOSC, NEBC); swamp west of Moscow Road, Hubbardton, 30 July 1973, 8216, (BOSC, ISC, NHA); Lake St. Catherine, Poultney, 30 July 1973, 8173, (BOSC); Jones Mill Pond, Rutland, 19 July 1972, 4557, (BOSC, NEBC, NHA); Burr Lake, Sudbury, 19 July 1972, 5600, (BOSC, DAO, NEBC). BENNINGTON CO.: Barber Pond, Pownal, 5 September 1973, 8408, (BOSC, ISC, NEBC, NHA). MASSACHUSETTS: ESSEX CO.: Pleasant Pond, Wenham, 30 September 1973, 6322, (BOSC). MIDDLESEX CO.: pond by greenhouse on Fresh Pond golf course, Cambridge, 28 September 1972. BERKSHIRE CO.: Mill Pond, Egremont, 15 June 1973, 7293, (BOSC, MASS, NEBC); Mansfield Pond, Great Barrington, 6 September 1972, 4668, (BOSC, NEBC, NHA); Pontosuc Lake, Lanesborough, 2 July 1973, 7394, (BOSC, MASS, NEBC, UCSB); Lake Buel, Monterey, 8 June 1971, 1472, (BOSC, NHA); Lake Garfield, Monterey, 26 June 1972; north end of Onota Lake, Pittsfield, 2 July 1973, 7443, (BOSC, CHSC); Richmond Pond, Richmond, 15 June 1973, 7239, (BOSC, NHA); Lily Brook, Stockbridge, 6 September 1972, 4672, (BOSC); Card Pond, West Stockbridge, 6 September 1972, 4669, (BOSC, NEBC); Cranberry Pond, West Stockbridge, 6 September 1972, 4672, (BOSC, NEBC); Shaker

Mill Pond, West Stockbridge, 15 June 1973, 7329, (BOSC, MASS, NEBC). CONNECTICUT: NEW HAVEN CO.: Graniss Pond, East Haven, 8 August 1973, 8492, (BOSC, CHSC, NLU). LITCHFIELD CO.: West Side Pond, Goshen, 9 August 1973, 8627, (BOSC); Lake Washining, Salisbury, 26 June 1972, 4513, (BOSC, NEBC); Wononpakook Lake, Salisbury, 9 August 1973, 8609, (BOSC, NEBC); Indian Lake, Sharon, 21 June 1971; marsh, north end of Hatch Pond, Sharon, 9 August 1973, 8610, (BOSC); Mudge Pond, Sharon, 6 September 1972, (BOSC, CS, NEBC, NHA).

Potamogeton friesii Rupr.: MAINE: AROOSTOOK CO.: Prestile Stream pond, Mars Hill, 18 July 1973, 7794, (BOSC); Pettingill Stream pond west of Presque Isle town line, Washburn, 2 August 1972, 4595, (BOSC, NEBC). VERMONT: CHITTENDEN CO.: Shelburne Pond, Shelburne, 31 July 1973, 8151, (BOSC, NHA). ADDISON CO.: Lake Champlain at the mouth of Otter Creek, Ferrisburg, 18 July 1972, 5553, (BOSC); Little Otter Creek, Ferrisburg, 18 July 1972, 4373, (BOSC, WCH); Otter Creek, Ferrisburg, 18 July 1972, 4549, (BOSC, NEBC). RUTLAND CO.: Lake Bamoseen, Hubbardton-Castleton, 19 July 1972, 4365, (BOSC, NEBC, RENO, SPC, WCH); Lake Hortonia, Hubbardton, 19 July 1972, 4367, (BOSC, DAO, NEBC, WCH, Z); Burr Lake, Sudbury, 19 July 1972, 4372, (BOSC, NEBC, WCH). MASSACHUSETTS: BERKSHIRE CO.: Shaker Mill Pond, West Stockbridge, 15 June 1973, 7315, (BOSC, CHSC, CS, MASS, MICH, NEBC, NHA, NLU, NYS, UCSB). CONNECTICUT: LITCHFIELD CO.: Wononskopomuc Lake, Salisbury, 15 June 1973, 7279, (BOSC).

Potamogeton strictifolius Ar. Benn.: VERMONT: CHITTENDEN CO.: Shelburne Pond, Shelburne, 31 July 1973, 8151, (BOSC). CALEDONIA CO.: Warden Pond, Barnet, 15 August 1972, 6455, (BOSC, MICH, MTMG, NEBC, NHA, NYS, WCH); Sarah Moor Pond, Barnet, 15 August 1972, 4374, (BOSC, CS, MICH, NEBC, NHA, SPH, UCSB, WCH). ADDISON CO.: East Creek, Orwell, 1 August 1973, 8285, (BOSC). WINDSOR CO.: Evarts' Pond (Lake Runnemede), Windsor, 30 August 1971, 5706, (BOSC).

Potamogeton X *longiligulatus* Fernald: VERMONT: ADDISON CO.: East Creek, Orwell, 1 August 1973, 8288, (BOSC). WINDSOR CO.: Evarts' Pond (Lake Runnemede), 30 August 1971, 4462, (BOSC, MICH, WCH). MASSACHUSETTS: BERKSHIRE CO.: Mill Pond, South Egremont, 21 June 1971, 2846, (BOSC).

Potamogeton pusillus L. var. *pusillus*: VERMONT: ADDISON CO.: Dead Creek, Ferrisburg, 18 July 1972, 5476, (BOSC); Little Otter Creek, Ferrisburg, 18 July 1972; swamp on west side of Otter Creek, Ferrisburg, 18 July 1972, 5572, (BOSC); Fern Lake, Leicester, 1 August 1973. WINDSOR CO.: Mill Pond, Windsor, 1 August 1971, 1813, (BOSC). RUTLAND CO.: Glen Lake, Castleton, 30 July 1973, 8313, (BOSC); Lake Bamoseen, Hubbardton-Castleton, 19 July 1972, 5624, (BOSC, DAO, UWM, Z); Lake Hortonia, Hubbardton, 19 July 1972, 5667, (BOSC); Lake St. Catherine, Poultney, 30 July

1973. MASSACHUSETTS: BERKSHIRE CO.: Mill Pond, Egremont, 21 June 1971, 7292, (BOSC, NHA); Prospect Lake, Egremont, 2 July 1973, 7459, (BOSC, MASS, NEBC); Lake Garfield, Monterey, 26 June 1972, 4795, (BOSC, RENO); north end of Onota Lake, Pittsfield, 2 July 1973; outlet of Onota Lake, Pittsfield, 2 July 1973, 7384, (BOSC, MASS, NEBC); Stockbridge Bowl, Stockbridge, 26 June 1972, 4693, (BOSC); Bridge's Pond, Williamstown, 15 September 1973, 8973, (BOSC, MASS, NEBC, NHA). CONNECTICUT: MIDDLESEX CO.: Black Pond, Middlefield, 8 August 1973, 8553, (BOSC, NLU). LITCHFIELD CO.: Lake Washinee, Salisbury, 26 June 1972; Lake Washining, Salisbury, 26 June 1972, 4715, (BOSC, NEBC, SPC); Wonoskopomuc Lake, Salisbury, 13 June 1973, 7326, (BOSC); Indian Lake, Sharon, 21 June 1971, 1546, (BOSC).

Potamogeton pusillus L. var. gemmiparus Robbins: MAINE: OXFORD CO.: horseshoe pond, North Fryeburg, 16 July 1972, 4457, (BOSC, MICH, MIN, NEBC, NHA, NLU, SPC, Z). KENNEBEC CO.: Belgrade Stream, Belgrade, 26 August 1972, 4501, (BOSC, MICH, NEBC, NHA); Maranacook Lake, Readfield, 26 August 1972, 4502, (BOSC, CS, MICH, NEBC, SPH). NEW HAMPSHIRE: CARROLL CO.: Conway Lake, Eaton, 30 July 1972, 5831, (BOSC, MTMG, NHA, Z); Moultonboro Bay-Lake Winnipesaukee, Moultonboro, 19 August 1972, 6527, (BOSC, NHA); Bearcamp Pond, Sandwich, 25 August 1971, 2446, (BOSC). RHODE ISLAND: PROVIDENCE CO.: Todds Pond, North Smithfield, 11 July 1973, 7509, (BOSC, NEBC, NHA, WVA).

WASHINGTON CO.: Pawcatuck River, Bradford, 12 July 1973, (BOSC).

<u>Potamogeton</u> <u>pusillus</u> L. var. <u>tenuissimus</u> Mert. & Koch: MAINE: AROOSTOOK CO.: south Nadeau Pond, Fort Fairfield, 19 July 1973, 7782, (BOSC); Prestile Stream pond, Mars Hill, 18 July 1973, 7792, (NEBC, NHA, NLU); Gentle Lake, Monticello, 20 July 1973, 8007, (BOSC, CHSC, FSU, MTMG); Madawaska Lake, T16-R4, 2 August 1972, 5943, (BOSC, NEBC, NHA); Long Lake, T17-R4 (Sinclair), 2 August 1972; Mud Lake, T17-R4 (Sinclair); 2 August 1972, 6049, (BOSC, NHA); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 7651, (BOSC). PENOBSCOT CO.: Pushaw Lake, Orono, 20 July 1973, 8042, (BOSC, MTMG). FRANKLIN CO.: Beaver Pond, Township D, 30 August 1972, 6770, (BOSC, CS); Long Pond, T2-R1 (Sandy River), 30 August 1972, 6745, (BOSC, SPH). OXFORD CO.: horseshoe pond, North Fryeburg, 16 July 1972, 5336, (BOSC, DAO, MIN, SPC, UWM); Cold Brook, T4-R3, 30 August 1972, 6783, (BOSC). KENNEBEC CO.: Belgrade Stream, Belgrade, 26 August 1972, 6587, (BOSC); Maranacook Lake, Readfield, 26 August 1972, 6653, (BOSC, NHA); Tingley Brook, Readfield, 26 August 1972, 6579, (BOSC); Torsey Lake, Readfield, 3 August 1972, 6144, (BOSC, MTMG, NHA). CUMBERLAND CO.: Stuart Brook above dam, Scarborough, 13 July 1972, 5245, (BOSC). YORK CO.: pond on west side of road at Fortunes Rock along Old Pond Road south of Lord's Pond, Biddeford, 10 August 1972, 6282, (BOSC, CS); Lord's Pond, Saco, 10 August 1972,

6286, (BOSC); Little Ossipee River, Waterboro, 10 August 1972, 4644, (BOSC, NEBC, NHA). NEW HAMPSHIRE: COOS CO.: Clarksville Pond, Clarksville, 26 August 1973, 8898, (BOSC); Fish Pond, Columbia, 7 August 1972, 6185, (BOSC); Island Brook, Dummer, 30 August 1972, 6757, (BOSC); Baker Pond, Lancaster, 15 August 1972, 6355, (BOSC); Martin Meadow Pond, Lancaster, 15 August 1972, 6340, (BOSC); oxbow pond on north side of Route 2, ¼ mile east of Vermont border, Lancaster, 15 August 1972; Connecticut River at Bench Mark 1880, Pittsburg, 26 August 1973, 8880, (BOSC, NHA, WVA); East Inlet stream, Pittsburg, 26 August 1973, 8895, (BOSC); West Inlet stream, Pittsburg, 26 August 1973, 8921, (BOSC). CARROLL CO.: Province Lake, Effingham-Wakefield, 4 July 1972, 4818, (BOSC, Z); Berry Bay-Ossipee Lake, Freedom, 4 August 1971; Square Brook, Freedom, 4 August 1971, 1815, (BOSC, NEBC, NHA); Silver Lake, Madison, 5 July 1972, 4838, (BOSC); Meadow Brook, Moultonboro, 21 August 1972, 6566, (BOSC, NHA); Moultonboro Bay-Lake Winnipesaukee, Moultonboro, 19 August 1972, 6523, (BOSC); Shannon Brook, Lake Winnipesaukee, Moultonboro, 21 August 1972, 9070, (BOSC, NHA); stream flowing into Moultonboro Bay on east side near Lee's Mills, Lake Winnipesaukee, Moultonboro, 19 August 1972, 6547, (BOSC, CA); Lake Wakondah, Moultonboro, 17 August 1971, 2076, (BOSC, NHA); Ossipee Lake, Ossipee-Freedom, 25 July 1971; Branch Brook, Ossipee, 25 July 1971, 1798, (BOSC); Pine River, Ossipee, 29 July 1972; stream north of Bearcamp River at Ossipee Lake, Ossipee, 25 July 1971, 2067, (BOSC, NEBC); swamp near north end of Duncan Lake, Ossipee, 19 June 1972; Chocorua Lake, Tamworth, 3 September 1971, 2347, (BOSC); Bearcamp Pond, Sandwich, 25 August 1971, 2447, (BOSC); horseshoe pond on Tamworth-West Ossipee Road, Tamworth, 29 August 1971, 2423, (BOSC, NHA); Nineteen Mile Brook, Tuftonboro, 25 August 1971, 2449, (BOSC); Twenty Mile Brook, Tuftonboro, 25 August 1971, 4862, (BOSC, SPC); pond south of Dorr Pond at settlement of Woodman, Wakefield, 29 August 1972, 6722, (BOSC); Stump Pond, Wakefield, 29 August 1972, 6750, (BOSC); Beaver Pond, Wolfeboro, 19 August 1972, 6469, (BOSC). GRAFTON CO.: Newfound Lake, Hebron, 15 August 1972, 6310, (BOSC, NHA); Ogontz Lake, Lyman, 7 July 1972, 4966, (BOSC). STRAFFORD CO.: Witcher's Falls-Cocheco River, Dover, 13 September 1973, 6988, (BOSC); Beard's Creek, Durham, 21 August 1971, 2024, (BOSC, NEBC, NHA); Mill Pond, Durham, 11 July 1972; Bellamy River below dam, Madbury, 10 September 1973, 9013, (BOSC); Branch River, Milton, 14 July 1972, 5263, (BOSC, CS, DAO, SPC); Northeast Pond, Milton, 14 July 1972, 5315, (BOSC, CS). BELKNAP CO.: Merrymeeting Marsh, Alton, 19 August 1972, 6487, (BOSC); Wickwas Lake, Meredith, 19 August 1972, 6511, (BOSC); beaver pond on north side of Upper Bay Road, Sanbornton, 19 August 1972, 6474, (BOSC). ROCKINGHAM CO.: Meadow Pond, inlet at north end, Hampton, 11 July 1972, 5213, (BOSC, CS); Taylor Brook Pond, Hampton-Hampton Falls, 11 July 1972, 5175, (BOSC, RENO, UWM). VERMONT: ESSEX

CO.: Spectacle Pond, Brighton, 7 July 1972, 5087, (BOSC); Neal Pond, Lunenberg, 15 August 1972, 6396, (BOSC). ORLEANS CO.: Pensioner Pond, Charleston, 9 August 1971, 2051, (BOSC); Barton River backwater, Irasburg, 9 August 1971. GRAND ISLE CO.: Dillenbeck Bay-Lake Champlain, Alburg, 31 July 1973, 8269, (BOSC); swamp on east side of Route 2 north of village, North Hero, 31 July 1973, 8178, (BOSC, NEBC, NHA). CALEDONIA CO.: Harvey Lake, Barnet, 23 August 1973, 8702, (BOSC); Sarah Moor Pond, Barnet, 15 August 1972, 8747, (BOSC); Little Eligo Pond, Hardwick, 5 August 1973, 8390, (BOSC); Ewell Pond, 5 August 1973, 8412, (BOSC); Fosters Pond, Peacham, 23 August 1973, 8687, (BOSC, NHA, WVA); Keiser Pond, Peacham, 5 August 1973, 8456, (BOSC); Bean Pond, Sutton, 4 August 1973, 8444, (BOSC). CHITTENDEN CO.: Mallets Bay-Lake Champlain, Colchester, 31 July 1973, 8115, (BOSC); Lake Iroquois, Hinesburg, 31 July 1973, 8361, (BOSC, ISC). ORANGE CO.: Lake Morey, Fairlee, 24 July 1972, 5744, (BOSC). WASH-INGTON CO.: Joes Brook, Cabot, 23 August 1973, 8817, (BOSC); Joes Pond, Cabot, 23 August 1973, 8679, (BOSC). ADDISON CO.: Dead Creek, Ferrisburg, 18 July 1972, 5421, (BOSC); Lewis Creek, Ferrisburg, 18 July 1972, 5451,(BOSC, NHA); South Slang, Ferrisburg, 18 July 1972, 5418, (BOSC); Cedar Lake, Monkton, 31 July 1973, 8187, (BOSC, MICH, NEBC); ditch along Swamp Road, Salisbury, 30 July 1973, 8143, (BOSC); Richville Pond, Shoreham Center, 31 July 1973, 8162, (BOSC). WINDSOR CO.: Evarts' Pond (Lake

Runnemede), Windsor, 24 July 1972; Mill Pond, Windsor, 1 August 1971, 1799, (BOSC, NHA). RUTLAND CO.: Black Pond, Hubbardton, 30 July 1973, 8329, (BOSC); Breese Pond, Hubbardton, 30 July 1973, 8142, (BOSC); Burr Lake, Sudbury, 19 July 1972, 5599, (BOSC). BENNINGTON CO.: Barber Pond, Pownal, 5 September 1973, 8966, (BOSC). MASSACHUSETTS: ESSEX CO.: Shawsheen River, Andover, 16 July 1972, 7035, (BOSC, ISC); Beck Pond, Hamilton, 9 August 1972, 6262, (BOSC); Chadwick's Lake, Haverhill, 17 September 1973, 9047, (BOSC); Pleasant Pond, Wenham, 30 September 1972, 6324, (BOSC). MIDDLESEX CO.: small pond by recreation area at Upper Mystic Lake, Arlington, 22 September 1971, 2695, (BOSC); Concord River at Route 225, Carlisle-Concord, 22 September 1971, 2608, (BOSC); Assabet River, Concord, 16 September 1972, 7030, (BOSC); Concord River, Concord, 10 June 1971, 1459, (BOSC, NHA); Sudbury River, Concord, 7 September 1971, 2693, (BOSC); Sucker Pond, Framingham, 9 September 1972, 6939, (BOSC); Whitehall Reservoir, Hopkinton, 10 June 1971, 1446, (BOSC, NEBC); small pond at southwest corner of junction of Route 135 and Speen Street, Natick, 9 September 1972, 6910, (BOSC). NORFOLK CO.: Ponkapoag Pond, Canton, 29 September 1971, 2648, (BOSC); Ames Long Pond, Stoughton, 14 June 1972, 4301, (BOSC, NHA, SPH). PLYMOUTH CO.: Mill Pond, Wareham, 12 September 1972, 6936, (BOSC). BARNSTABLE CO.: Oyster Pond, Falmouth, 12 September 1972, 6979, (BOSC); Red Brook, Falmouth, 12 September 1972, 6984, (BOSC).

WORCESTER CO.: stream between Quabog Pond and Quacumquasit Pond, East Brookfield-Brookfield, 18 June 1971, 1493, (BOSC, NHA); Lake Ripple, Grafton, 25 June 1972, 4915, (BOSC, NHA); Silver Lake, Grafton, 25 June 1972, 4888, (BOSC, NHA); Mill Pond, Milford, 24 June 1972, 4416, (BOSC, NHA, SPH); Walker Pond, Sturbridge, 18 June 1971, 1478, (BOSC); Lake Chauncy, Westborough, 20 June 1972, 4333, (BOSC, CSU, NHA, SPH); inlet at northeast corner of Lake Chauncy, Westborough, 20 June 1972, 4337, (BOSC, ISC, NHA); Hocomonco Pond, Westborough, 20 June 1972, 4376, (BOSC, NHA); pond west of Wyman Lake, Westminster, 25 July 1973, 8116, (BOSC). FRANKLIN CO.: Millers River, Erving, 5 September 1973, 8975, (BOSC). BERKSHIRE CO.: Mansfield Pond, Great Barrington, 16 September 1972, 6827, (BOSC, NHA); Laurel Lake, Lenox, 26 June 1972, 4959, (BOSC, NHA); Harmon Pond, New Marlborough, 2 July 1973, 7476, (BOSC, MASS, NEBC, NHA); north end of Onota Lake, Pittsfield, 2 July 1973, 7441, (BOSC, NEBC, NHA); outlet to Onota Lake, Pittsfield, 2 July 1973, 7533, (BOSC, WVA); Richmond Pond, Richmond, 15 June 1973, 7233, (BOSC, MASS, NEBC, NLU); Lily Brook, Stockbridge, 8 June 1971, 4693, (BOSC, NEBC); Card Pond, West Stockbridge, 6 September 1972, 6838, (BOSC); Cranberry Pond, West Stockbridge, 6 September 1972, 6871, (BOSC); Shaker Mill Pond, West Stockbridge, 15 June 1973, 7321, (BOSC). RHODE ISLAND: PROVIDENCE CO.: Sneech Pond, Cumberland, 11 July 1973, 7534, (BOSC); Todds Pond, North Smithfield, 11 July 1973, 7510, (BOSC, CHSC, UCSB).

WASHINGTON CO.: Tucker Pond, South Kingstown, 12 July 1973, 7610, (BOSC, NEBC); Pawcatuck River, Bradford, 12 July 1973, 7592, (BOSC, NEBC, NHA). CONNECTICUT: MIDDLESEX CO.: Black Pond, Middlefield, 8 August 1973, 8549, (BOSC); Coghinchaug River, Middlefield, 8 August 1973. NEW HAVEN CO.: Graniss Pond, East Haven, 8 August 1973, 8595, (BOSC, NEBC, UCSB); Lake Quonnipaug, North Guilford, 8 August 1973, 8521, (BOSC). LITCHFIELD CO.: Dog Pond, Goshen, 8 August 1973, 8605, (BOSC); Bantam Lake, Morris, 9 August 1973, 8585, (BOSC); Lake Washining, Salisbury, 26 June 1972, 4713, (BOSC, MIN).

Potamogeton hillii Morong: VERMONT: BENNINGTON CO.: South Stream, Pownal, 30 July 1973, (BOSC, CS, FSU, ISC, MICH, MTMG, NEBC, NHA, NLU, NYS, OS, UCSB, WCH). MASSACHUSETTS: BERKSHIRE CO.: Cone Brook, Richmond, 6 September 1972, 4489, (BOSC, MICH, MIN, NEBC, NHA, SPC, WVA, Z).

Potamogeton obtusifolius Mert. & Koch: MAINE: AROOSTOOK CO.: Howard Brook at Monson Lake, Fort Fairfield, 18 July 1973, 7756, (BOSC, NEBC); Monson Lake, Fort Fairfield, 18 July 1973, 7722, (BOSC, CS, NEBC, NHA); Black Lake, Fort Kent, 2 August 1972, 4623, (BOSC, NEBC, NHA); Daigle Pond, New Canada, 2 August 1972, 6085, (BOSC, NEBC, NHA, RENO); small farm pond on east side of U. S. Route 1, approximately one mile north of Houlton town line, Littleton, 17 July 1973, 7630, (BOSC, NEBC); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 5898, (BOSC, NHA, Z). PENOBSCOT CO.: Pushaw Lake, Orono, 20 July 1973, 8047, (BOSC, CHSC, FSU, NEBC, NHA, NLU, MTMG). NEW HAMPSHIRE: COOS CO.: Fish Pond, Columbia, 7 August 1972, 6210, (BOSC, NHA, SPH, UWM). ROCKINGHAM CO.: Taylor Brook Pond, Hampton-Hampton Falls, 21 August 1971, 2394, (BOSC, KNSC, NEBC). VERMONT: ORLEANS CO.: Barton River backwater, Irasburg, 9 August 1971, 2042, (BOSC, NEBC, NHA). CALEDONIA CO.: Harvey Lake, Barnet, 23 August 1973, 8697, (BOSC, CS, NEBC); Warden Pond, Barnet, 15 August 1972, 6433, (BOSC, CS, NEBC, NHA); Keiser Pond, Peacham-Danville, 5 August 1973, 8487, (BOSC, MICH, NEBC); swamp south of Keiser Lake, Peacham, 5 August 1973, 8403, (BOSC, NEBC, NHA, UCSB). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8873, (BOSC, ISC, NEBC, WVA). MASSACHUSETTS: ESSEX CO.: Pleasant Pond, Wenham, 30 September 1972, 2689, (BOSC, NHA). MIDDLESEX CO.: marsh across from dump, Billerica, 10 June 1971, 1451, (BOSC, NEBC, NHA).

Potamogeton vaseyi Robbins: MAINE: AROOSTOOK CO.: Madawaska Lake, T16-R4, 2 August 1972, 4600, (BOSC, NEBC, NHA, UCSB). NEW HAMPSHIRE: CARROLL CO.: Lake Kanasatka, Moultonboro, 10 July 1972, 5131, (BOSC, Z). STRAFFORD CO.: Northeast Pond, Milton, 14 July 1972, 5313, (BOSC, CS, MIN, NEBC, NHA, RENO). SULLIVAN CO.: Blow-Me-Down Pond, Cornish, 24 July 1972, 4464, (BOSC, MICH, NEBC).

VERMONT: ORLEANS CO.: Crystal Lake, Barton, 7 July 1972, 5041, (BOSC). FRANKLIN CO.: Alder Run, Franklin, 31 July 1973, 8210, (BOSC, ISC, NEBC, NHA). CHITTENDEN CO.: Mallets Bay-Lake Champlain, Colchester, 31 July 1973, 8127, (BOSC, CS, NEBC). ORANGE CO.: Lake Fairlee, West Fairlee, 24 July 1972, 4370, (BOSC, NEBC, NHA, SPH, WCH). MASSACHUSETTS: ESSEX CO.: Chadwick's Lake, Haverhill, 17 September 1973, 9044, (BOSC, CHSC, NEBC). BERKSHIRE CO.: Lake Garfield, Monterey, 26 June 1972, 4448, (BOSC, DAO, MICH, NHA). CONNECTICUT: MIDDLESEX CO.: Crystal Lake, Middletown, 8 August 1973, 8674, (BOSC, NEBC, NLU, UCSB).

Potamogeton lateralis Morong: NEW HAMPSHIRE: COOS CO.: oxbow pond off Connecticut River on north side of Route 2, ¼ mile east of Vermont border, Lancaster, 6387, (BOSC, NEBC, NHA).

Potamogeton spirillus Tuckerman: MAINE: AROOSTOOK CO.: Daigle Pond, New Canada, 2 August 1972, 4618, (BOSC, NEBC); Madawaska Lake, T16-R4, 2 August 1972, 5949, (BOSC); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 5902, (BOSC). FRANKLIN CO.: Gull Pond, Dallas (T2-R2), 30 August 1972, 6753, (BOSC); Haley Pond, Rangley-Dallas, 30 August 1972, 6748, (BOSC); portion of Long Pond cut off by Route 14, Sandy River (T2-R1), 30 August 1972. OXFORD CO.: Cold Brook, T4-R3, 30 August 1972, old course, Saco River, Fryeburg Harbor, 16 July

1972, 5370, (BOSC, NHA, Z); horseshoe pond, North Fryeburg, 16 July 1972. KENNEBEC CO.: Belgrade Stream, Belgrade, 26 August 1972, 6581, (BOSC); Echo Lake, Mt. Vernon, 26 August 1972, 6688, (BOSC); Maranacook Lake, Readfield, 20 August 1972, 6638, (BOSC); Torsey Lake, Readfield, 3 August 1972, 6159, (BOSC, SPH); Tingley Brook, Readfield, 26 August 1972, 6582, (BOSC, CS); Lake Annabessacook, Winthrop, 26 August 1972, 6677, (BOSC). YORK CO.: Great Works River, South Berwick, 10 September 1973, 9005, (BOSC). NEW HAMPSHIRE: COOS CO.: Clarksville Pond, Clarksville, 26 August 1973, 8862, (BOSC); Androscoggin River, Errol, 26 August 1973; East Inlet stream, Pittsburg, 26 August 1973, 8892, (BOSC); Back Pond, Stewartstown, 7 August 1972, 6231, (BOSC, ISC, NHA). CARROLL CO.: Conway Lake, Eaton, 30 July 1972, 5830, (BOSC); Hoyt Brook, Freedom, 1 September 1972; Lake Kanasatka, Moultonboro, 18 August 1971, 5137, (BOSC, SPC); Moultonboro Bay-Lake Winnipesaukee, Moultonboro, 19 August 1972; Lake Wakondah, Moultonboro, 17 August 1971, 5162, (BOSC, RENO, Z); Bearcamp River, Ossipee, 29 July 1972; Branch Brook, Ossipee, 25 July 1971, 2808, (BOSC); Pine River, Ossipee, 29 July 1972; stream north of Bearcamp River at Ossipee Lake, Ossipee, 25 July 1971; Chocorua Lake, Tamworth, 21 July 1971, 1634, (BOSC); Bearcamp Pond, Sandwich, 25 August 1971; Nineteen Mile Brook, Tuftonboro, 25 August 1971, 2473, (BOSC). GRAFTON CO.: Ogontz Lake, Lyman, 7 July 1972. STRAFFORD CO.: Lamprey River, Durham, 30 September

1972; Witchers Falls-Cocheco River, Dover, 13 September 1973; Bellamy River, Madbury, 10 September 1973, 9015, (BOSC); Branch River, Milton, 14 July 1972, 5258, (BOSC); Northeast Pond, Milton, 14 July 1972; Isinglass River, Rochester, 10 September 1973, 9015, (BOSC). BELKNAP CO.: Merrymeeting Marsh, Alton, 19 August 1972; Wickwas Lake, Meredith, 19 August 1972. MERRIMAC CO.: Danbury Bog Pond, Danbury, 23 July 1972. ROCKINGHAM CO.: Meadow Pond, Hampton Beach, 11 July 1972, (BOSC, MIN, NHA, UWM). VERMONT: ESSEX CO.: Wallace Pond, Canaan, 7 August 1972, 6244, (BOSC); Neal Pond, Lunenburg, 15 August 1972, 6397, (BOSC). ORLEANS CO.: Pensioner Pond, Charleston, 9 August 1971, 2039, (BOSC, NEBC, NHA). FRANKLIN CO.: Alder Run, Franklin, 31 July 1973, 8208, (BOSC, NHA). GRAND ISLE CO.: Lake Champlain, North Hero, 31 July 1973, 8326, (BOSC, ISC). CALEDONIA CO.: Peacham Pond, Peacham, 15 August 1972. CHITTENDEN CO.: Mallets Bay-Lake Champlain, Colchester, 31 July 1973, 8121, (BOSC, MICH, MTMG, NEBC); Lake Iroquois, Hineburg, 31 July 1973, 8357, (BOSC). ORANGE CO.: Lake Morey, Fairlee, 21 July 1972, 5746, (BOSC). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8815, (BOSC). ADDISON CO.: Fern Lake, Leicester, 1 August 1973; Lake Bamoseen, Hubbardton-Castleton, 19 July 1972, 5631, (BOSC). MASSACHUSETTS: ESSEX CO.: Beck Pond, Hamilton, 9 August 1972, 6265, (BOSC). MIDDLESEX CO.: Winter Pond, Arlington, 15 June 1972, 4346, (BOSC); Concord River, Carlisle-Concord, 16 September 1972, 7025, (BOSC); Assabet River, Concord, 5 October 1971, 2639, (BOSC, KNSC); Sudbury River, Concord, 16 September 1972, 7025, (BOSC); Sudbury River, Framingham, 3 October 1971, 3207, (BOSC); Charles River, Newton, 14 June 1971, 1523, (BOSC). NORFOLK CO.: Ponkapoag Pond, Canton, 29 September 1971. PLYMOUTH CO.: Agawam River, Wareham, 10 September 1971, 2675, (BOSC). WORCESTER CO.: Brookfield River, Brookfield-East Brookfield, 18 June 1971; Lake Nipmuc, Mendon, 9 September 1971, 2673, (BOSC); Pratt Pond, Upton, 25 June 1972. BERKSHIRE CO.: Lake Garfield, Monterey, 26 June 1972, 4793, (BOSC); outlet to Onota Lake, Pittsfield, 2 July 1973, 7353, (BOSC). RHODE ISLAND: PROVIDENCE CO.: Abbott Run Brook, Cumberland, 11 July 1973, 7552, (BOSC, WVA). WASHINGTON CO.: Warden Pond, South Kingstown, 12 July 1973, 7561, (BOSC, CHSC, NLU); Pawcatuck River, Bradford, 12 July 1973, 7586, (BOSC). CONNECTICUT: MIDDLESEX CO.: Crystal Lake, Middletown, 8 August 1973; Lake Quonnipaug, North Guilford, 8 August 1973, 8523, (BOSC, NEBC, NLU). LITCHFIELD CO.: Dog Pond, Goshen, 9 August 1973, 8604, (BOSC); Bantam Lake, Morris, 9 August 1973, 8586, (BOSC).

Potamogeton diversifolius Raf. var. diversifolius: MASSACHUSETTS: FRANKLIN CO.: Laurel Lake, Erving, 25 July 1973, 8988, (BOSC).

Potamogeton diversifolius Raf. var. trichophyllus Morong: MAINE: CUMBERLAND CO.: Long Pond, Saco, 10 August

1972, 6289, (BOSC). NEW HAMPSHIRE: CARROLL CO.: Conway Lake, Eaton, 2 September 1971; Hoyt Brook, Freedom, 1 September 1972; Shannon Brook, Lake Winnipesaukee, Moultonboro, 2 August 1972, 6561, (BOSC); Bearcamp River, Ossipee, 29 July 1972; Ossipee Lake, Ossipee-Freedom, 25 July 1971, 1796, (BOSC); Pine River, Ossipee, 29 July 1972; Bearcamp Pond, Sandwich, 25 August 1971, 2406, (BOSC); Little Lake, Tamworth, 3 September 1971, 2382, (BOSC); Nineteen Mile Brook, Tuftonboro, 25 August 1971, 2391, (BOSC, NEBC, NHA); pond south of Round Pond, east of Route 16 near Ossipee town line, Wakefield, 29 August 1972, 6715, (BOSC); Stump Pond, Wakefield, 29 August 1972, 6741, (BOSC, CS). GRAFTON CO.: Newfound Lake, Hebron, 15 August 1972, 6309, (BOSC). BELKNAP CO.: Wickwas Lake, Meredith, 19 August 1972, 6508, (BOSC). MERRIMAC CO.: Danbury Bog Pond, Danbury, 23 July 1973, 5215, (BOSC). MASSACHUSETTS: ESSEX CO.: Lily Pond, Gloucester, 9 August 1972, 4481, (BOSC, MICH). MIDDLESEX CO.: Winter Pond, Arlington, 15 June 1972, 4347, (BOSC); North Pond, Hopkinton, 10 June 1971. NORFOLK CO.: Houghton's Pond, Canton, 29 September 1971, 2617, (BOSC); Ponkapoag Pond, Canton, 29 September 1971, 2642, (BOSC, NHA). WORCESTER CO.: Lake Nipmuc, Mendon, 9 September 1971; Pratt Pond, Upton, 25 June 1972, 4881, (BOSC, ISC); Walker Pond, Sturbridge, 18 June 1971, 1482, (BOSC, NHA); pond west of Wyman Lake, Westminster, 25 July 1973, 8115, (BOSC, MTMG, MLU). FRANKLIN CO.: Laurel Lake, Erving, 25 July 1973, 8984, (BOSC, MICH, NEBC); Lake Rohunta, Orange-Athol, 25 July 1973, 8064, (BOSC, MASS, UCSB). RHODE ISLAND: PROVIDENCE CO.: Sneech Pond, Cumberland, 11 July 1973, 7531, (BOSC, CHSC); Todds Pond, North Smithfield, 11 July 1973, 7506, (BOSC, NLU). WASHINGTON CO.: Tucker Pond, South Kingstown, 12 July 1973; Pawcatuck River, Bradford, 12 July 1973; stream along Route 1A, Westerly, 12 July 1973, 7627, (BOSC). CONNECTICUT: MIDDLESEX CO.: Crystal Lake, Middletown, 2 August 1973, 8641, (BOSC).

Potamogeton epihydrus Raf. var. epihydrus: MAINE: AROOSTOOK CO.: Monson Lake, Fort Fairfield, 18 July 1973, 7704, (BOSC, NEBC, NHA, UWM); Black Lake, Fort Kent, 2 August 1972, 4628, (BOSC, NEBC, NHA); Daigle Pond, New Canada, 2 August 1972, 4622, (BOSC, NEBC, NHA); Madawaska Lake, T16-R4, 2 August 1972, 5984, (BOSC, NEBC, NHA); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 5910, (BOSC, NHA). FRANKLIN CO.: Gull Lake, Dallas (T2-R2), 30 August 1972, 6762, (BOSC, CS, NEBC, SPH). VERMONT: ORLEANS CO.: Barton River backwater, Irasburg, 9 August 1971, 2723, (BOSC). CALEDONIA CO.: Little Eligo Pond, Hardwick, 5 August 1973, 8354, (BOSC); Keiser Pond, Peacham-Danville, 5 August 1973, 8467, (BOSC, FSU, MICH, NEBC, NHA, NLU). ADDISON CO.: South Slang, Ferrisburg, 18 July 1972, 5415, (BOSC, NEBC, UWM); swamp west of Otter Creek, Ferrisburg, 18 July 1972, 4556, (BOSC, NEBC). RUTLAND CO.: Black Pond, Hubbardton, 30 July 1973, 8338, (BOSC); Lake Hortonia, Hubbardton, 19 July 1972, 4461, (BOSC, MICH, RENO). MASSACHUSETTS: BERKSHIRE CO.: Lily Brook, Stockbridge, 8 June 1971, 6863, (BOSC, NHA); Cranberry Pond, West Stockbridge, 6 September 1972, 4679, (BOSC, NEBC).

Potamogeton epihydrus Raf. var. ramosus (Peck) House: MAINE: AROOSTOOK CO.: SquaPan Lake, Ashland, 19 July 1973, 7982, (BOSC); Eagle Lake, Eagle Lake, 19 July 1973, 7948, (BOSC); Fish River near Eagle Lake, Eagle Lake, 19 July 1973, 7947, (BOSC, UCSB); south branch, Meduxnekeag River, Hodgdon, 20 July 1973, 7962, (BOSC); Gentle Lake, Monticello, 20 July 1973, 8004, (BOSC); Mosquito Brook, Portage Lake, 19 July 1973; Portage Lake, Portage Lake, 19 July 1973, 7901, (BOSC, NEBC); Brishlotte Pond, St. Agatha, 19 July 1973, 7978, (BOSC); Madawaska Lake, T16-R4, 2 August 1972; Long Lake, T17-R4 (Sinclair), 2 August 1972, 6015, (BOSC); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 5906, (BOSC); St. Froid Lake, Winterville, 19 July 1973, 7877, (BOSC); Red River near St. Froid Lake, Winterville, 19 July 1973, 7845, (BOSC). PENOBSCOT CO.: Pushaw Lake, Orono, 20 July 1973, 8021, (BOSC). FRANKLIN CO.: Beaver Pond, Township D, 30 August 1972, 6782, (BOSC); Gull Pond, Dallas (T2-R2), 30 August 1972; portion of Long Pond cut off by Route 14, Sandy River (T2-R1), 30 August 1972; Long Pond stream, Sandy River (T2-R1), 30 August 1972, 4694, (BOSC, NEBC); Haley Pond, Rangeley-Dallas, 30 August 1972, 6708, (BOSC). OXFORD CO.: Charles River, Fryeburg Harbor, 16 July 1972, 5394, (BOSC); old course, Saco River, Fryeburg Harbor, 16 July 1972, 5388, (BOSC, NHA); horseshoe pond, North Fryeburg, 16 July 1972, 5361, (BOSC); Cold Brook, T4-R3, 30 August 1972. KENNEBEC CO.: Belgrade Stream, Belgrade, 26 August 1972, 6602, (BOSC); Echo Lake, Mt. Vernon, 26 August 1972, 6691, (BOSC, UCSB); Maranacook Lake, Readfield, 26 August 1972; Tingley Brook, Readfield, 26 August 1972, 6624, (BOSC); Torsey Lake, Readfield, 3 August 1972, 6156, (BOSC); Lake Annabessacook, Winthrop, 26 August 1972, 6682, (BOSC). CUMBERLAND CO.: Stuart Brook above dam, Scarborough, 13 July 1972. YORK CO.: Shoreup Brook, Eliot, 10 September 1973, 9019, (BOSC); Little Ossipee River backwater, Waterboro, 10 August 1972, 6303, (BOSC). NEW HAMPSHIRE: COOS CO.: Fish Pond, Columbia, 7 August 1972, 6195, (BOSC, CS); Island Brook, Dummer, 30 August 1972, 6777, (BOSC); Androscoggin River, Errol, 26 August 1973, 8827, (BOSC); Baker Pond, Lancaster, 15 August 1972, 6359, (BOSC); Martin Meadow Pond, Lancaster, 15 August 1972, 6345, (BOSC); East Inlet Pond, Pittsburg, 26 August 1973, 8902, (BOSC); East Inlet Stream, Pittsburg, 26 August 1973, 8886, (BOSC); inlet at north end of Second Connecticut Lake consisting of Connecticut River and Scott Bog stream, Pittsburg, 26 August 1973, 8877, (BOSC); West Inlet Stream, Pittsburg, 26 August 1973, 8919, (BOSC, NHA); small pond on south side of Route 2 approximately ¼ mile west of Maine border, Shelburne, 26 August 1973, 8933, (BOSC); Back Pond, Stewartstown, 7 August 1972, 6234, (BOSC). CARROLL CO.: Church pond outlet, Albany, 28 August 1972, Lake Pequaket, Conway, 2 September 1971; Conway Lake, Eaton, 2 September 1971, 2327, (BOSC); Province Lake, Effingham-Wakefield, 22 July 1971, 3766, (BOSC); Berry Bay-Ossipee Lake, Freedom, 4 August 1971; Square Brook, Freedom, 4 August 1971; Hoyt Brook, Freedom, 1 September 1972; Cooks Pond, Madison, 23 July 1971, 1787, (BOSC); Silver Lake, Madison, 5 July 1972, 4844, (BOSC); Meadow Brook, Moultonboro, 21 August 1972, 6573, (BOSC, CHSC); Moultonboro Bay-Lake Winnipesaukee, Moultonboro, 19 August 1972, 6544, (BOSC); Shannon Brook, Lake Winnipesaukee, Moultonboro, 21 August 1972; Lake Wakondah, Moultonboro, 17 August 1971, 2078, (BOSC); Big Dan Hole Pond, Ossipee-Tuftonboro, 4 July 1972; Branch Brook, Ossipee, 25 July 1971; Connor Pond, Ossipee, 29 July 1971, 3557, (BOSC, NHA); Little Dan Hole Pond, Ossipee, 4 July 1972, 2196, (BOSC); Ossipee Lake, Ossipee-Freedom, 25 July 1971; Pine River, Ossipee, 29 July 1972; stream north of Bearcamp River at Ossipee Lake, Ossipee, 25 July 1971; small pond at Brown's Ridge Road and Route 16, Ossipee, 28 August 1972, 6714, (BOSC); Bearcamp Pond, Sandwich, 25 August 1971; Chocorua Lake, Tamworth, 21 August 1971, 1640, (BOSC); pond along Tamworth-West Ossipee Road, Tamworth, 29 August 1971, 3790, (BOSC); Nineteen Mile Brook, Tuftonboro, 25 August 1971, 2331, (BOSC);

Twenty Mile Brook, Tuftonboro, 25 August 1971, 3784, (BOSC, KNSC, NHA); Stump Pond, Wakefield, 29 August 1972, 6756, (BOSC); pond south of Dorr Pond at Woodman, Wakefield, 29 August 1972, 6736, (BOSC); Beaver Pond along south side of Route 25, Wolfeboro, 19 August 1972; Wiley Brook pond, Wolfeboro, 12 August 1971. GRAFTON CO.: Newfound Lake, Hebron, 15 August 1972, 6315, (BOSC); Lily Pond, Livermore, 28 August 1972, 6707, (BOSC); Post Pond, Lyman, 24 July 1972, 5738, (BOSC). STRAFFORD CO.: Cocheco River at Witcher's Falls, Dover, 13 September 1973, 7000, (BOSC); Beard's Creek, Durham, 21 August 1971; Mill Pond, Durham, 11 July 1972; Bellamy River, Madbury, 10 September 1973, 9008, (BOSC); Branch River, Milton, 14 July 1972, 5289, (BOSC, DAO, SPC, WVA, Z); Northeast Pond, Milton, 14 July 1972, 5328, (BOSC, SPH); Isinglass River, Rochester, 10 September 1973, 9017, (BOSC, WVA); Fresh Creek, Rollinsford, 11 July 1972, 5001, (BOSC, DAO). BELKNAP CO.: Merrymeeting Marsh, Alton, 19 August 1972, 6495, (BOSC); Wickwas Lake, Meredith, 19 August 1972, 6517, (BOSC); beaver marsh pond on north side of Upper Bay Road, Sanbornton, 19 August 1972. MERRIMAC CO.: Danbury Bog Pond, Danbury, 23 July 1972, 5735, (BOSC, ISC). SULLIVAN CO.: Blow-Me-Down Pond, Cornish, 24 July 1972, 5732, (BOSC). ROCKINGHAM CO.: Pow Wow Pond, Kingston, 17 September 1973, 9055, (BOSC). CHESHIRE CO.: Connecticut River, Hinsdale, 25 July 1971, 8122, (BOSC). VERMONT: ESSEX CO.:

Nulhegan Pond, Brighton, 7 July 1972, 5115, (BOSC, RENO); Spectacle Pond, Brighton, 7 July 1972, 5090, (BOSC, SPC); Wallace Pond, Canaan, 7 August 1972, 6259, (BOSC); Neal Pond, Lunenburg, 15 August 1972, 6401, (BOSC). ORLEANS CO.: Pensioner Pond, Charleston, 9 August 1971; Barton River backwater, Irasburg, 9 August 1971, 2552, (BOSC). FRANKLIN CO.: Alder Run, Franklin, 31 July 1973, 8206, (BOSC, NEBC). CALEDONIA CO.: Little Eligo Pond, Hardwick, 5 August 1973, 8385, (BOSC); Harvey Lake, Barnet, 23 August 1973, 8699, (BOSC, ISC); Peacham Pond, Peacham, 15 August 1972, 6419, (BOSC). CHITTENDEN CO.: Lake Iroquois, Hinesburg, 31 July 1973, 8350, (BOSC). ORANGE CO.: Lake Morey, Fairlee, 24 July 1972, 5775, (BOSC). WASHINGTON CO.: Joes Pond, Cabot, 23 August 1973, 8676, (BOSC). RUTLAND CO.: Sunrise Lake, Benson, 1 August 1973, 8237, (BOSC); Glen Lake, Castleton, 30 July 1973, 8308, (BOSC); Black Pond, Hubbardton, 30 July 1973, 8337, (BOSC); Lake St. Catherine, Poultney, 30 July 1973, 8466, (BOSC, MICH). WINDHAM CO.: Lily Pond, Vernon, 25 July 1973, 8124, (BOSC). MASSACHUSETTS: ESSEX CO.: Shawsheen River, Andover, 17 September 1972, 7043, (BOSC); Beck Pond, Hamilton, 9 August 1972, 6270, (BOSC). MIDDLESEX CO.: Russell Mill Pond, Chelmsford, 17 September 1972, 7049, (BOSC); Assabet River, Concord, 16 September 1972, 7029, (BOSC); Concord River at Route 225, Concord-Carlisle, 22 September 1971, 2705, (BOSC); Sudbury

River, Framingham, 3 October 1971, 3210, (BOSC); small pond at southwest corner of junction of Route 135 and Speen Street, Natick, 9 September 1972, 6914, (BOSC). SUFFOLK CO.: Neponset River, Readville, 14 June 1971, 2902, (BOSC). NORFOLK CO.: Hemenway Pond, Milton, 28 September 1971, 2626, (BOSC); Ponkapoag Pond, Canton, 29 September 1971, 2646, (BOSC); Trout Brook, Dover, 9 September 1972, 6932, (BOSC, NLU); Ames Long Pond, Stoughton, 14 June 1972, 4258, (BOSC, NHA). PLYMOUTH CO.: Agawam River, Wareham, 10 September 1971, 2674, (BOSC); Mill Pond, Wareham, 10 September 1971. BARNSTABLE CO.: Red Brook, Falmouth, 12 September 1972, 6986, (BOSC, CS). WORCESTER CO.: Still River, Bolton, 16 September 1972; Brookfield River, Brookfield-East Brookfield, 18 June 1971, 2939, (BOSC); stream between Quabog Pond and Quacumquasit Pond, East Brookfield-Brookfield, 18 June 1971, 2930, (BOSC); Lake Nipmuc, Mendon, 9 September 1971, 2672, (BOSC); Mill Pond, Milford, 24 June 1972, 4426, (BOSC, NHA); Walker Pond, Sturbridge, 18 June 1971, 2953, (BOSC); Lake Chauncy, Westborough, 20 June 1972, Hocomonco Pond, Westborough, 20 June 1972, 4406, (BOSC, MASS); pond west of Wyman Lake on Route 140, Westminster, 25 July 1973, 8113, (BOSC, MTMG). FRANKLIN CO.: Laurel Lake, Erving, 25 July 1973, 8077, (BOSC); Lake Rohunta, Orange-Athol, 25 July 1973, 8061, (BOSC); Millers River, Erving, 5 September 1973, 8979, (BOSC). BERKSHIRE CO.: Fountain Pond, Great Barrington, 6 September 1972, 6821, (BOSC, CS); Pontosuc Lake, Lanesborough, 2 July 1973, 7393, (BOSC); Harmon Pond, New Marlborough, 2 July 1973, 7470, (BOSC); Cone Brook, Richmond, 6 September 1972; Schenab Brook, Sheffield, 6 September 1972, 6810, (BOSC); Lily Brook, Stockbridge, 8 September 1972, 6860, (BOSC); Cranberry Pond, West Stockbridge, 6 September 1972, 6890, (BOSC). RHODE ISLAND: PROVIDENCE CO.: Abbott Run Brook, Cumberland, 11 July 1973, 7540, (BOSC, WVA); Sneech Pond, Cumberland, 11 July 1973, 7527, (BOSC, NEBC); Todds Pond, North Smithfield, 11 July 1973, 7492, (BOSC). WASHINGTON CO.: Warden Pond, South Kingstown, 12 July 1973, 7557, (BOSC); Tucker Pond, South Kingstown, 12 July 1973, 7603, (BOSC, NLU); Pawcatuck River, Bradford, 12 July 1973, 7578, (BOSC). CONNECTICUT: MIDDLESEX CO.: Coginchaug River, Middlefield, 8 August 1973, 8618, (BOSC, NLU); Crystal Lake, Middletown, 8 August 1973, 8646, (BOSC); Lake Quonnipaug, North Guilford, 8 August 1973, 8488, (BOSC, CHSC).

Potamogeton alpinus Balbis var. tenuifolius (Raf.) Ogden: MAINE: AROOSTOOK CO.: Eagle Lake, Eagle Lake, 19 July 1973, 7940, (BOSC, NEBC, UCSB); small farm pond on east side of U. S. Route 1, approximately one mile north of Houlton town line, Littleton, 17 July 1973, 7635, (BOSC, NEBC); Echo Lake, Presque Isle, 19 July 1973, 4677, (BOSC); Howard Brook at Monson Lake, Fort Fairfield, 18 July 1973, 7753, (BOSC, NEBC); Monson Lake, Fort Fairfield, 18 July 1973, 7711, (BOSC, NEBC); Madawaska Lake, T16-R4, 2 August 1972, 4467, (BOSC, MICH); Long Lake, T17-R4 (Sinclair), 2 August 1972, 4472, (BOSC, MICH, NEBC, NHA, SPH); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 7639, (BOSC, NEBC); Red River near St. Froid Lake, Winterville, 19 July 1973, 7848, (BOSC); St. Froid Lake, Winterville, 19 July 1973, 7820, (BOSC, FSU, NEBC, NLU). PENOBSCOT CO.: Pushaw Lake, Orono, 20 July 1973, 8027, (BOSC, CHSC, NHA). FRANKLIN CO.: Haley Pond, Rangley-Dallas, 30 August 1972, 6706, (BOSC, NHA, WVA); Long Pond stream, Sandy River (T2-R1), 30 August 1972, 6738, (BOSC, NEBC, NHA). NEW HAMPSHIRE: COOS CO.: East Inlet Stream, Pittsburg, 26 August 1973, 8885, (BOSC, NEBC, NHA, WVA); Connecticut River at Bench Mark 1880, Pittsburg, 26 August 1973, 8873, (BOSC, MICH, NEBC); Cross Pond, Stewartstown, 7 August 1971, 4476, (BOSC, MICH, NEBC, NHA). VERMONT: ESSEX CO.: Wallace Pond, Canaan, 7 August 1972, 4477, (BOSC, MICH, NEBC, NHA). ORLEANS CO.: Crystal Lake, Barton, 7 July 1972, 5076, (BOSC, MICH, MIN, NEBC, SPC, RENO, Z); Barton River backwater, Irasburg, 9 August 1971, 2581, (BOSC, KNSC, NEBC, NHA). CALEDONIA CO.: Newark Pond, Newark, 23 August 1973, 8657, (BOSC, NEBC, NHA); South Dolloff Pond, Sutton, 4 August 1973, 8376, (BOSC, NEBC, NHA, NLU). ORANGE CO.: Lake Fairlee, West Fairlee,

24 July 1972, 4583, (BOSC, ISC, NEBC, NHA). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8778, (BOSC, ISC, NEBC, NHA). BENNINGTON CO.: Battenkill River, Arlington, 30 July 1973, 8159, (BOSC).

Potamogeton alpinus var. subellipticus (Fernald) Ogden: MAINE: AROOSTOOK CO.: Butterfield Lake, Caswell, 19 July 1973, 7772, (BOSC, NLU); ditch along road to Butterfield Lake, Caswell, 19 July 1973, 7762, (BOSC, CS, NEBC); Gerrard Pond, Caswell, 1 August 1972, 4592, (BOSC, ISC, NEBC, NHA); Masters Daggett Brook, Caswell, 18 July 1973, 7695, (BOSC); Butterfield Brook, Caswell, 18 July 1973, 7697, (BOSC, NEBC, WVA); small farm pond on east side of U. S. Route 1, approximately one mile north of Houlton town line, Littleton, 17 July 1973, 7633, (BOSC, NEBC, NHA); Echo Lake, Presque Isle, 19 July 1973, 4681, (BOSC); stream leading into Lindsey Lake, Fort Fairfield, 18 July 1973, 7702, (BOSC); Monson Lake, Fort Fairfield, 18 July 1973, 7709, (BOSC). FRANKLIN CO.: Haley Pond, Rangeley-Dallas, 30 August 1972, 6704, (BOSC). VERMONT: ORLEANS CO.: Crystal Lake, Barton, 7 July 1972, 5066, (BOSC, DAO, MICH, MIN, RENO, SPC, SPH, UWM, Z); Pensioner Pond, Charleston, 9 August 1971, 2745, (BOSC, NEBC); Barton River backwater, Irasburg, 9 August 1971, 2579, (BOSC, KNSC, NEBC). CALEDONIA CO.: swamp south of Keiser Lake, Peacham, 5 August 1973, 8379, (BOSC, NEBC, NHA); Keiser Lake, Peacham-Danville, 5 August 1973, 8480, (BOSC, NEBC, NHA); Newark Pond, Newark, 23 August 1973, 8652, (BOSC, MICH). ORANGE CO.: Lake Fairlee, West Fairlee, 24 July 1972, 5800, (BOSC, NHA). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8782, (BOSC, VT).

<u>Potamogeton</u> <u>amplifolius</u> Tuckerman: MAINE: AROOSTOOK CO.: SquaPan Lake, Ashland, 19 July 1973, 7979, (BOSC); Eagle Lake Eagle Lake, 19 July 1973, 7945, (BOSC, UCSB); Black Lake, Fort Kent, 2 August 1972, 4625, (BOSC, NEBC, NHA); south branch, Meduxenkeag River, Hodgdon, 20 July 1972, 7964, (BOSC); Gentle Lake, Monticello, 20 July 1973, 8000, (BOSC, ISC); Jewel Pond, Monticello, 3 August 1972, 6135, (BOSC, CS); Portage Lake, Portage Lake, 19 July 1973, 7892, (BOSC, NLU, WVA); Echo Lake, Presque Isle, 19 July 1973, 4679, (BOSC); Madawaska Lake, T16-R4, 2 August 1972, 5694, (BOSC, ISC); Long Lake, T17-R4 (Sinclair), 2 August 1972, 6032, (BOSC); Mud Lake, T17-R4 (Sinclair), 2 August 1972, 6063, (BOSC); Pettingill Stream pond west of Presque Isle town line, Washburn, 2 August 1972, 7638, (BOSC); Red River near St. Froid Lake, Winterville, 19 July 1973, 7844, (BOSC). FRANKLIN CO.: Gull Pond, Dallas (T2-R2), 30 August 1972, 6764, (BOSC); Haley Pond, Rangeley-Dallas (T2-R2), 30 August 1972, 6717, (BOSC). KENNEBEC CO.: Belgrade Stream, Belgrade, 26 August 1972, 6605, (BOSC); Echo

Lake, Mt. Vernon, 26 August 1972, 6695, (BOSC); Maranacook Lake, Readfield, 26 August 1972, 6665, (BOSC); Tingley Brook, Readfield, 26 August 1972, 6627, (BOSC). NEW HAMPSHIRE: COOS CO.: Clarksville Pond, Clarksville, 26 August 1973, 8896, (BOSC); Fish Pond, Columbia, 7 August 1972, 6203, (BOSC, MTMG, NLU); Baker Pond, Lancaster, 15 August 1972, 6373, (BOSC); Martin Meadow Pond, Lancaster, 15 August 1972, 6348, (BOSC, CHSC). CARROLL CO.: Hoyt Brook, Freedom, 1 September 1972; Lake Kanasatka, Moultonboro, 10 July 1972, 5161, (BOSC); Meadow Brook, Moultonboro, 21 August 1972, 6570, (BOSC); Moultonboro Bay-Lake Winnipesaukee, Moultonboro, 19 August 1972, 6538, (BOSC); stream flowing into Moultonboro Bay on east side near Lees Mills, Moultonboro, 19 August 1972; Lake Wakondah, Moultonboro, 17 August 1971, 3675, (BOSC); Shannon Brook, Lake Winnipesaukee, Moultonboro, 21 August 1972; Ossipee Lake, Ossipee-Freedom, 25 July 1971, Bearcamp Pond, Sandwich, 25 August 1971, 3649, (BOSC); Twenty Mile Brook, Tuftonboro, 2 July 1972, 4866, (BOSC, RENO). GRAFTON CO.: Post Pond, Lyman, 24 July 1972, 5741, (BOSC). STRAFFORD CO.: Mill Pond, Durham, 11 July 1972, 9065, (BOSC); Bellamy River, Madbury, 10 September 1973, 9006, (BOSC). BELKNAP CO.: Merrymeeting Marsh, Alton, 19 August 1972. ROCKINGHAM CO.: Taylor Brook Pond, Hampton-Hampton Falls, 11 July 1972, (BOSC). VERMONT: ESSEX CO.: Island Pond, Brighton, 7 July 1972, 5114, (BOSC);

Spectacle Pond, Brighton, 7 July 1972, 5097, (BOSC, CS, RENO); Wallace Pond, Canaan, 7 August 1972, 6250, (BOSC); Neal Pond, Lunenberg, 15 August 1972, 6400, (BOSC). ORLEANS CO.: Pensioner Pond, Charleston, 9 August 1971, 2736, (BOSC); Barton River backwater, Irasburg, 9 August 1971; Seymour Lake, Morgan, 7 July 1972, 5084, (BOSC); Bald Hill Pond, Westmore, 23 August 1973, 8730, (BOSC); Long Pond, Westmore, 9 August 1971, 2550, (BOSC, NEBC). CALEDONIA CO.: Little Eligo Pond, Hardwick, 5 August 1973, 8381, (BOSC); Newark Pond, Newark, 23 August 1973, 8358, (BOSC); Ewell Pond, Peacham, 5 August 1973, 8415, (BOSC); Martins Pond, Peacham, 23 August 1973, 8670, (BOSC). CHITTENDEN CO.: Lake Iroquois, Hinesburg, 31 July 1973, 8345, (BOSC). ORANGE CO.: Lake Morey, Fairlee, 24 July 1972, 5763, (BOSC); Lake Fairlee, West Fairlee, 24 July 1972, 5814, (BOSC). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8873, (BOSC). RUTLAND CO.: Sunrise Lake, Benson, 1 August 1973, 8232, (BOSC); Glen Lake, Castleton, 30 July 1973, 8301, (BOSC); Lake Bomoseen, Hubbardton-Castleton, 19 July 1972, 5666, (BOSC, DAO); Black Pond, Hubbardton, 30 July 1973, 8335, (BOSC); Breese Pond, Hubbardton, 30 July 1973; Lake St. Catherine, Poultney, 30 July 1973, 8161, (BOSC); Burr Lake, Sudbury, 19 July 1972, 5606, (BOSC); Little Pond, Wells, 30 July 1973, 8185, (BOSC). MASSACHUSETTS: WORCESTER CO.: stream between Quabog Pond and Quacumquasit Pond, East Brookfield-Brookfield, 18 June 1971, 2931, (BOSC); Lake Ripple, Grafton, 25 June 1972, 4928, (BOSC). BERKSHIRE CO.: Goose Pond, Lee, 2 July 1973, 2477, (BOSC); Wood's Pond, Housatonic River, Lenox, 2 July 1973, Lake Garfield, Monterey, 26 June 1972, 4814, (BOSC, NHA, SPC); Harmon Pond, New Marlborough, 2 July 1973, 2468, (BOSC); Shaker Mill Pond, West Stockbridge, 15 June 1973. CONNECTICUT: MIDDLESEX CO.: Black Pond, Middlefield, 8 August 1973, 8530, (BOSC). NEW HAVEN CO.: Lake Quonnipaug, North Guilford, 8 August 1973, 8514, (BOSC, NEBC). LITCHFIELD CO.: Dog Pond, Goshen, 9 August 1973, 8602, (BOSC); West Side Pond, Goshen, 9 August 1973, 8619, (BOSC); Bantam Lake, Morris, 9 August 1973, 8582, (BOSC); Lake Washining, Salisbury, 26 June 1972, 4788, (BOSC); Wononskopomuc Lake, Salisbury, 15 June 1973, 7271, (BOSC); Mudge Pond, Sharon, 6 September 1972, 6899, (BOSC).

Potamogeton pulcher Tuckerman: NEW HAMPSHIRE: CARROLL CO.: Berry Bay-Lake Ossipee, Freedom, 16 July 1971, 3700, (BOSC); Hoyt Brook, Freedom, 1 September 1972, 4488, (BOSC, MICH); Moultonboro Bay-Lake Winnipesaukee, Moultonboro, 19 August 1972, 6539, (BOSC, DAO, MICH, MIN, NEBC, NHA, UWM); Ossipee Lake, Ossipee-Freedom, 25 July 1971. STRAFFORD CO.: Northeast Pond, Milton, 14 July 1972, 5324, (BOSC, CS, NEBC). ROCKINGHAM CO.: Pow Wow Pond, Kingston, 17 September 1973, 9060, (BOSC, NEBC, NHA). MASSACHUSETTS: ESSEX CO.: Beck Pond, Hamilton, 9 August 1972, 4478, (BOSC, MICH). MIDDLESEX CO.: Icehouse Pond, Hopkinton, 10 June 1971, 2874, (BOSC). NORFOLK CO.: Ponkapoag Pond, Canton, 29 September 1971, 3233, (BOSC, NHA); Ames Long Pond, Stoughton, 14 June 1972, 4269, (BOSC, NEBC, NHA). WORCESTER CO.: Brookfield River, East Brookfield-Brookfield, 18 June 1971, 4688, (BOSC); Lake Ripple, Grafton, 25 June 1972; Hopedale Pond, Hopedale, 16 June 1971, 2915, (BOSC); Walker Pond, Sturbridge, 18 June 1971, 2949, (BOSC); Hocomonco Pond, Westborough, 20 June 1972, 4400, (BOSC, NEBC, NHA). RHODE ISLAND: PROVIDENCE CO.: Sneech Pond, Cumberland, 11 July 1973, 7522, (BOSC, NHA, WVA); Todds Pond, North Smithfield, 11 July 1973, 7487, (BOSC, CS, MICH). WASHINGTON CO.: Pawcatuck River, Bradford, 12 July 1973, 7563, (BOSC, CHSC, NLU, UCSB); Tucker Pond, South Kingstown, 12 July 1973; stream along Route 1A, Westerly, 12 July 1973, 7619, (BOSC, NHA). CONNECTICUT: NEW HAVEN CO.: Lake Quonnipaug, North Guilford, 8 August 1973, 8494, (BOSC).

Potamogeton nodosus Poiret: MAINE: YORK CO.: Great Works River at Emerys Bridge Road, South Berwick, 10 September 1973. NEW HAMPSHIRE: COOS CO.: Androscoggin River, Errol, 26 August 1973, 8834, (BOSC, CS, MICH, NEBC, NHA, NLU, NYS, SPH, WVA). STRAFFORD CO.: Cocheco River at Witchers Falls, Dover, 13 September 1973, 4495, (BOSC, CS, DAO, MICH, MIN, NEBC, RENO, SPH, WVA, Z). CHESHIRE CO.: Connecticut River, Hinsdale, 25 July 1971, 8109, (BOSC, FSU, MTMG, NEBC, NHA). VERMONT: CHITTENDEN CO.: Pond Brook, Colchester, 31 July 1973, 8199, (BOSC, NEBC, NHA). ADDISON CO.: McCuen Slang, Addison, 1 August 1973, 8165, (BOSC, CHSC, ISC, NEBC, NHA, WVA); East Branch of Dead Creek, Bridport, 1 August 1973, 8273, (BOSC, NEBC, NHA); Dead Creek, Ferrisburg, 18 July 1972, 4546, (BOSC, NEBC, NHA); Lewis Creek, Ferrisburg, 18 July 1972, Otter Creek, Ferrisburg, 18 July 1972, 4551, (BOSC, NEBC); Richville Pond, Shoreham Center, 30 July 1973, 8157, (BOSC, NEBC, NHA); stream across Whiting-Shoreham Center Road, Whiting, 30 July 1973, 8294, (BOSC, NEBC, UCSB). RUTLAND CO.: Hubbardton River, Benson, 1 August 1973, 8220, (BOSC, MICH, NEBC, NHA); Burr Lake, Sudbury, 19 July 1973, 5608, (BOSC, NEBC, UWM, Z). MASSACHUSETTS: SUFFOLK CO.: Neponset River, Readville, 14 June 1971. BERKSHIRE CO.: Mill Pond, Egremont, 21 June 1971, 7285, (BOSC); Schenab Brook, Sheffield, 6 September 1972, 6813, (BOSC, NEBC, NHA); Lily Brook, Stockbridge, 8 September 1972, (BOSC, CS, NHA). CONNECTICUT: LITCHFIELD CO.: Lake Washining, Salisbury, 26 June 1972, 4769, (BOSC, DAO, NEBC, SPC); Indian Lake, Sharon, 15 June 1973, 7246, (BOSC, NEBC).

Potamogeton gramineus L. var. _gramineus_: MAINE: AROOSTOOK CO.: Whitehead Lake, Bridgewater, 20 July 1973, 7993, (BOSC); Gerrard Pond, Caswell, 1 August 1972, 5877, (BOSC, NHA); Pierce Lake, Caswell, 1 August 1972, 5867, (BOSC); Eagle Lake, Eagle Lake, 19 July 1973, 7958, (BOSC, NEBC); Fish River near Eagle Lake, Eagle Lake, 19 July 1973, 7927, (BOSC); Monson Lake, Fort Fairfield, 18 July 1973, 7721, (BOSC); Nadeau Pond Stream, 1 August 1972, 5846, (BOSC); Page Pond, Fort Fairfield, 18 July 1973, 7732, (BOSC, WVA); Mosquito Brook, Portage Lake, 19 July 1973, 7883, (BOSC, CHSC); Portage Lake, Portage Lake, 19 July 1973, 7900, (BOSC, MICH); Brishlotte Pond, St. Agatha, 19 July 1973, 7974, (BOSC); Madawaska Lake, T16-R4, 2 August 1972, 5957, (BOSC); Long Lake, T17-R4 (Sinclair), 2 August 1972, 6032, (BOSC, CHSC, NHA); Mud Lake, T17-R4 (Sinclair), 2 August 1972, 6078, (BOSC, NHA, UCSB); Caribou Lake, Washburn, 17 July 1973, 4663, (BOSC, NLU); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 5929, (BOSC); St. Froid Lake, Winterville, 19 July 1973, 7832, (BOSC, NHA). PENOBSCOT CO.: Pushaw Lake, Orono, 20 July 1973, 8015, (BOSC, FSU, MTMG, NLU). FRANKLIN CO.: Gull Pond, Dallas (T2-R2), 30 August 1972, 6757, (BOSC); Long Pond stream, Sandy River, (T2-R1), 30 August 1972, 6728, (BOSC). OXFORD CO.: Cold Brook (T4-R3), 30 August 1972. KENNEBEC CO.: Maranacook Lake, Readfield, 26 August 1972, 6646, (BOSC). YORK CO.: Great Works River at Emerys Bridge Road, South Berwick, 10 September 1973; Little Ossipee River backwater, Waterboro, 10 August 1972, 6301, (BOSC). NEW

HAMPSHIRE: COOS CO.: Lombard Pond, Colebrook, 17 August 1972, 6226, (BOSC, MTMG, NHA); Island Brook, Dummer, 30 August 1972, 6773, (BOSC); East Inlet Pond, Pittsburg, 26 August 1973, 8903, (BOSC, NEBC); Connecticut River at Bench Mark 1880, Pittsburg, 26 August 1973, 8874, (BOSC); Moose Falls--Connecticut River, Pittsburg, 26 August 1973, 8922, (BOSC); West Inlet Stream, Pittsburg, 26 August 1973, 8920, (BOSC). CARROLL CO.: Lake Pequaket, Conway, 2 September 1971, 2352, (BOSC, NHA); Conway Lake, Eaton, 2 September 1971, 2337, (BOSC, NEBC, NHA); Silver Lake, Madison, 5 July 1972, 4842, (BOSC, DAO, UWM, Z); Lake Kanasatka, Moultonboro, 10 July 1972, 5136, (BOSC); Lake Wakondah, Moultonboro, 17 August 1971, 2077, (BOSC, NEBC); Big Dan Hole Pond, Ossipee-Tuftonboro, 4 July 1972, 4827, (BOSC, MIN, RENO, SPC); Branch Brook, Ossipee, 25 July 1971, 3449, (BOSC, KNSC); Ossipee Lake, Ossipee-Freedom, 25 July 1971; Pine River, Ossipee, 29 July 1972; Bearcamp Pond, Sandwich, 25 August 1971, 3732, (BOSC, KNSC); Nineteen Mile Brook, Tuftonboro, 25 August 1971, 3340, (BOSC); Twenty Mile Brook, Tuftonboro, 25 August 1971. STRAFFORD CO.: Lamprey River, Durham, 30 September 1972; Branch River, Milton, 14 July 1972, 5257, (BOSC); Northeast Pond, Milton, 14 July 1972, 5320, (BOSC). VERMONT: ESSEX CO.: Island Pond, Brighton, 7 July 1972, 5107, (BOSC, RENO); Neal Pond, Lunenberg, 15 August 1972, 6405, (BOSC, CS). ORLEANS CO.: Crystal Lake, Barton, 7 July 1972, 5043, (BOSC, CS, DAO, ISC, MIN); Bald Hill Pond, Westmore, 23 August 1973, 8734, (BOSC); Long Pond, Westmore, 9 August 1971, 2715, (BOSC, KNSC). FRANKLIN CO.: Alder Run, Franklin, 31 July 1973, 8264, (BOSC). GRAND ISLE CO.: Dillenbeck Bay-Lake Champlain, Alburg, 31 July 1973, 8266, (BOSC); Lake Champlain, North Hero, 31 July 1973, 8321, (BOSC, MICH, WVA). CALEDONIA CO.: Harvey Lake, Barnet, 23 August 1973, 8713, (BOSC); Sarah Moor Pond, Barnet, 15 August 1972, 6464, (BOSC, SPH); Warden Pond, Barnet, 15 August 1972, 6448, (BOSC, NHA); Little Eligo Pond, Hardwick, 5 August 1973; Center Pond, Newark, 23 August 1973, 8664, (BOSC); Newark Pond, Newark, 23 August 1973, 8658, (BOSC); Ewell Pond, Peacham, 5 August 1973, 8425, (BOSC, ISC); Fosters Pond, Peacham, 23 August 1973, 8686, (BOSC); Keiser Pond, Peacham-Danville, 5 August 1973, 8475, (BOSC); Bean Pond, Sutton, 4 August 1973, 8441, (BOSC); South Dolloff Pond, Sutton, 4 August 1973, 8374, (BOSC). CHITTENDEN CO.: Mallets Bay-Lake Champlain, Colchester, 31 July 1973, 8113, (BOSC, NHA). ORANGE CO.: Lake Morey, Fairlee, 24 July 1972, 5779, (BOSC, CS, NHA); Lake Fairlee, West Fairlee, 24 July 1972, 5808, (BOSC). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8783, (BOSC); Joes Pond, Cabot, 23 August 1973, 8678, (BOSC). ADDISON CO.: Lake Dunmore, Leicester-Salisbury, 13 July 1971, 2772, (BOSC, NHA); Fern Lake, Leicester, 1 August 1973, 8252, (BOSC). RUTLAND CO.: Glen Lake, Castleton, 30 July 1973, 8303, (BOSC). MASSACHUSETTS: ESSEX CO.: Pleasant Pond, Wenham, 30 September 1972, 7145, (BOSC). MIDDLESEX CO.: Fresh Pond, Cambridge, 1 October 1973, 7139, (BOSC). WORCESTER CO.: Lake Chauncy, Westborough, 20 June 1972, 4320, (BOSC, CS, NHA, SPH). BERKSHIRE CO.: Goose Pond, Lee, 2 July 1973, 7478, (BOSC); Laurel Lake, Lenox, 26 June 1972; Lake Buel, Monterey, 8 June 1971, 3018, (BOSC); north end Onota Lake, Pittsfield, 2 July 1973, 7428, (BOSC, MASS); Richmond Pond, Richmond, 15 June 1973, 7219, (BOSC, MASS, NEBC); Shaker Mill Pond, West Stockbridge, 15 June 1973. RHODE ISLAND: PROVIDENCE CO.: Sneech Pond, Cumberland, 11 July 1973, 7560, (BOSC, NEBC, NHA). CONNECTICUT: MIDDLESEX CO.: Black Pond, Middlefield, 8 August 1973, 8542, (BOSC, UCSB). NEW HAVEN CO.: Lake Quonnipaug, North Guilford, 8 August 1973, 8513, (BOSC). LITCHFIELD CO.: West Side Pond, Goshen, 9 August 1973, 8622, (BOSC).

<u>Potamogeton</u> <u>gramineus</u> L. var. <u>maximus</u> Morong ex Benn.: MAINE: AROOSTOOK CO.: Fish River near Eagle Lake, Eagle Lake, 19 July 1973, 7958, (BOSC, NEBC); St. Froid Lake, Winterville, 19 July 1973. OXFORD CO.: Charles River at Kezar outlet, Fryeburg Harbor, 16 July 1972, 5395, (BOSC). NEW HAMPSHIRE: COOS CO.: Connecticut River at Bench Mark 1880, Pittsburg, 26 August 1973, 8875, (BOSC). CARROLL CO.: Branch Brook, Ossipee, 25 July 1971, 1795, (BOSC); Pine River, Ossipee, 29 July

1972; Horseshoe Pond on Tamworth-West Ossipee Road, Tamworth, 29 August 1971, 3787, (BOSC, NHA). STRAFFORD CO.: Northeast Pond, Milton, 14 July 1972. VERMONT: ESSEX CO.: Wallace Pond, Canaan, 7 August 1972, 6252, (BOSC); Neal Pond, Lunenberg, 15 August 1972, 6404, (BOSC). CALEDONIA CO.: Warden Pond, Barnet, 15 August 1972. CHITTENDEN CO.: Lake Iroquois, Hinesburg, 31 July 1973. ORANGE CO.: Lake Morey, Fairlee, 24 July 1972, 4465, (BOSC, MICH, NEBC). MASSACHUSETTS: WORCESTER CO.: Lake Ripple, Grafton, 25 June 1972, 4938, (BOSC, DAO, NEBC, NHA, RENO). RHODE ISLAND: WASHINGTON CO.: Pawcatuck River, Bradford, 12 July 1973, 7577, (BOSC).

Potamogeton gramineus L. var. myriophyllus Robbins: MAINE: KENNEBEC CO.: Torsey Lake, Readfield, 3 August 1972, 6155, (BOSC). NEW HAMPSHIRE: CARROLL CO.: Cooks Pond, Madison, 23 July 1971; Lake Kanasatka, Moultonboro, 18 August 1971; Moultonboro Bay at Lake Winnipesaukee, Moultonboro, 19 August 1972, 6521, (BOSC, SPH); Ossipee Lake, Ossipee, 25 July 1971; Pine River, Ossipee, 29 July 1972; Bearcamp Pond, Sandwich, 25 August 1971; Stump Pond, Wakefield, 29 August 1972, 6743, (BOSC, ISU, NLU). GRAFTON CO.: Ogontz Lake, Lyman, 7 July 1972, 7201, (BOSC, DAO, NEBC, SPC). VERMONT: ADDISON CO.: Lake Dunmore, Leicester-Salisbury, 13 July 1971. RUTLAND CO.: Lake Bomoseen, Hubbardton, 19 July 1972, 5634, (BOSC); Little Pond, Wells, 30 July 1973, 8197, (BOSC). MASSACHUSETTS: MIDDLESEX CO.: Fresh Pond, Cambridge, 1 October 1972, 5037, (BOSC). BERKSHIRE CO.: Harmon Pond, New Marlborough, 2 July 1973, 7472, (BOSC). CONNECTICUT: MIDDLESEX CO.: Crystal Lake, Middletown, 8 August 1973, 8645, (BOSC, NLU). LITCHFIELD CO.: West Side Pond, Goshen, 9 August 1973, 8623, (BOSC, NEBC); Lake Washining, Salisbury, 26 June 1972, 4773, (BOSC, MIN, UWM).

Potamogeton illinoensis Morong: VERMONT: CALEDONIA CO.: Harvey Lake, Barnet, 23 August 1973, 8607, (BOSC, ISC, NLU, MICH). ADDISON CO.: Lake Dunmore, Leicester-Salisbury, 13 July 1971, 2768, (BOSC); Fern Lake, Leicester, 1 August 1973, 8244, (BOSC, MTMG, NEBC); Cedar Lake, Monkton, 31 July 1973, 8181, (BOSC, NEBC, VT). RUTLAND CO.: Sunrise Lake, Benson, 1 August 1973, 8235, (BOSC, NEBC); Breese Pond, Hubbardton, 30 July 1973, 8134, (BOSC, FSU, NEBC, VT); Lake Hortonia, Hubbardton, 19 July 1972, 5693, (BOSC, NHA); Burr Lake, Sudbury, 19 July 1972, 5612, (BOSC, NEBC, NHA, UWM, Z); Little Pond, Wells, 30 July 1973, 8187, (BOSC, ISC, NEBC). BENNINGTON CO.: Barber Pond, Pownal, 5 September 1973, 8949, (BOSC, NEBC, WVA). MASSACHUSETTS: ESSEX CO.: Pleasant Pond, Wenham, 7 September 1971, 2795, (BOSC). BERKSHIRE CO.: Mansfield Pond, Great Barrington, 6 September 1972, 6837, (BOSC, NEBC, NHA, SPH); Laurel Lake, Lee-Lenox, 26 June 1972, 4502, (BOSC, NEBC); Lake Buel, Monterey, 8 June 1971, 3019, (BOSC, KNSC, NEBC, NHA); outlet to Onota Lake, Pittsfield, 2 July 1973, (BOSC, MASS, NEBC, NHA); Richmond Pond, Richmond, 15 July 1973; Shaker Mill Pond, West Stockbridge, 15 June 1973, 7334, (BOSC). CONNECTICUT: MIDDLESEX CO.: Black Pond, Middlefield, 8 August 1973, 8547, (BOSC, CS, MICH, NEBC, UCSB, WVA). NEW HAVEN CO.: Lake Quonnipaug, North Guilford, 8 August 1973, 8494, (BOSC, NEBC). LITCHFIELD CO.: Lake Washinee, Salisbury, 26 June 1972, 4784, (BOSC, NEBC, RENO, SPC); Lake Washining, Salisbury, 26 June 1972, 4741, (BOSC, DAO, NEBC, Z); Wononskopomuc Lake, Salisbury, 15 June 1973, 7264, (BOSC, CHSC, NEBC, NLU); Mudge Pond, Sharon, 6 September 1972, 4682, (BOSC, NEBC); Indian Lake, Sharon, 15 June 1973, 7244, (BOSC).

Potamogeton natans L.: MAINE: AROOSTOOK CO.: SquaPan Lake, Ashland, 19 July 1973; Butterfield Lake, Caswell, 19 July 1973, Gerrard Pond, Caswell, 1 August 1972, 5880, (BOSC); Eagle Lake, Eagle Lake, 19 July 1973; Fish River near Eagle Lake, Eagle Lake, 19 July 1973, 7920, (BOSC); Fischer Pond, Fort Fairfield, 18 July 1973, 7748, (BOSC, NEBC, NLU); Monson Lake, Fort Fairfield, 18 July 1973, 7718, (BOSC); south Nadeau Pond, Fort Fairfield, 19 July 1973, 7780, (BOSC); Page Pond, Fort Fairfield, 18 July 1973; Black Lake, Fort Kent, 2 August 1972, 6117, (BOSC); Prestile Stream Pond, Mars Hill, 18 July 1973; Jewel Pond, Monticello, 3 August 1972; Madawaska Lake, T16-R4, 2 August 1972, 5966, (BOSC); Mud Lake, T17-R4 (Sinclair), 2 August 1972, 6061, (BOSC); Mosquito Brook, Portage Lake, 19 July 1973, 7881, (BOSC); Portage Lake, Portage Lake, 19 July 1973, 7902, (BOSC, CHSC); Brishlotte Pond, St. Agatha, 19 July 1973, 7871, (BOSC); Caribou Lake, Washburn, 17 July 1973, 4661, (BOSC); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 5924, (BOSC, NHA); Red River near St. Froid Lake, Winterville, 19 July 1973. FRANKLIN CO.: Haley Pond, Rangeley-Dallas (T2-R2), 30 August 1972, 6718, (BOSC); Long Pond, Sandy River (T2-R1), 30 August 1972, 6750, (BOSC). OXFORD CO.: Charles River, Fryeburg Harbor, 16 July 1972, 5393, (BOSC); Cold Brook, T4-R3, 30 August 1972; old course Saco River, Fryeburg Harbor, 16 July 1972, 5386, (BOSC). KENNEBEC CO.: Belgrade Stream, Belgrade, 26 August 1972, 6607, (BOSC); Maranacook Lake, Readfield, 26 August 1972; Tingley Brook, Readfield, 26 August 1972, 6628, (BOSC); Torsey Lake, Readfield, 3 August 1972, 6167, (BOSC, CS); Lake Annabessacook, Winthrop, 26 August 1972, 6685, (BOSC). CUMBERLAND CO.: Stuart Brook above dam, Scarborough, 13 July 1972, 5253, (BOSC); Little Ossipee River backwater, Waterboro, 10 August 1972, 6300, (BOSC). NEW HAMPSHIRE: COOS CO.: Fish Pond, Columbia, 7 August 1972, 6781, (BOSC); Island

Brook, Dummer, 30 August 1972; Androscoggin River, Errol, 26 August 1973, 8828, (BOSC); Baker Pond, Lancaster, 15 August 1972, 6370, (BOSC); oxbow pond, Lancaster, 15 August 1972, 6391, (BOSC); Martin Meadow Pond, Lancaster, 15 August 1972, 6350, (BOSC); East Inlet Pond, Pittsburg, 26 August 1973, 8899, (BOSC, WVA); Back Pond, Stewartstown, 7 August 1972, 6236, (BOSC). CARROLL CO.: Lake Pequaket, 2 September 1971; Conway Lake, Eaton, 2 September 1971, 3619, (BOSC, KNSC); Province Lake, Effingham, 22 July 1971, 3386, (BOSC); Hoyt Brook, Freedom, 1 September 1972; Shaw Pond, Freedom, 29 August 1971, 3829, (BOSC); Cooks Pond, Madison, 23 July 1971, 3752, (BOSC); Silver Lake, Madison, 5 July 1972, 4856, (BOSC, UWM); Shannon Brook, Lake Winnipesaukee, Moultonboro, 21 August 1972; Meadow Brook, Moultonboro, 21 August 1972, 6568, (BOSC); Moultonboro Bay-Lake Winnipesaukee, Moultonboro, 19 August 1972, 6542, (BOSC); Lake Kanasatka, 18 August 1971, 3351, (BOSC); Lake Wakondah, Moultonboro, 17 August 1971, 3654, (BOSC); stream flowing into Moultonboro Bay on east side near Lees Mills at Lake Winnipesaukee, 19 August 1972; swamp south of Squam Lake on Bean Road, Moultonboro, 15 August 1971, 3290, (BOSC); Ossipee Lake, Ossipee-Freedom, 25 July 1971; Pine River, Ossipee, 29 July 1972; Bearcamp Pond, Sandwich, 25 August 1971; Horseshoe Pond along West Ossipee-Tamworth Road, Tamworth, 29 August 1971, 3786, (BOSC); Chocorua Lake, Tamworth, 21 July

1971, 3692, (BOSC); Little Lake, Tamworth, 3 September 1971, 3298, (BOSC); Nineteen Mile Brook, Tuftonboro, 25 August 1971; Twenty Mile Brook, Tuftonboro, 25 August 1971, 3286, (BOSC); pond south of Dorr Pond at settlement of Woodman, Wakefield, 29 August 1972, 6730, (BOSC); Stump Pond, Wakefield, 29 August 1972, 5584, (BOSC). GRAFTON CO.: Newfound Lake, Hebron, 15 August 1972, 6319, (BOSC); Ogontz Lake, Lyman, 7 July 1972, 5035, (BOSC, RENO). STRAFFORD CO.: Beards Creek, Durham, 21 July 1971, 3714, (BOSC); Mill Pond, Durham, 11 July 1972; Witchers Falls-Cocheco River, Dover, 13 September 1973, 2021, (BOSC); Branch River, Milton, 14 July 1972, 5302, (BOSC); Northeast Pond, Milton, 14 July 1972. BELKNAP CO.: Merrymeeting Marsh, Alton, 19 August 1972, 4480, (BOSC); Wickwas Lake, Meredith, 19 August 1972. MERRIMAC CO.: Danbury Bog Pond, Danbury, 23 July 1972. SULLIVAN CO.: Blow-Me-Down Pond, Cornish, 24 July 1972, 5733, (BOSC). ROCKINGHAM CO.: Pow Wow Pond, Kingston, 17 September 1973, 9064, (BOSC). VERMONT: ESSEX CO.: Nulhegan Pond, Brighton, 7 July 1972, 5120, (BOSC, DAO, MIN); Spectacle Pond, Brighton, 7 July 1972, 4858, (BOSC); Neal Pond, Lunenberg, 15 August 1972, 6402, (BOSC). ORLEANS CO.: Crystal Lake, Barton, 7 July 1972, 5081, (BOSC, Z); Pensioner Pond, Charleston, 9 August 1971, 2739, (BOSC). CALEDONIA CO.: Harvey Lake, Barnet, 23 August 1973, 8701, (BOSC); Sarah Moor Pond, Barnet, 15 August 1972, 6466, (BOSC);

Warden Pond, Barnet, 15 August 1972, 6450, (BOSC); Little Eligo Pond, Hardwick, 5 August 1973, 8390, (BOSC); Ewell Pond, Peacham, 5 August 1973, 8417, (BOSC, NHA); Keiser Pond, Peacham-Danville, 5 August 1973, 8478, (BOSC); Peacham Pond, Peacham, 5 August 1972, 6415, (BOSC); Bean Pond, Sutton, 4 August 1973, 8442, (BOSC); south Dolloff Pond, Sutton, 4 August 1973, 8377, (BOSC, MICH). ORANGE CO.: Lake Morey, Fairlee, 21 July 1972, 5759, (BOSC); Lake Fairlee, West Fairlee, 24 July 1972, 5817, (BOSC, SPH). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8793, (BOSC). ADDISON CO.: Lewis Creek, Ferrisburg, 18 July 1972; Little Otter Creek, Ferrisburg, 18 July 1972; Otter Creek, Ferrisburg, 18 July 1972, 5545, (BOSC, Z); South Slang, Ferrisburg, 18 July 1972, 5418, (BOSC); East Creek, Orwell, 1 August 1973, 8281, (BOSC, FSU); stream across Route 22A, Shoreham, 1 August 1973, 8200, (BOSC); Richville Pond, Shoreham Center, 30 July 1973, 8159, (BOSC). WINDSOR CO.: Evarts' Pond (Lake Runnemede), Windsor, 24 July 1972; Mill Pond, Windsor, 1 August 1971, 3456, (BOSC). RUTLAND CO.: Jones Mill Pond, Brandon, 19 July 1972, 5586, (BOSC); Lake Bamoseen, Castleton-Hubbardton, 19 July 1972, 5663, (BOSC); Lake Hortonia, Hubbardton, 19 July 1972, 5703, (BOSC); Burr Lake, Sudbury, 19 July 1972, 5610, (BOSC). WINDHAM CO.: Lily Pond, Vernon, 25 July 1973. BENNINGTON CO.: Barber Pond, Pownel, 5 September 1973, 8956, (BOSC, ISC); South Stream, Pownal, 30 July 1973, 8128, (BOSC). MASSACHUSETTS: ESSEX CO.: Colonial Pond, Lynnfield, 1 October 1972, 7143, (BOSC). MIDDLESEX CO.: Russell Mill Pond, Chelmsford, 16 September 1972, 7047, (BOSC); Concord River at Route 225, Carlisle, 22 September 1971; Sudbury River, Framingham, 3 October 1971, 3272, (BOSC); Fisk Pond, Natick, 3 October 1971; small pond northeast of Fisk Pond, Natick, 9 September 1972, 6913, (BOSC); Charles River, Newton, 14 June 1971, 2887, (BOSC). SUFFOLK CO.: Neponset River, Readville, 14 June 1971, 2908, (BOSC). NORFOLK CO.: Charles River, Dover, 3 October 1971; Trout Brook, Dover, 9 September 1972, 6927, (BOSC). WORCESTER CO.: Still River, Bolton, 16 September 1972, 7006, (BOSC); Silver Lake, Grafton, 25 June 1972, 4905, (BOSC); Mill Pond, Milford, 24 June 1972, 4428, (BOSC, ISC); Pratt Pond, Upton, 25 June 1972, 4895, (BOSC); pond west of Wyman Lake on Route 140, Westminster, 25 July 1973, 8112, (BOSC). FRANKLIN CO.: Lake Rohunta, Orange, 25 July 1973, 8062, (BOSC). BERKSHIRE CO.: Mill Pond, Egremont, 21 June 1971, 2986, (BOSC); Fountain Pond, Great Barrington, 6 September 1972, 6834, (BOSC); Woods Pond along Housatonic River, Lee, 2 July 1973; Laurel Lake, Lee, 26 June 1972, 4974, (BOSC); Lake Buel, Monterey, 8 June 1971, 3049, (BOSC); north end of Onota Lake, Pittsfield, 2 July 1973, 7417, (BOSC); Cone Brook, Richmond, 6 September 1972, 6806, (BOSC); Richmond Pond, Richmond, 15 June 1973, 7210, (BOSC); Lily Brook, Stockbridge, 8 September 1972, 6857, (BOSC); Card Pond, West Stockbridge, 6 September 1972, 6843, (BOSC); Cranberry Pond, West Stockbridge, 6 September 1972, 6883, (BOSC); Shaker Mill Pond, West Stockbridge, 15 June 1973, 7333, (BOSC). RHODE ISLAND: PROVIDENCE CO.: Sneech Pond, Cumberland, 11 July 1973, 7525, (BOSC); Todds Pond, North Smithfield, 11 July 1973, 7488, (BOSC). WASHINGTON CO.: Warden Pond, South Kingstown, 12 July 1973, 7558, (BOSC, NLU); Pawcatuck River, Bradford, 12 July 1973, 7574, (BOSC). CONNECTICUT: MIDDLESEX CO.: Coginchaug River, Middlefield, 8 August 1973. NEW HAVEN CO.: Lake Quonnipaug, North Guilford, 8 August 1973, 8510, (BOSC). LITCHFIELD CO.: Lake Washinee, Salisbury, 26 June 1972, 4785, (BOSC); Lake Washining, Salisbury, 26 June 1972, 4738, (BOSC, SPC); Indian Lake, Sharon, 21 June 1971, 2996, (BOSC); marsh at north end of Hatch Pond, Sharon, 9 August 1973, 8606, (BOSC).

Potamogeton oakesianus Robbins: MAINE: FRANKLIN CO.: Beaver Pond, Township D, 30 August 1972, 6780, (BOSC, SPC); Long Pond, Sandy River (T2-R1), 30 August 1972, 6749, (BOSC). YORK CO.: Etherington Pond, Biddeford, 10 August 1972, 6276, (BOSC, SPC, Z). NEW HAMPSHIRE: COOS CO.: small unnamed pond on south side of Route 2 approximately 1½ miles west of Maine border, Shelburne, 26 August 1973, 8925, (BOSC); East Inlet pond, Pittsburg, 26 August 1973, 8901, (BOSC). CARROLL CO.: Cooks

Pond, Madison, 23 July 1971, 3482, (BOSC, KNSC); Silver Lake, Madison, 5 July 1972, 4857, (BOSC); Big Dan Hole Pond, Ossipee-Tuftonboro, 4 July 1972, 4833, (BOSC); Little Dan Hole Pond, Ossipee, 4 July 1972; Ossipee Lake, Ossipee-Freedom, 25 July 1971; Bearcamp River, Ossipee, 29 July 1972; small pond at Browns Ridge Road and Route 16, Ossipee, 28 August 1971; Chocorua Lake, Tamworth, 21 July 1971, 3807, (BOSC, NHA); Little Lake, Tamworth, 3 September 1971, 3296, (BOSC); Wiley Brook pond, Wolfeboro, 12 August 1971, 3856, (BOSC); pond south of Round Pond, Wakefield, 29 August 1972. BELKNAP CO.: Merrymeeting Marsh, Alton, 19 August 1972, 4480, (BOSC, MICH, UWM); Wickwas Lake, Meredith, 19 August 1972. ROCKINGHAM CO.: Pow-Wow Pond, Kingston, 17 September 1973. VERMONT: ORANGE CO.: Lake Fairlee, West Fairlee, 24 July 1972, 5807, (BOSC). WINDHAM CO.: Lily Pond, Vernon, 25 July 1973, 8123, (BOSC). MASSACHUSETTS: MIDDLESEX CO.: Charles River, Newton, 14 June 1971. NORFOLK CO.: Charles River, Dover, 3 October 1971; Ames Long Pond, Stoughton, 14 June 1972, 4275, (BOSC, NHA). WORCESTER CO.: Brookfield River, Brookfield-East Brookfield, 18 June 1971; Lake Ripple, Grafton, 25 June 1972, 4955, (BOSC, NHA); Hopedale Pond, Hopedale, 16 June 1971, 2918, (BOAC); Walker Pond, Sturbridge, 18 July 1971, 2950, (BOSC). FRANKLIN CO.: Laurel Lake, Erving, 25 July 1973, 8102, (BOSC, FSU, MTMG, NHA, WVA). RHODE ISLAND: PROVIDENCE

CO.: Todds Pond, North Smithfield, 11 July 1973, 7490, (BOSC, WVA). WASHINGTON CO.: Tucker Pond, South Kingston, 12 July 1973, 7614, (BOSC, NEBC); Warden Pond, South Kingstown, 12 July 1973, 7559, (BOSC).

Potamogeton praelongus Wulfen: MAINE: AROOSTOOK CO.: Butterfield Lake, Caswell, 19 July 1973, 7769, (BOSC, NHA, NLU); Gerrard Pond, Caswell, 1 August 1972, 5888, (BOSC); Eagle Lake, Eagle Lake, 19 July 1973, 7943, (BOSC, UCSB); Black Lake, Fort Kent, 2 August 1972, 4626, (BOSC, NEBC, NHA); Monson Lake, Fort Fairfield, 18 July 1973, 7715, (BOSC, NEBC); Daigle Pond, New Canada, 2 August 1972, 6099, (BOSC, CS, NEBC, NHA); Portage Lake, Portage Lake, 19 July 1973, 7896, (BOSC, CHSC, NEBC, NHA); Echo Lake, Presque Isle, 17 July 1973, 4688, (BOSC, NEBC); Madawaska Lake, T16-R4, 2 August 1972, 4604, (BOSC, NEBC); Long Lake, T17-R4 (Sinclair), 2 August 1972, 4611, (BOSC, NEBC). KENNEBEC CO.: Torsey Lake, Readfield, 3 August 1972, 6168, (BOSC, CS). NEW HAMPSHIRE: COOS CO.: Lombard Pond, Colebrook, 7 August 1972, 4635, (BOSC, NEBC); Fish Pond, Columbia, 7 August 1972, 6201, (BOSC, ISC, NEBC, NHA, SPH). CARROLL CO.: Lake Kanasatka, Moultonboro, 10 July 1972, (BOSC); Lake Wakondah, Moultonboro, 17 August 1971, 5165, (BOSC, NEBC, NHA, UWM). GRAFTON CO.: Ogontz Lake, Lyman, 7 July 1972, (BOSC, DAO, MIN, NEBC, RENO, UWM, Z). VERMONT: ORLEANS CO.: Bald Hill Pond, Westmore, 23 August 1973, 8731, (BOSC). CALEDONIA CO.: Harvey Lake, Barnet, 23 August 1973, 8690, (BOSC); Center Pond, Newark, 23 August 1973, 8660, (BOSC); Ewell Pond, Peacham, 5 August 1973, 8422, (BOSC, Z); Keiser Pond, Peacham-Danville, 5 August 1973, 8472, (BOSC, MTMG). CHITTENDEN CO.: Lake Iroquois, Hinesburg, 31 July 1973, 8341, (BOSC, Z). ORANGE CO.: Lake Morey, Fairlee, 24 July 1972, 4580, (BOSC, NEBC, NHA). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8798, (BOSC, Z); Joes Pond, Cabot, 23 August 1973, 8799, (BOSC, NHA). ADDISON CO.: Fern Lake, Leicester, 1 August 1973, 8251, (BOSC, FSU, ISC, NEBC); Lake Bamoseen, Hubbardton, 19 July 1972, 4460, (BOSC, MICH, MIN, NEBC, SPC). MASSACHUSETTS: ESSEX CO.: Chadwicks Lake, Haverhill, 17 September 1973, 9048, (BOSC); Pleasant Pond, Wenham, 30 September 1972, (BOSC). BERKSHIRE CO.: Prospect Lake, Egremont, 2 July 1973; Lake Buel, Garfield, 8 June 1971, 3093, (BOSC, KNSC, NEBC, NHA); Lake Garfield, Monterey, 26 June 1972, 4807, (BOSC, DAO, NHA, SPC); Richmond Pond, Richmond, 15 June 1973, 7217, (BOSC, MASS, NEBC); Cranberry Pond, West Stockbridge, 6 September 1972, 6884, (BOSC, NEBC, NHA); Shaker Mill Pond, 15 June 1973, 7301, (BOSC, MASS, MICH, NEBC, NHA, NLU). CONNECTICUT: LITCHFIELD CO.: Dog Pond, Goshen, 9 August 1973; Bantam Lake, Morris, 9 August 1973, 8580, (BOSC); Lake Washinee, Salisbury, 26 June 1972, 4786, (BOSC, Z); Wonoskopomuc Lake, Salisbury, 15 June 1973, 7262, (BOSC, NEBC); Indian Lake, Sharon, 15 June 1973, 7242, (BOSC).

<u>Potamogeton</u> <u>richardsonii</u> (Benn.) Rydb.: MAINE: AROOSTOOK CO.: Eagle Lake, Eagle Lake, 19 July 1973, 7953, (BOSC, WVA); Fish River near Eagle Lake, Eagle Lake, 19 July 1973, 7930, (BOSC, NLU, WVA); Daigle Pond, New Canada, 2 August 1972, 6103, (BOSC, MTMG, NEBC, NHA, SPH); Portage Lake, Portage Lake, 19 July 1973, 7898, (BOSC, NEBC, NHA); Long Lake, T17-R4 (Sinclair), 2 August 1972, 6068, (BOSC, NEBC, NHA); Pettingill Stream pond west of Presque Isle town line, Washburn, 17 July 1973, 4596, (BOSC, NEBC); Red River near St. Froid Lake, Winterville, 19 July 1973. PENOBSCOT CO.: Pushaw Lake, Orono, 20 July 1973, 8036, (BOSC). VERMONT: ORLEANS CO.: Pensioner Pond, Charleston, 9 August 1971, 2735, (BOSC, NEBC, NHA); Barton River backwater, Irasburg, 9 August 1971, 2592, (BOSC, NHA). WASHINGTON CO.: Joes Brook, Cabot, 23 August 1973, 8764, (BOSC, NEBC). GRAND ISLE CO.: Dillenbeck Bay-Lake Champlain, Alburg, 31 July 1971. CHITTENDEN CO.: Mallets Bay-Lake Champlain, Colchester, 31 July 1973, 8103, (BOSC, FSU, MICH, MTMG, NEBC, NHA). ADDISON CO.: Lake Champlain at mouth of Otter Creek, Ferrisburg, 5562, (BOSC, MIN, NHA); Dead Creek, Ferrisburg, 18 July 1972, 5498, (BOSC); Hawkins Bay-Lake Champlain, Ferrisburg, 18 July 1972, 5466, (BOSC, NEBC, UWM); Lewis Creek, Ferrisburg, 18 July

1972, 5457, (BOSC); Little Otter Creek, Ferrisburg, 18 July 1972, 5437, (BOSC, RENO); Otter Creek, Ferrisburg, 18 July 1972, 5534, (BOSC, NEBC, UWM); South Slang, Ferrisburg, 18 July 1972, 5412, (BOSC). MASSACHUSETTS: BERKSHIRE CO.: Laurel Lake, Lee-Lenox, 26 June 1972, 4979, (BOSC); Lake Buel, Great Barrington, 8 June 1971, 3047, (BOSC, NEBC); outlet to Onota Lake, Pittsfield, 2 July 1973, 7362, (BOSC, CHSC, CS, MASS, NEBC, NHA); north end of Onota Lake, Pittsfield, 2 July 1973, 7410, (BOSC, MASS, NEBC, NHA, NYS, UCSB). CONNECTICUT: LITCHFIELD CO.: Mudge Pond, Sharon, 6 September 1972, 6902, (BOSC); Indian Lake, Sharon, 15 June 1973, 7243, (BOSC).

Potamogeton perfoliatus L. var. bupleuroides (Fernald) Farwell: MAINE: AROOSTOOK CO.: SquaPan Lake, Ashland, 19 July 1973, 7983, (BOSC, CHSC, MTMG, NEBC); Eagle Lake, Eagle Lake, 19 July 1973, 7955, (BOSC, NHA, NLU); Fish River near Eagle Lake, Eagle Lake, 19 July 1973, 7917, (BOSC); Portage Lake, Portage Lake, 19 July 1973, 7904, (BOSC, NEBC); Madawaska Lake, T16-R4 (Sinclair), 2 August 1972, 4603, (BOSC, CHSC, NEBC, NHA); Pettingill Stream pond west of Presque Isle town line, Washburn, 2 August 1972, 5922, (BOSC, NHA); St. Froid Lake, Winterville, 19 July 1973, 7819, (BOSC, MICH, NEBC, NHA, UCSB). PENOBSCOT CO.: Pushaw Lake, Orono, 20 July 1973, 8020, (BOSC, FSU, NHA). FRANKLIN CO.: Haley Pond, Dallas, 30 August 1972, 6800, (BOSC, NEBC, NHA). KENNEBEC CO.:

Torsey Lake, 3 August 1972, 6171, (BOSC, CS, UCSB); Lake Annabessacook, Winthrop, 26 August 1972, 6683, (BOSC). CUMBERLAND CO.: Dunstan River, Scarborough, 13 July 1972, 5237, (BOSC, NEBC, SPC). NEW HAMPSHIRE: COOS CO.: Baker Pond, Lancaster, 15 August 1972, 6361, (BOSC, CS, NHA). CARROLL CO.: Province Lake, Effingham, 22 July 1971, 3765, (BOSC); Lake Wakondah, Moultonboro, 17 August 1971, 3774, (BOSC, KNSC, NEBC, UWM); Lake Kanasatka, Moultonboro, 10 July 1972, 5155, (BOSC); Nineteen Mile Brook, Tuftonboro, 25 August 1971, 3342, (BOSC, NEBC, NHA). GRAFTON CO.: Ogontz Lake, Lyman, 7 July 1972, 5015, (BOSC, DAO, NEBC, RENO). STRAFFORD CO.: Johnson Creek, Durham, 11 July 1972; Branch River, Milton, 14 July 1972, 5295, (BOSC, CS, DAO, ISC, NEBC, SPH); Northeast Pond, Milton, 14 July 1972, 5322, (BOSC); Fresh Creek, Rollinsford, 11 July 1972, 5205, (BOSC, DAO, MIN, NEBC, RENO). ROCKINGHAM CO.: Taylor Brook pond, Hampton-Hampton Falls, 21 August 1971, 5180, (BOSC, SPC, Z). VERMONT: ESSEX CO.: Wallace Pond, Canaan, 7 August 1972, 4637, (BOSC, NEBC, NHA); Pensioner Pond, Charleston, 9 August 1971. GRAND ISLE CO.: Dillenbeck Bay-Lake Champlain, 31 July 1973, 8258, (BOSC, NEBC); Lake Champlain, North Hero, 31 July 1973, 8317, (BOSC, MICH, NHA). CHITTENDEN CO.: Lake Iroquois, Hinesburg, 31 July 1973, 8349, (BOSC, NEBC). ORANGE CO.: Lake Fairlee, West Fairlee, 24 July 1972, 5807, (BOSC). WINDSOR CO.: Evarts' Pond (Lake

Runnemede), 24 July 1972, 5715, (BOSC). RUTLAND CO.: Little Pond, Wells, 30 July 1973, 8193, (BOSC, ISC). MASSACHUSETTS: ESSEX CO.: Chadwicks Lake, Haverhill, 17 September 1973, 9052, (BOSC, MASS, NEBC); Pleasant Pond, Wenham, 30 September 1972, MIDDLESEX CO.: small pond by recreation area at Upper Mystic Lake, Arlington, 28 September 1972, 3519, (BOSC, NHA); Mystic River, 23 September 1971, 3514, (BOSC, NHA); small pond on north side of Fresh Pond by Cambridge Greenhouse, Cambridge, 28 September 1972, 7121, (BOSC). PLYMOUTH CO.: Agawam River, Wareham, 10 September 1971, 2834, (BOSC, NHA, KNSC); brackish water portion of Agawam River, Wareham, 10 September 1971, 2831, (BOSC). BARNSTABLE CO.: Nobska Pond, Falmouth, 12 September 1972, 6651, (BOSC, NHA); Oyster Pond, Falmouth, 12 September 1972, 6962, (BOSC, NHA). WORCESTER CO.: stream between Quabog Pond and Quacumquasit Pond, Brookfield, 18 June 1971, 2932, (BOSC). BERKSHIRE CO.: Lily Brook, West Stockbridge, 8 September 1972, 6858, (BOSC); Stockbridge Bowl, Stockbridge, 8 June 1971, 3070, (BOSC). CONNECTICUT: NEW HAVEN CO.: Lake Quonnipaug, North Guilford, 8 August 1971, 8491, (BOSC). LITCHFIELD CO.: Wononskopomuc Lake, Salisbury, 15 June 1973, 7256, (BOSC, NEBC, NLU).

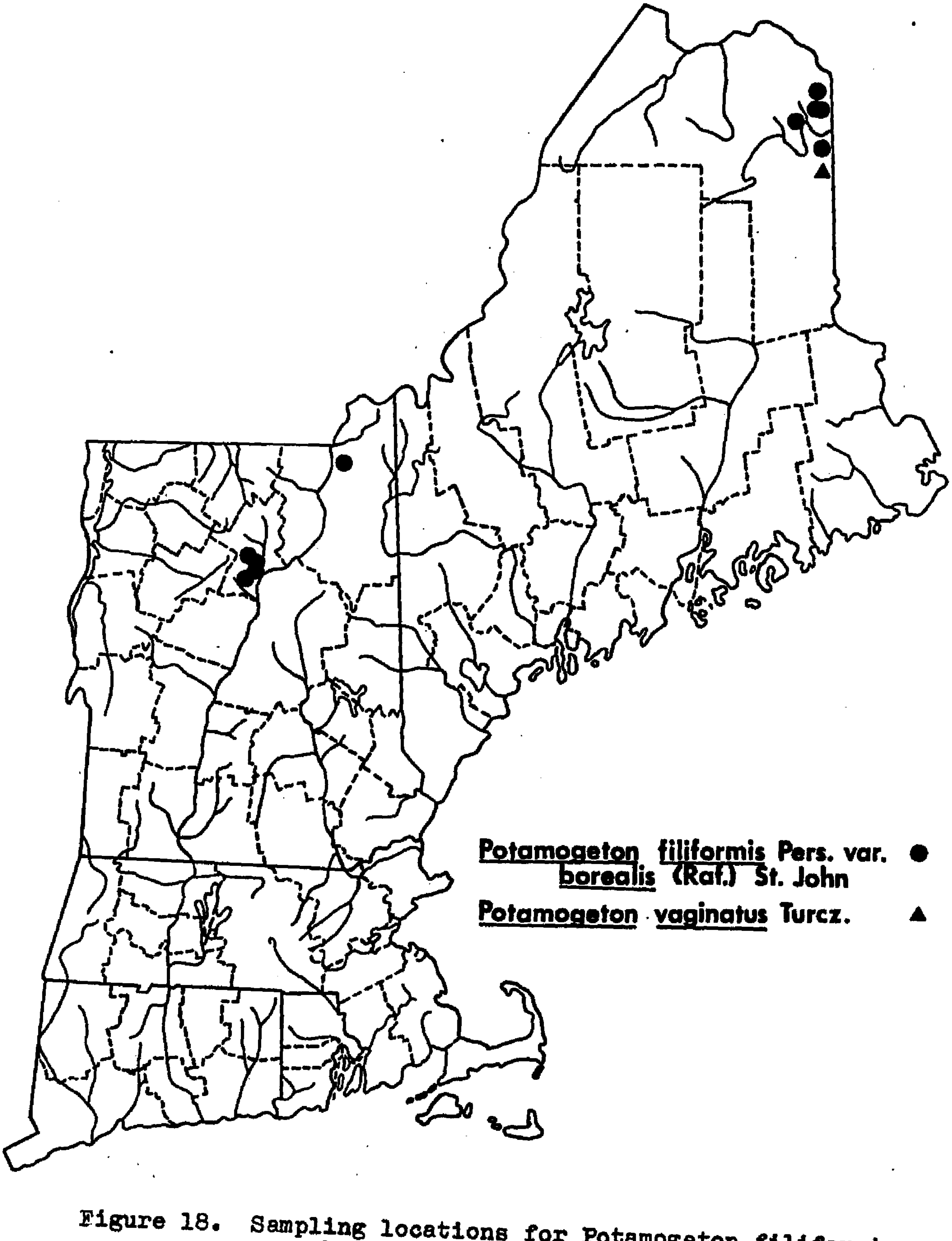


Figure 18. Sampling locations for Potamogeton filiformis var. borealis and Potamogeton vaginatus.

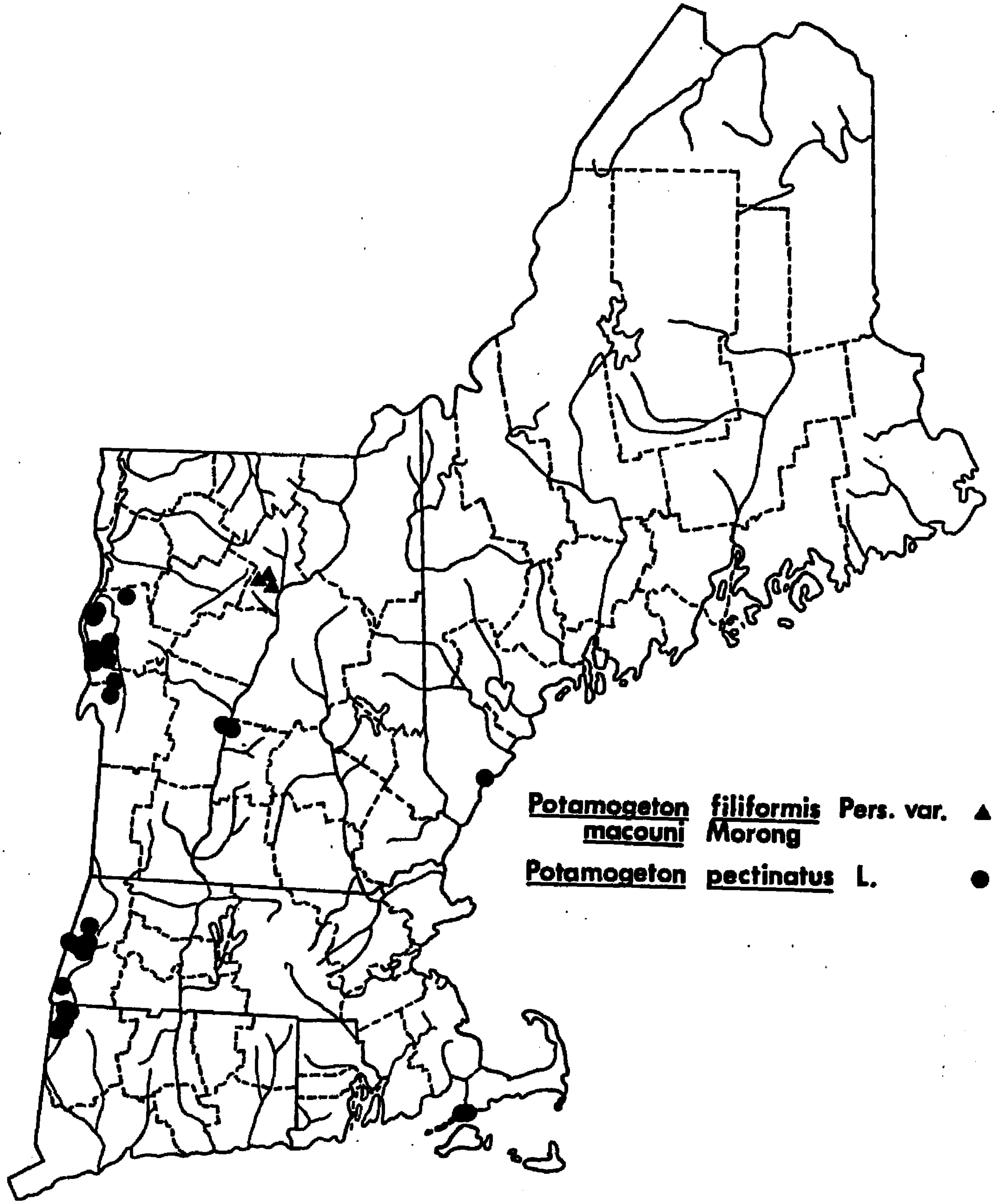


Figure 19. Sampling locations for Potamogeton filiformis var. macounii and Potamogeton pectinatus.

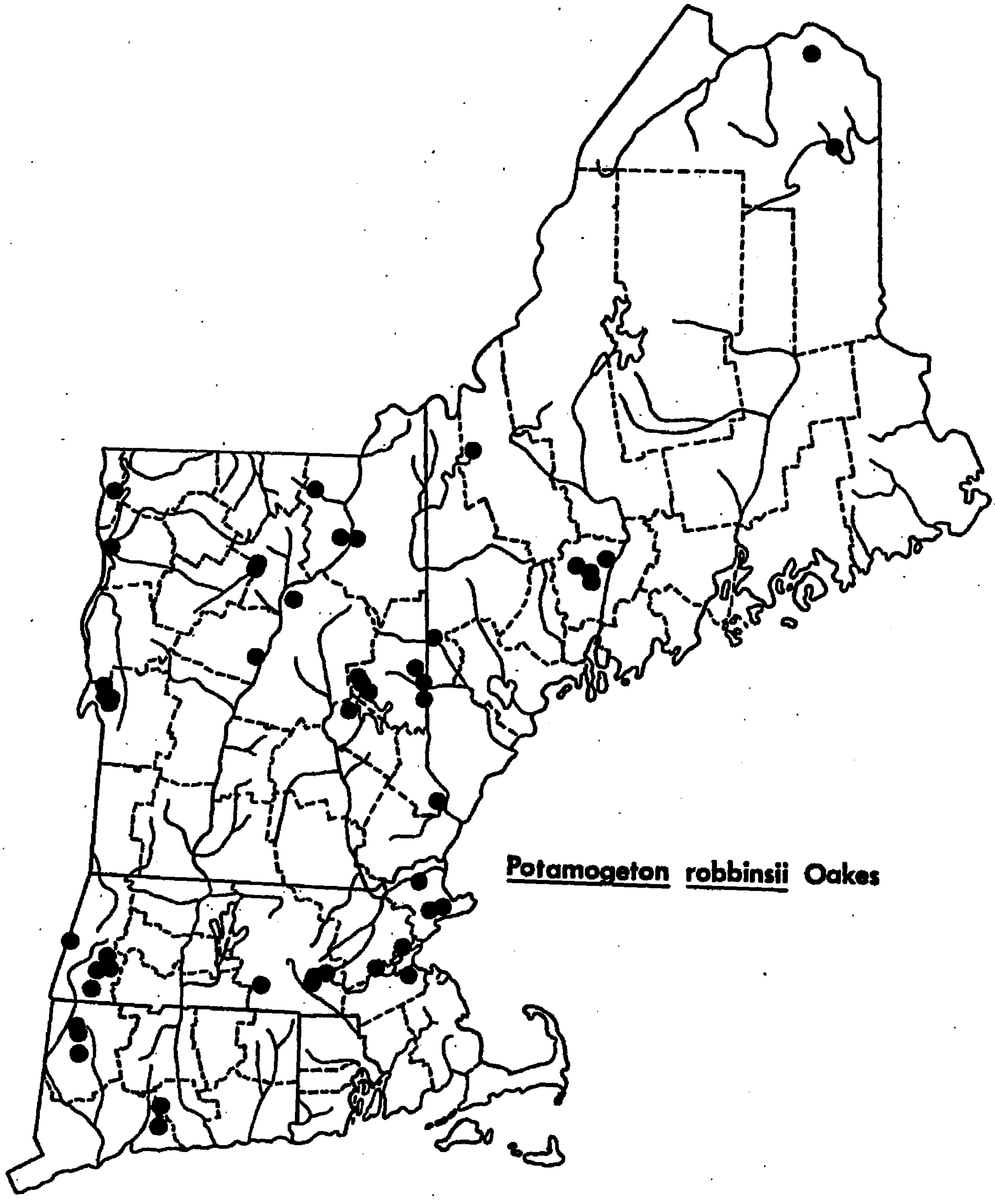


Figure 20. Sampling locations for Potamogeton robbinsii.

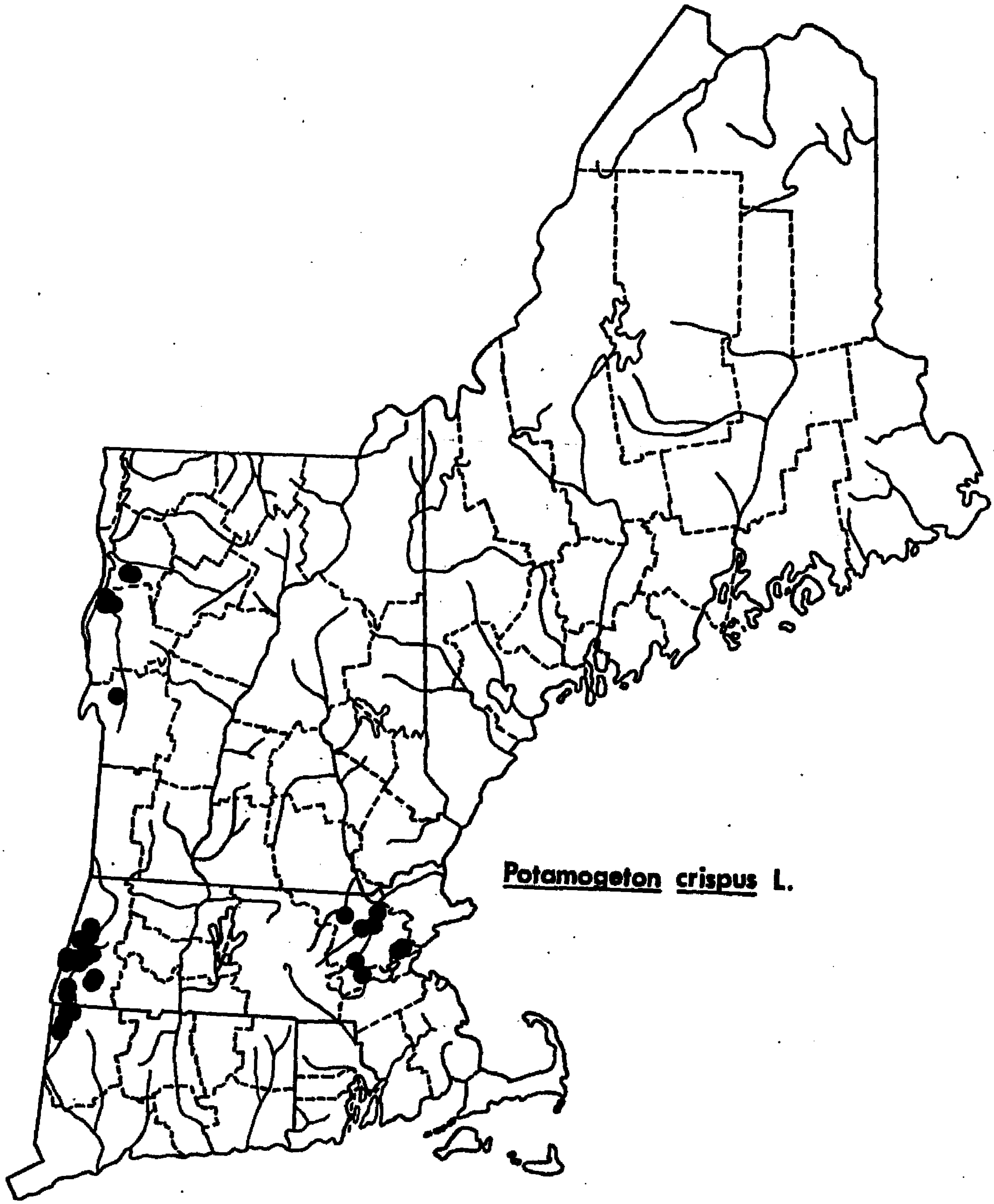


Figure 21. Sampling locations for _Potamogeton_ _crispus_.

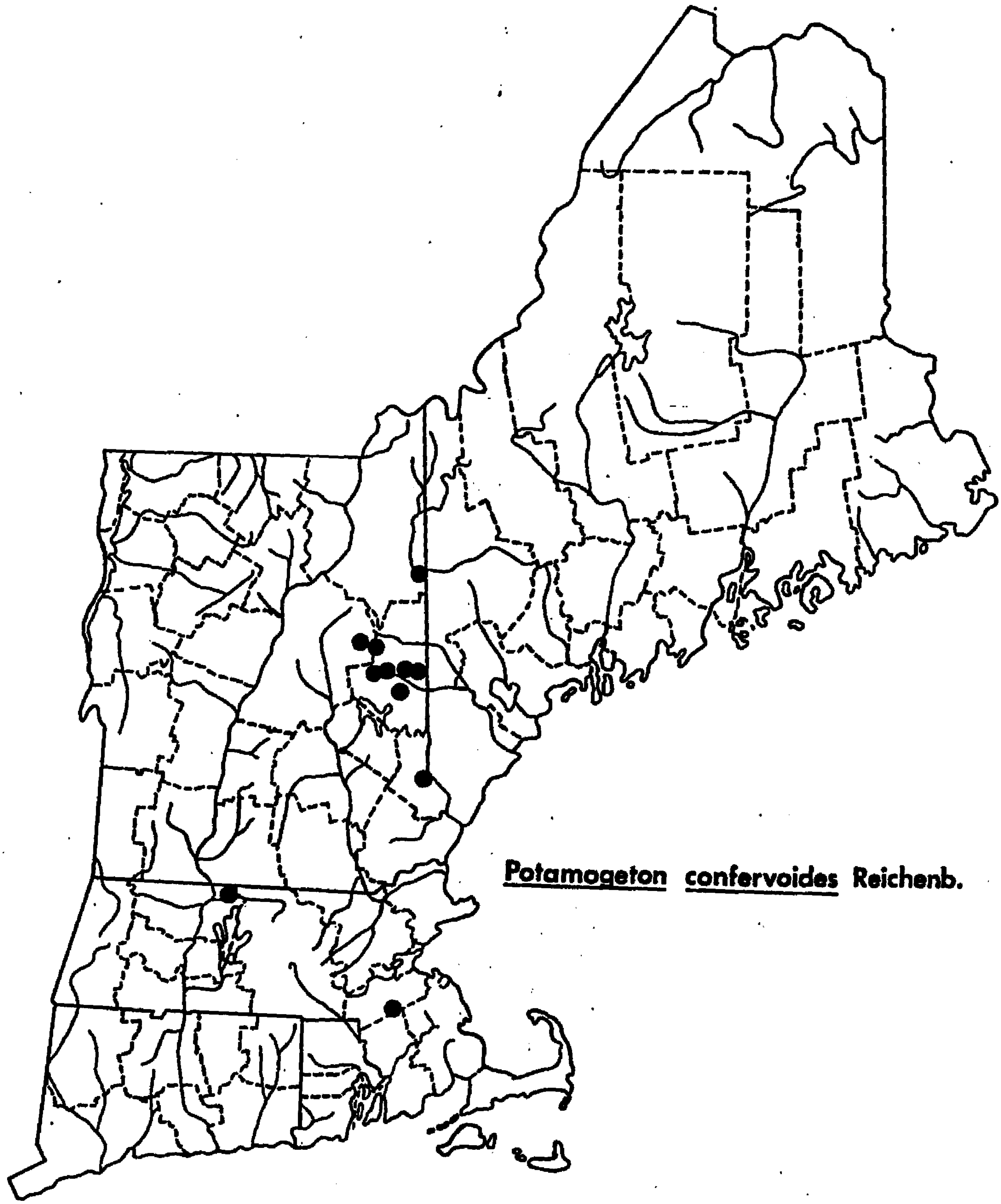


Figure 22. Sampling locations for Potamogeton confervoides.

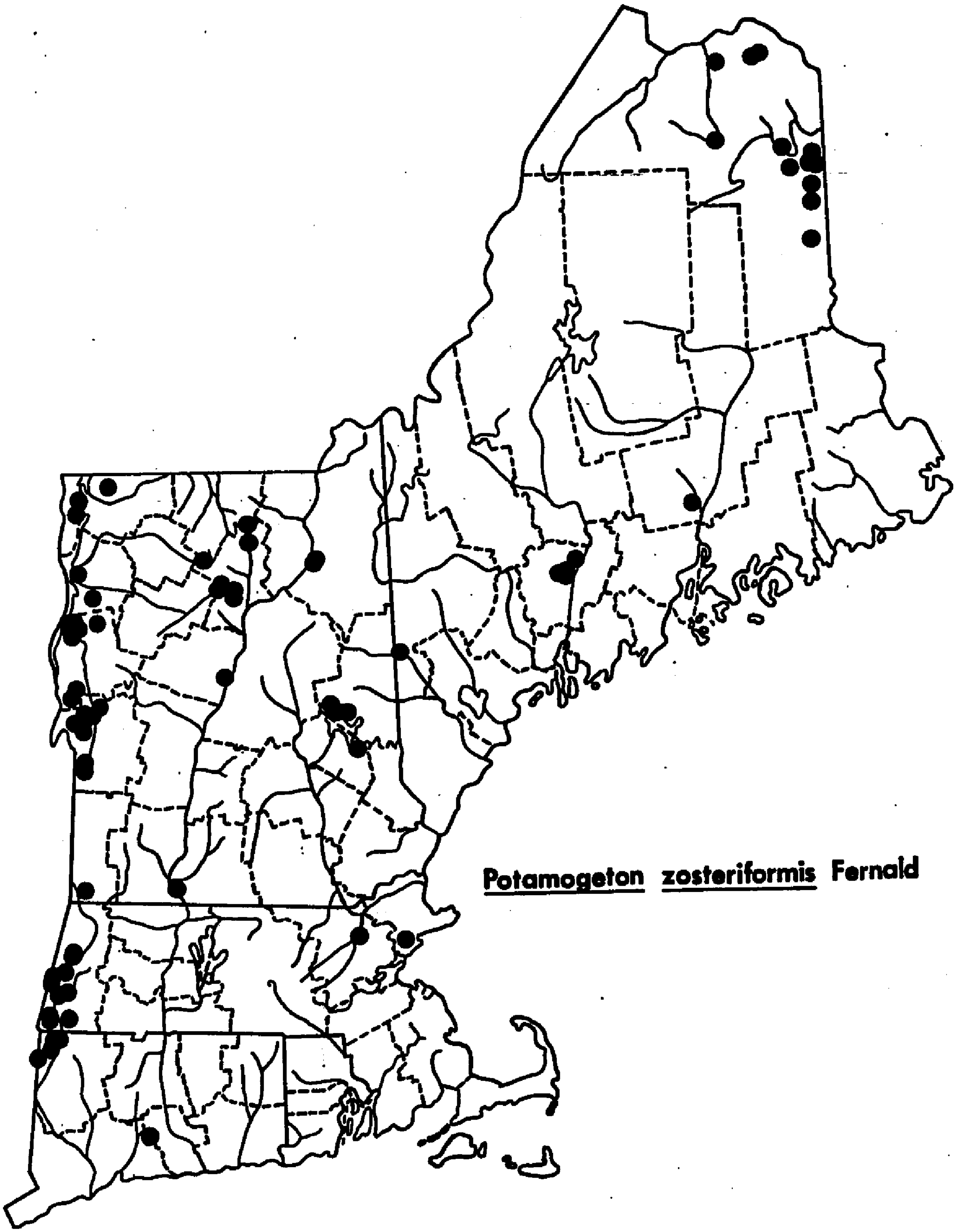


Figure 23. Sampling locations for Potamogeton zosteriformis.

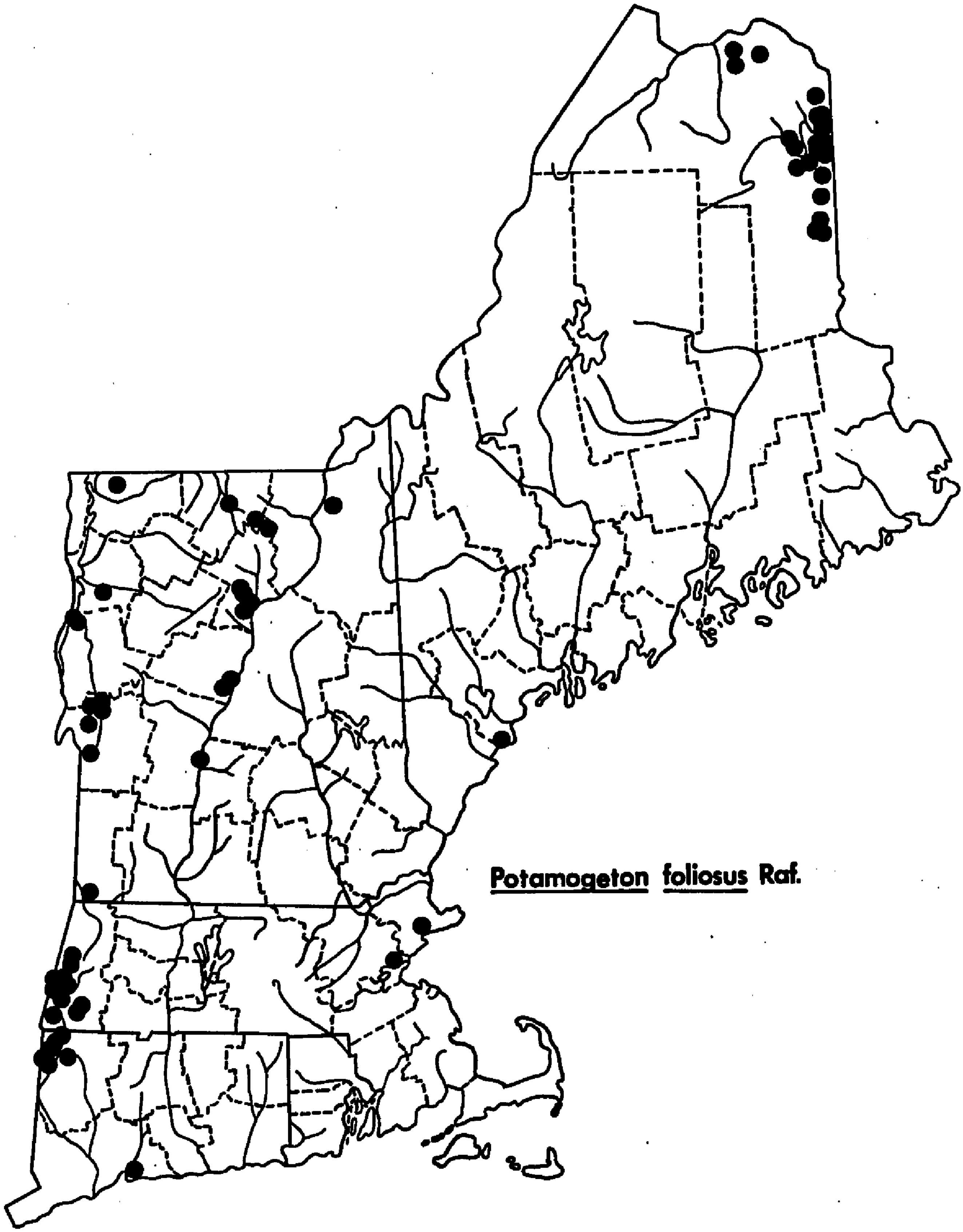


Figure 24. Sampling locations for Potamogeton foliosus.

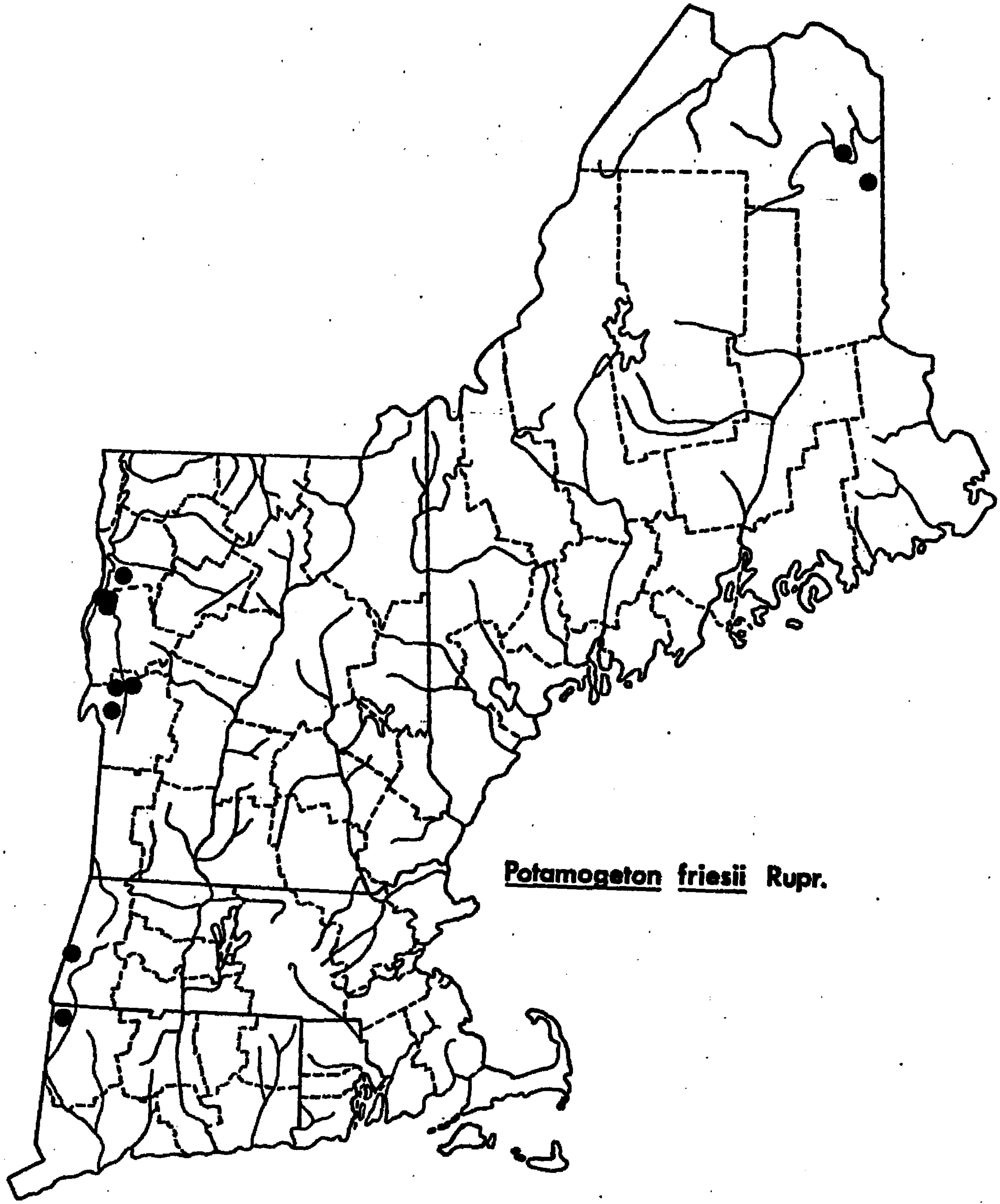


Figure 25. Sampling locations for Potamogeton friesii.

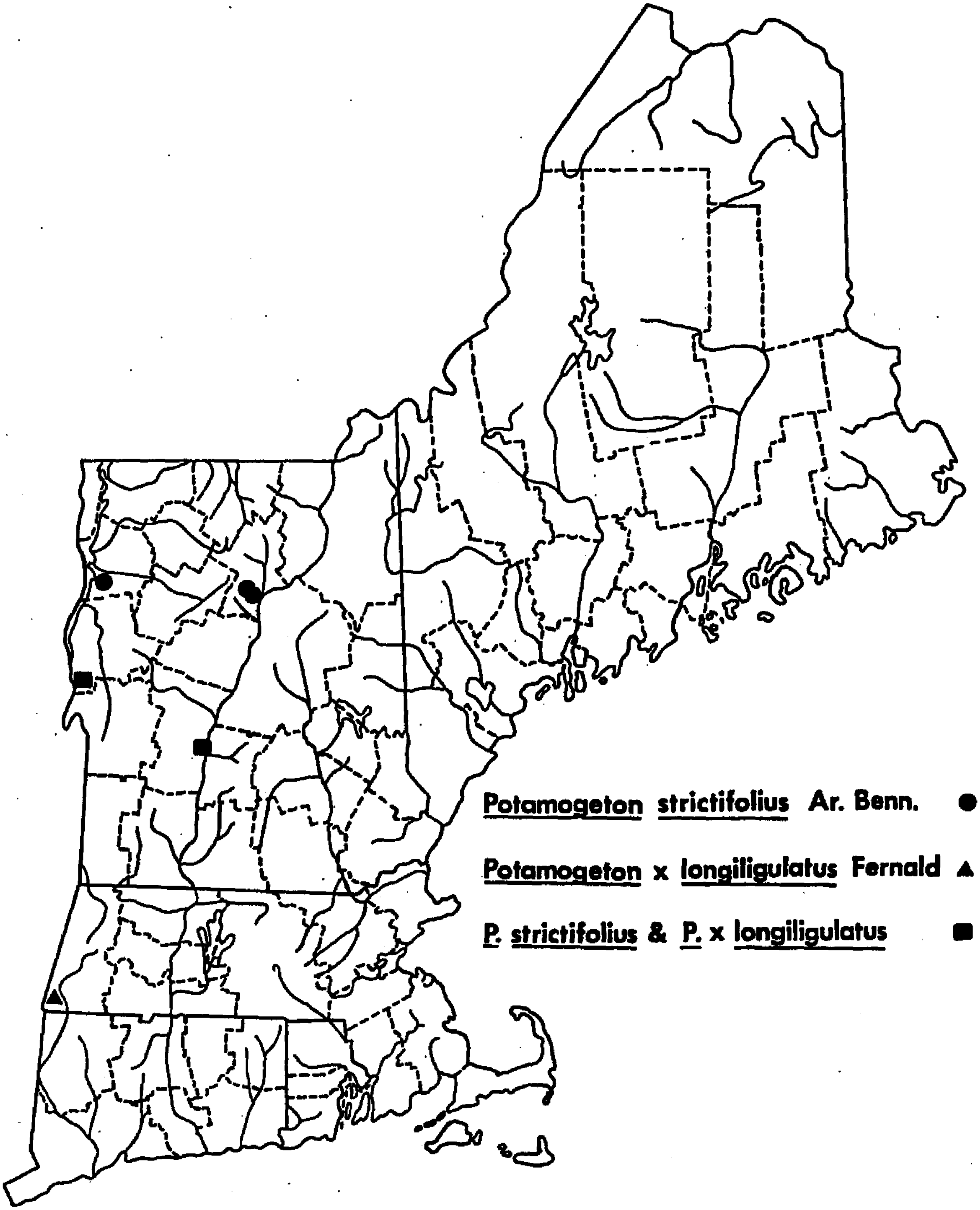


Figure 26. Sampling locations for Potamogeton strictifolius and Potamogeton X longiligulatus.

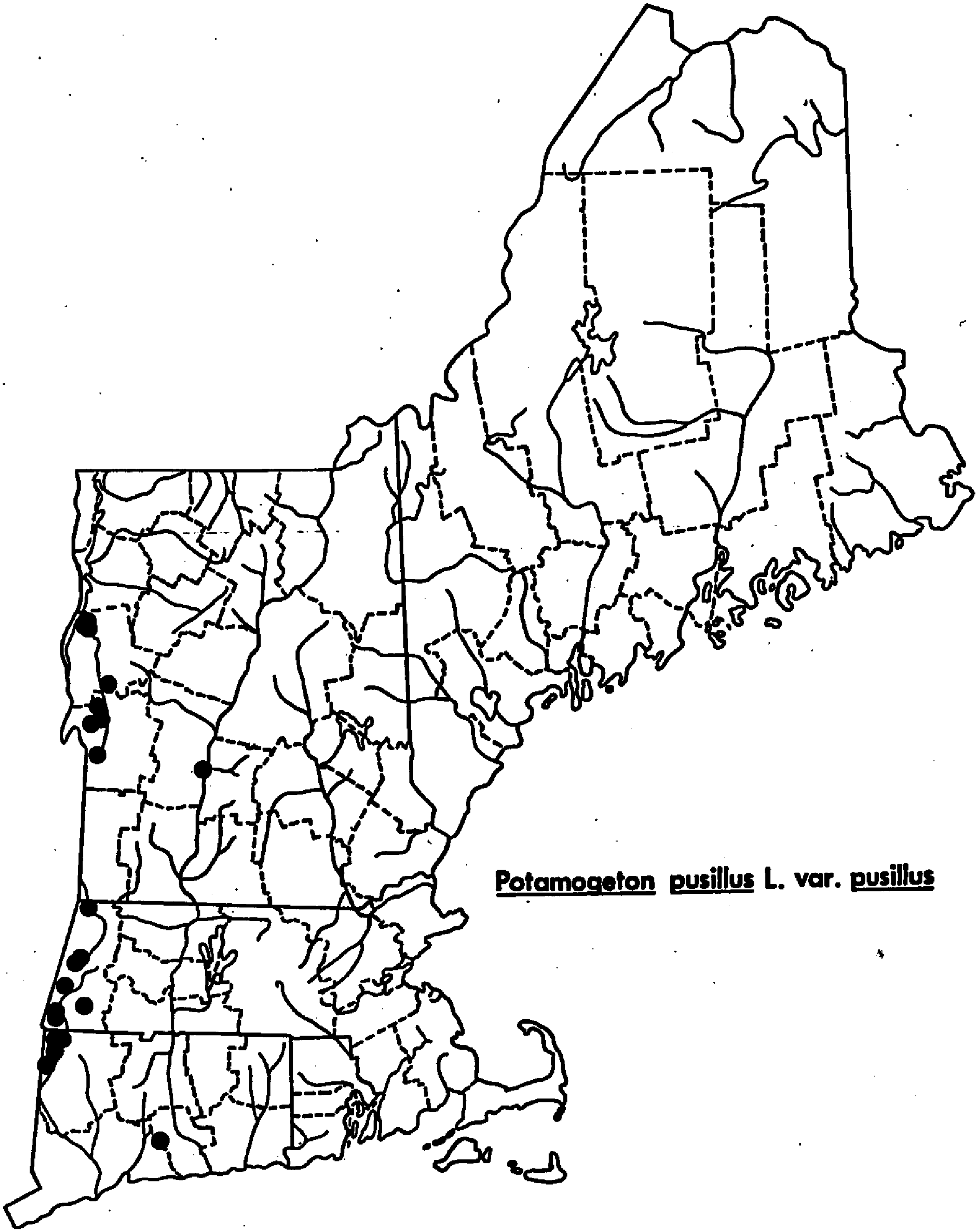


Figure 27. Sampling locations for Potamogeton pusillus var. pusillus.

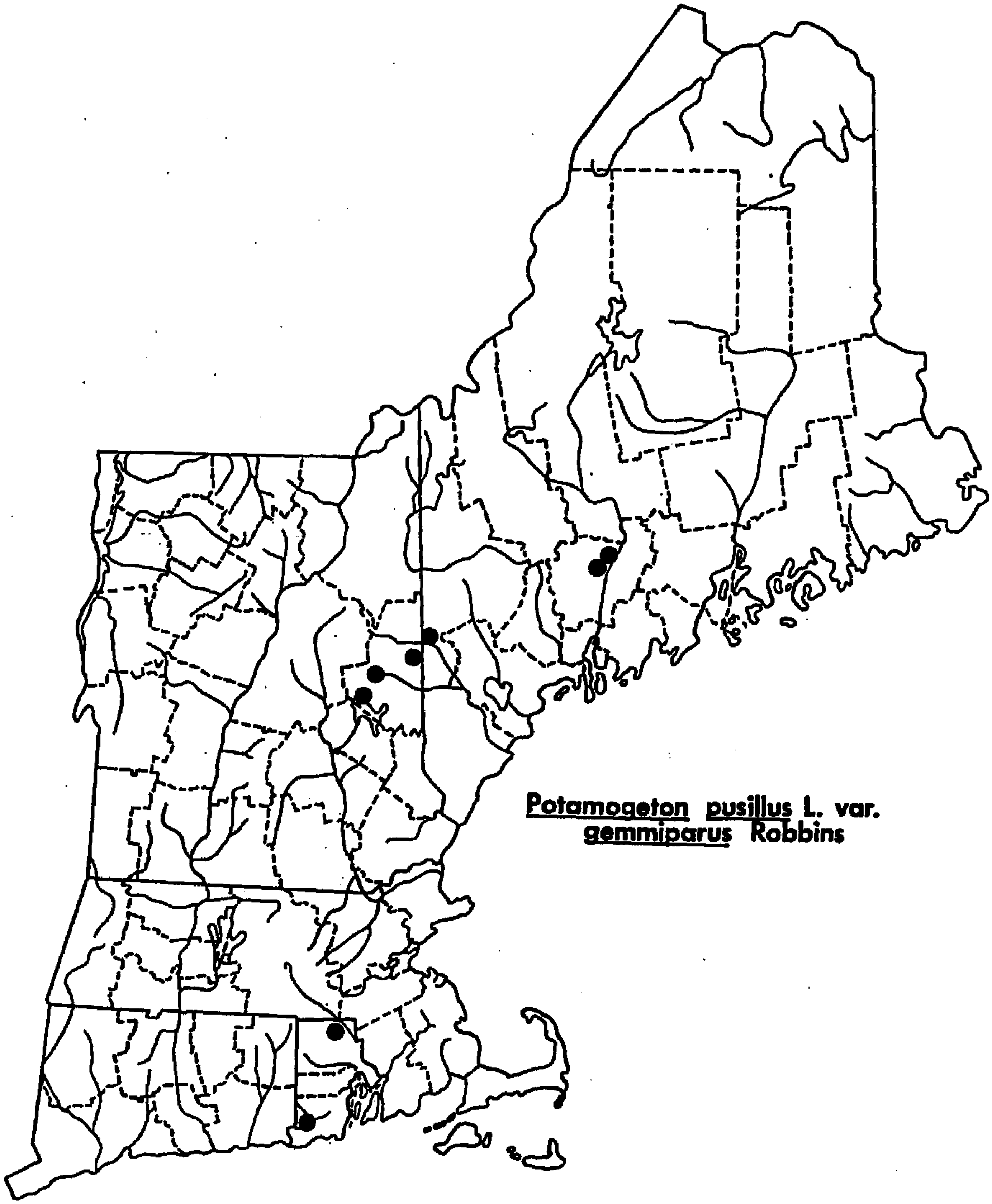


Figure 28. Sampling locations for Potamogeton pusillus var. gemmiparus.

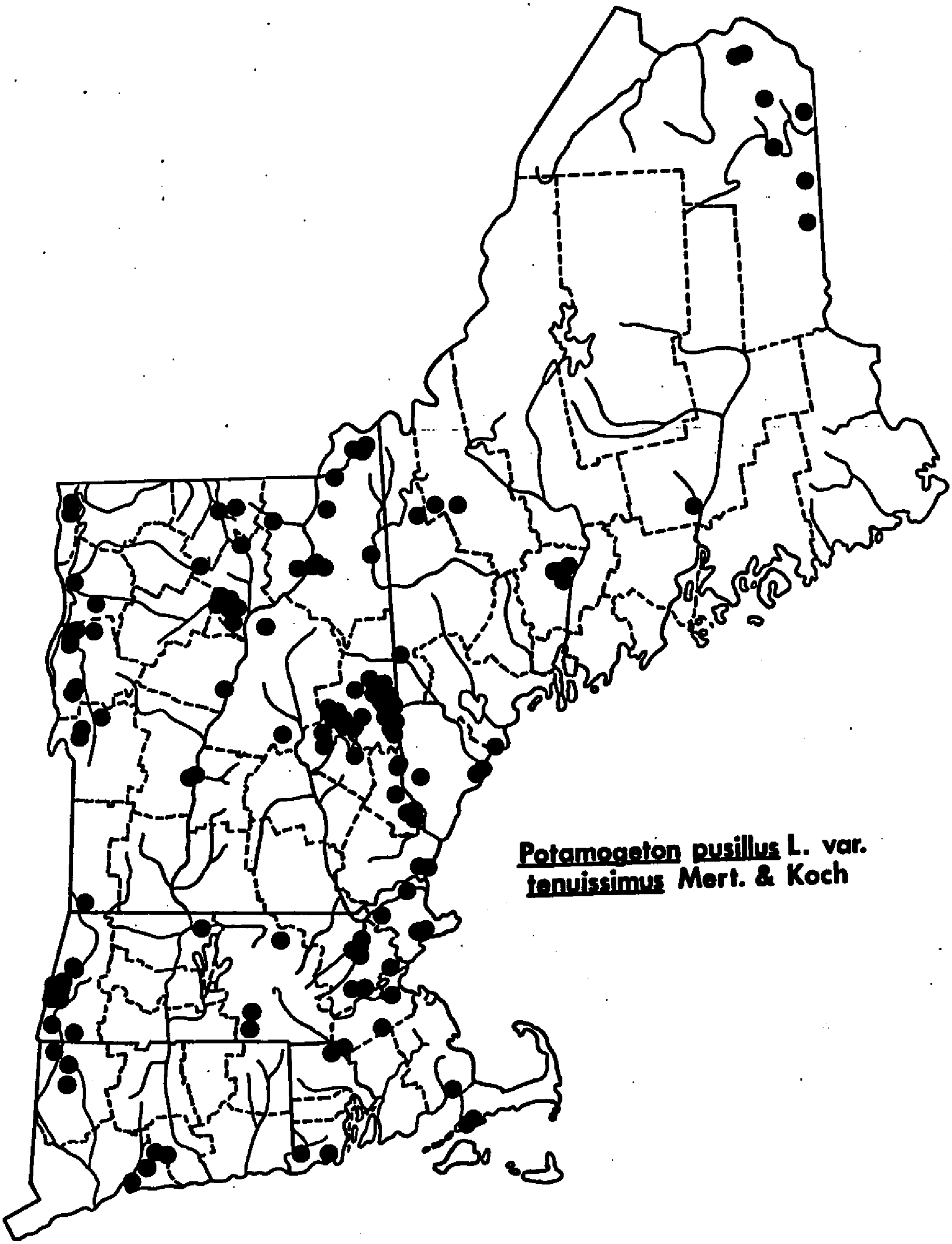


Figure 29. Sampling locations for Potamogeton pusillus var. tenuissimus.

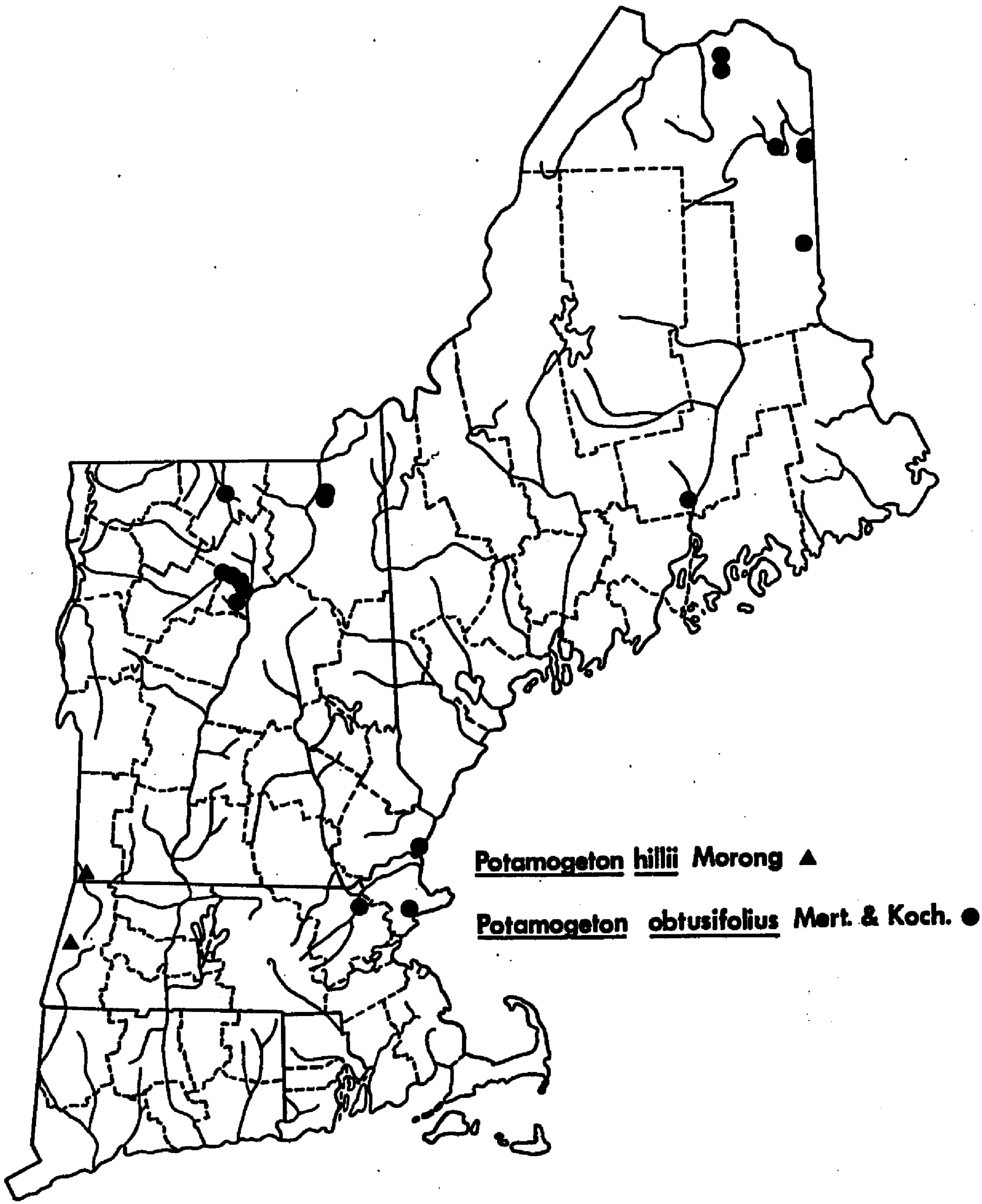


Figure 30. Sampling locations for Potamogeton hillii and Potamogeton obtusifolius.

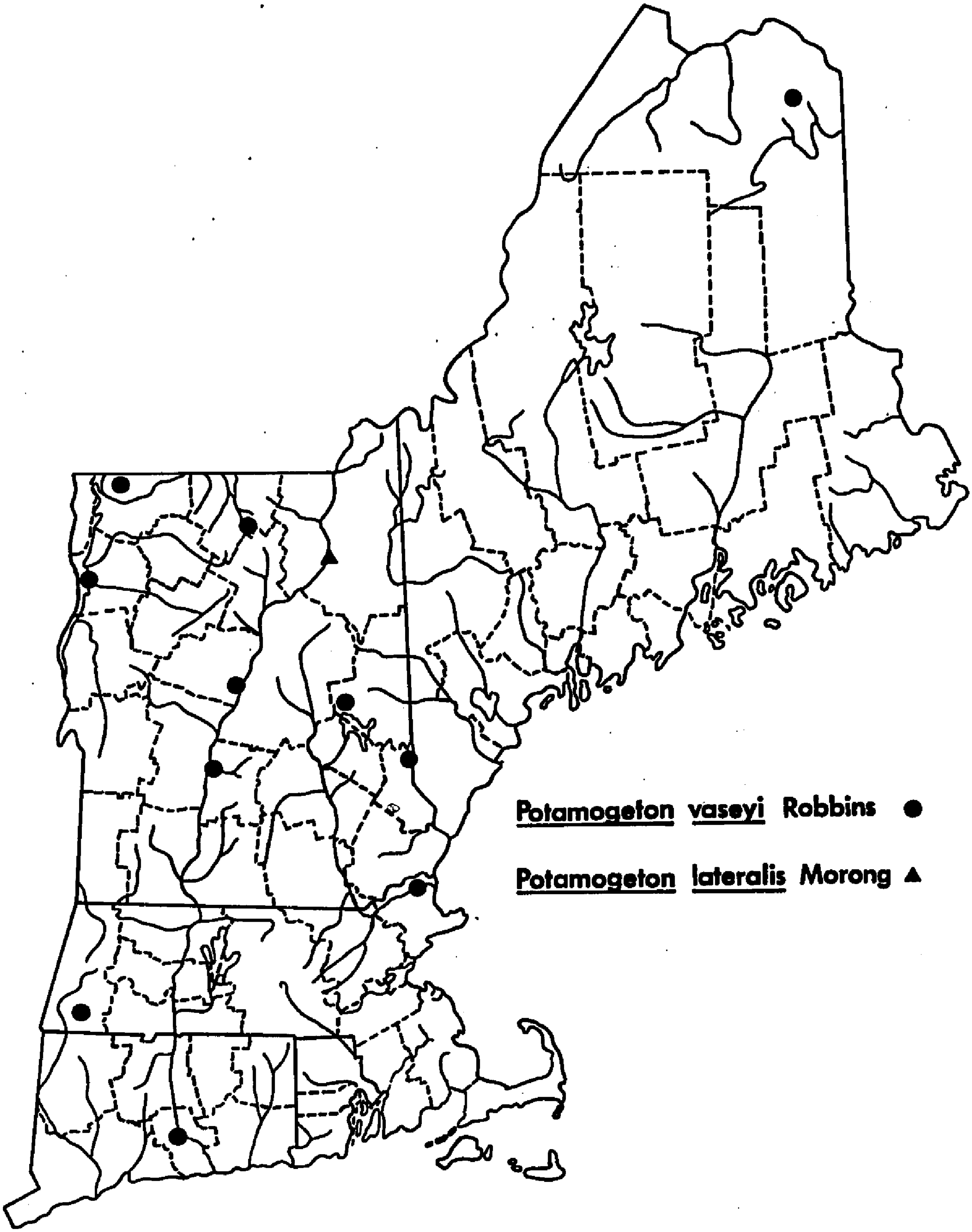


Figure 31. Sampling locations for Potamogeton vaseyi and Potamogeton lateralis.

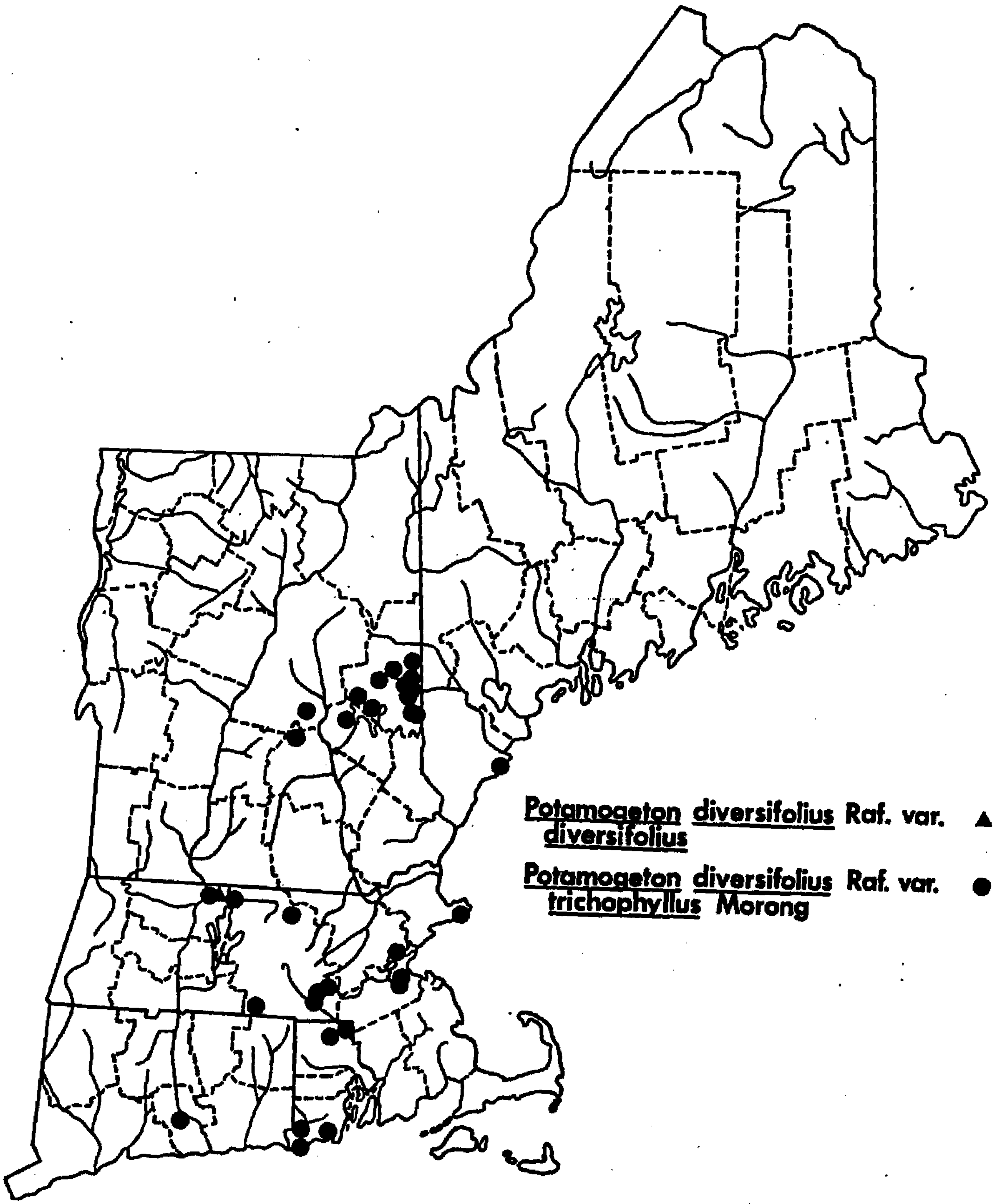


Figure 32. Sampling locations for *Potamogeton diversifolius* var. *diversifolius* and *Potamogeton diversifolius* var. *trichophyllus*.

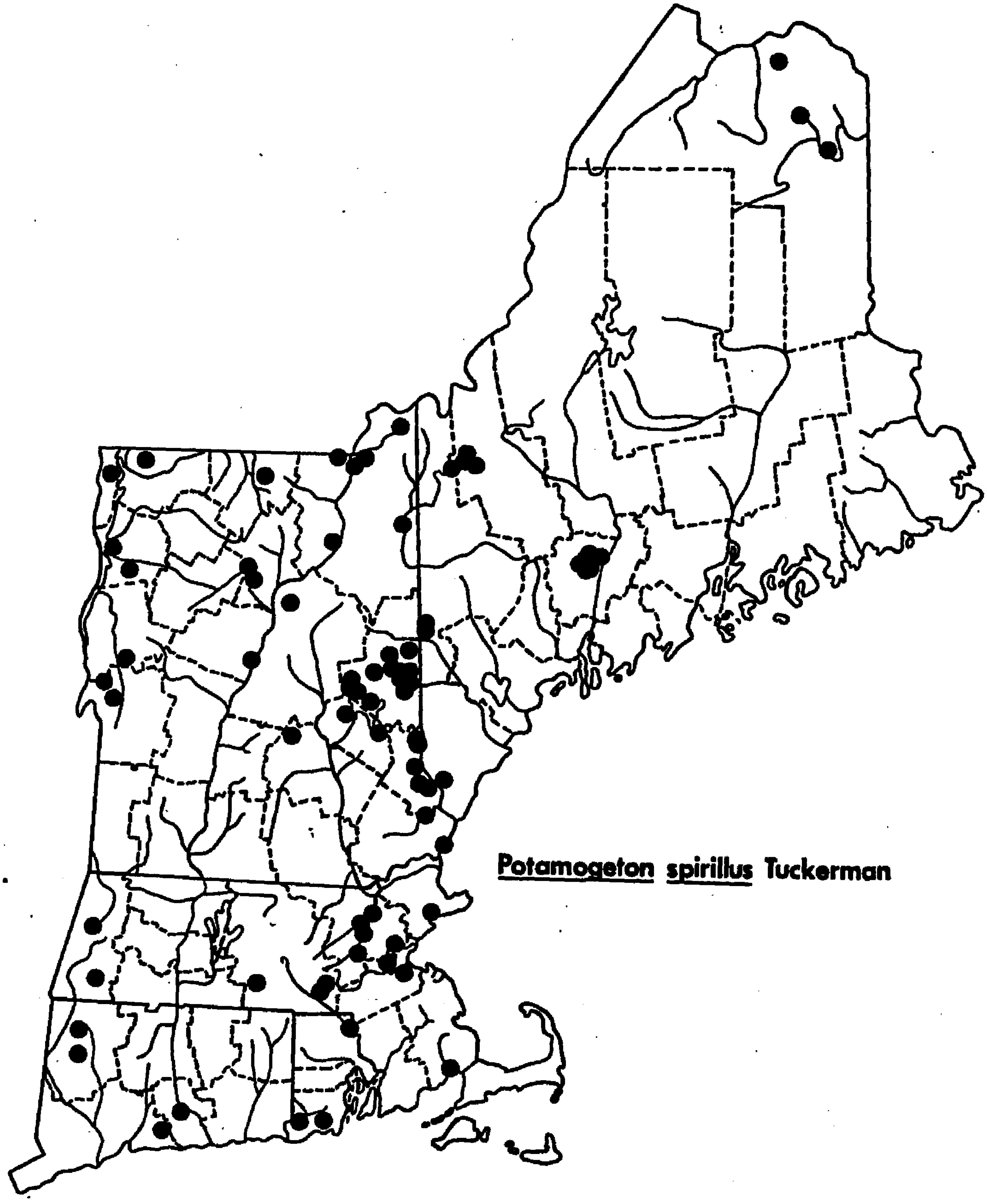


Figure 33. Sampling locations for Potamogeton spirillus.

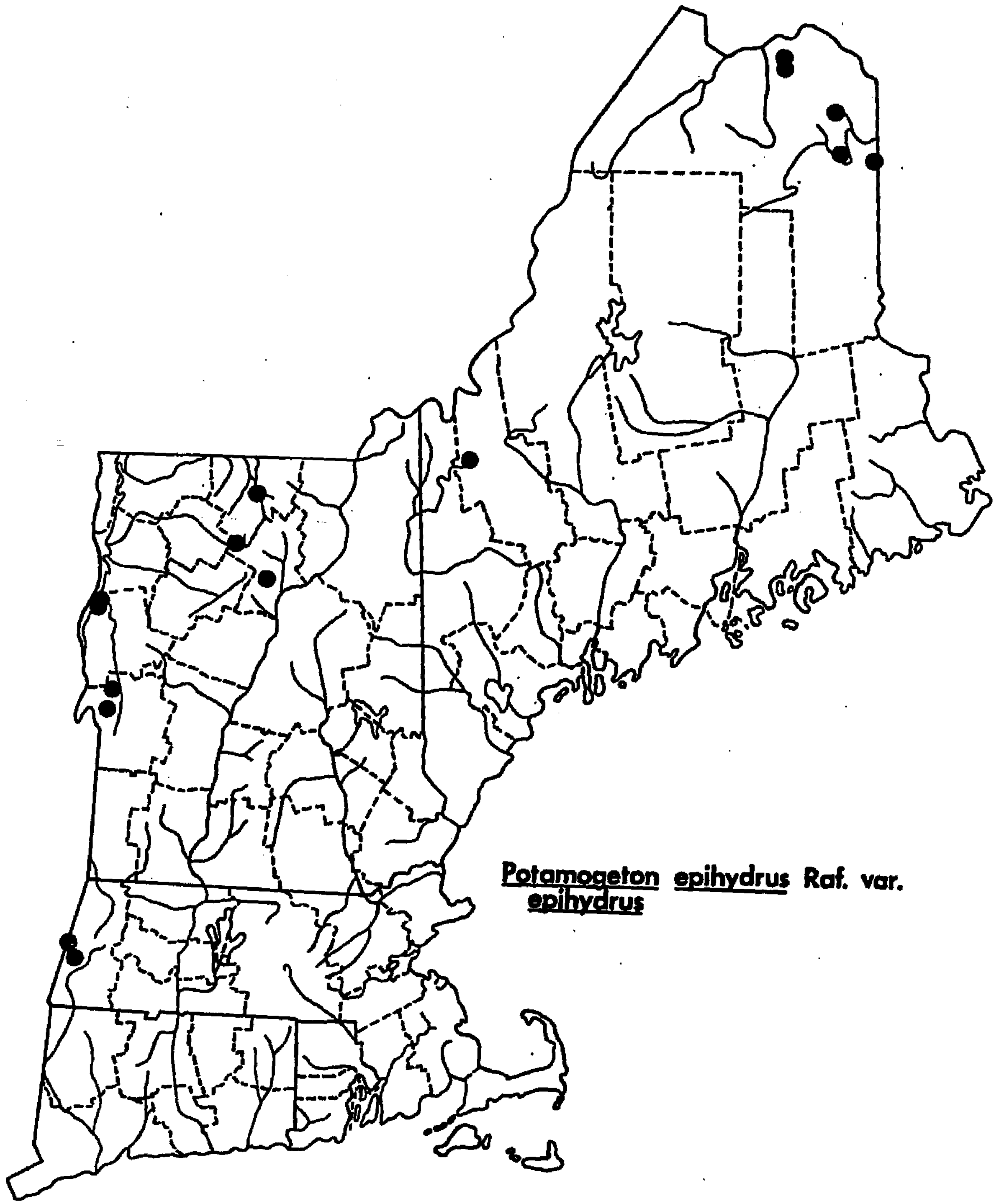


Figure 34. Sampling locations for Potamogeton epihydrus var. epihydrus.

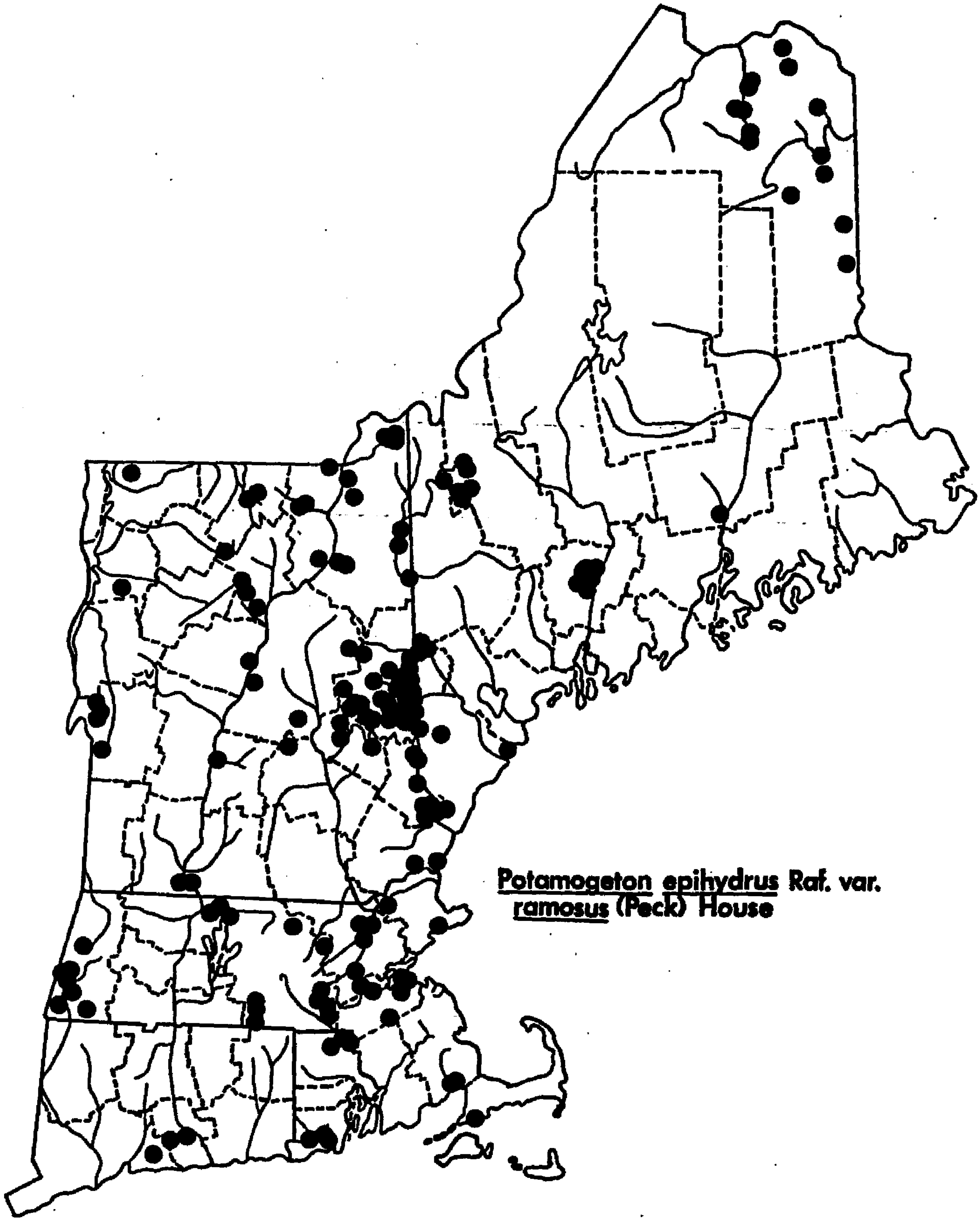


Figure 35. Sampling locations for Potamogeton epihydrus var. ramosus.

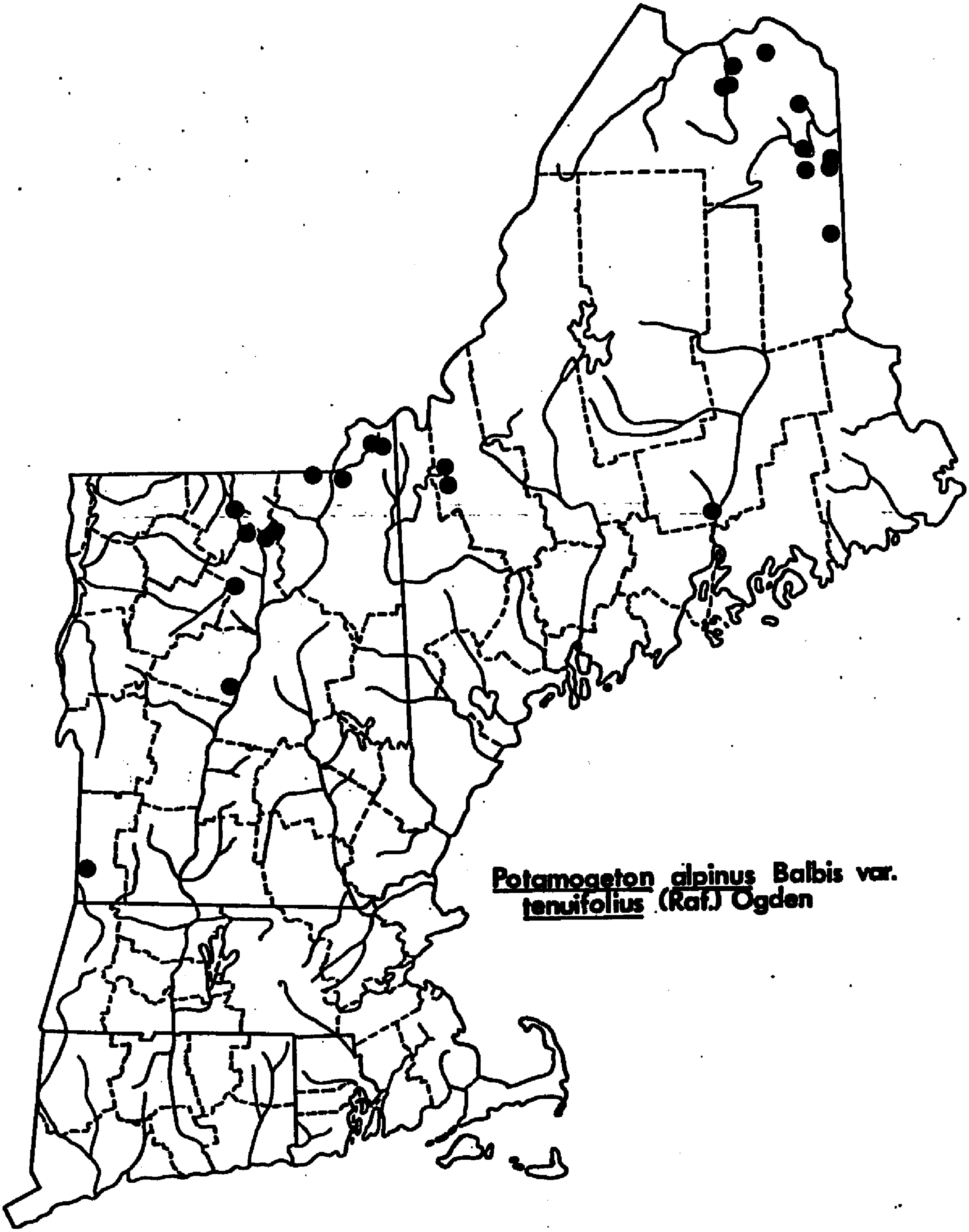


Figure 36. Sampling locations for Potamogeton alpinus var. tenuifolius.

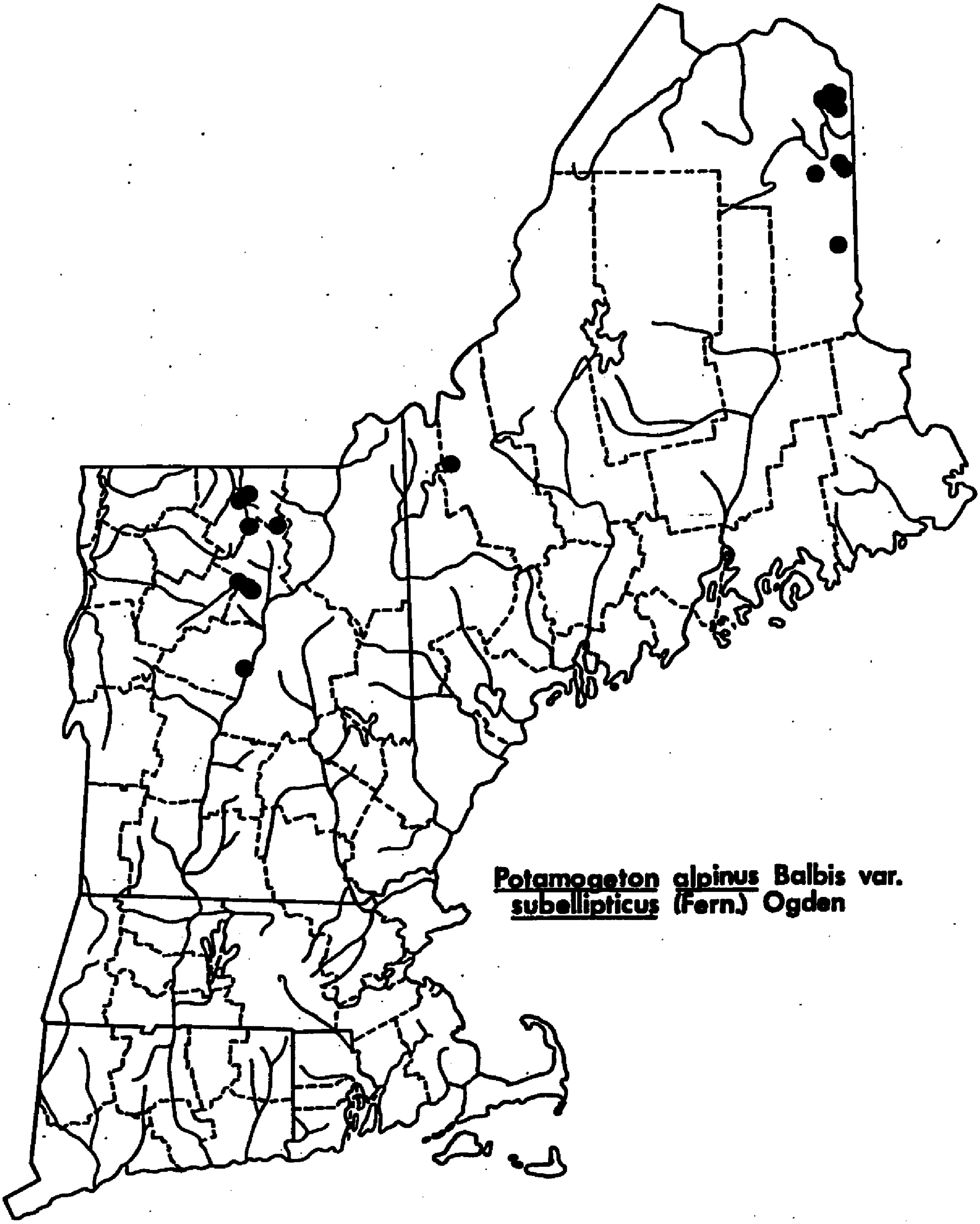


Figure 37. Sampling locations for Potamogeton alpinus var. subellipticus.

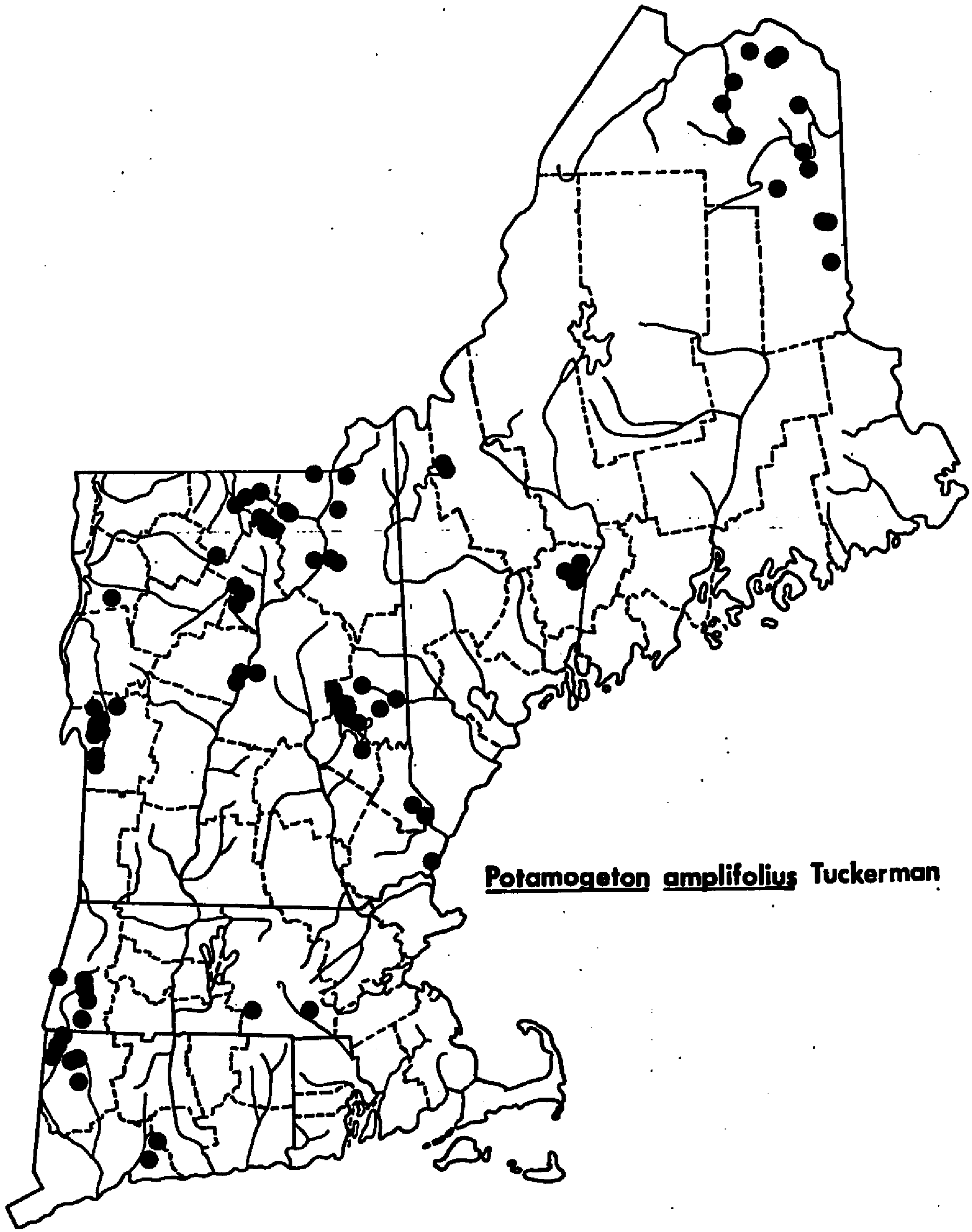


Figure 38. Sampling locations for Potamogeton amplifolius.

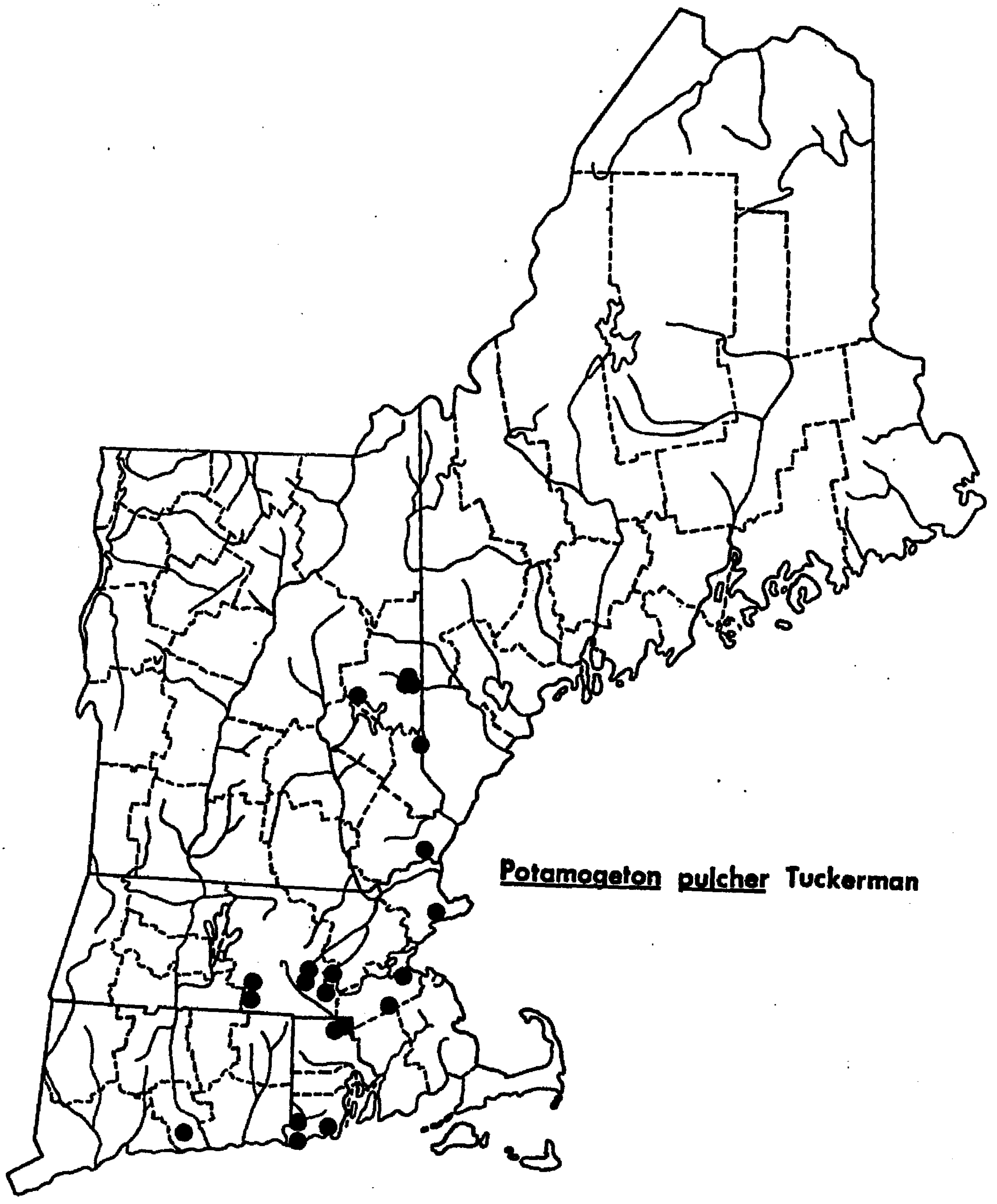


Figure 39. Sampling locations for Potamogeton pulcher.

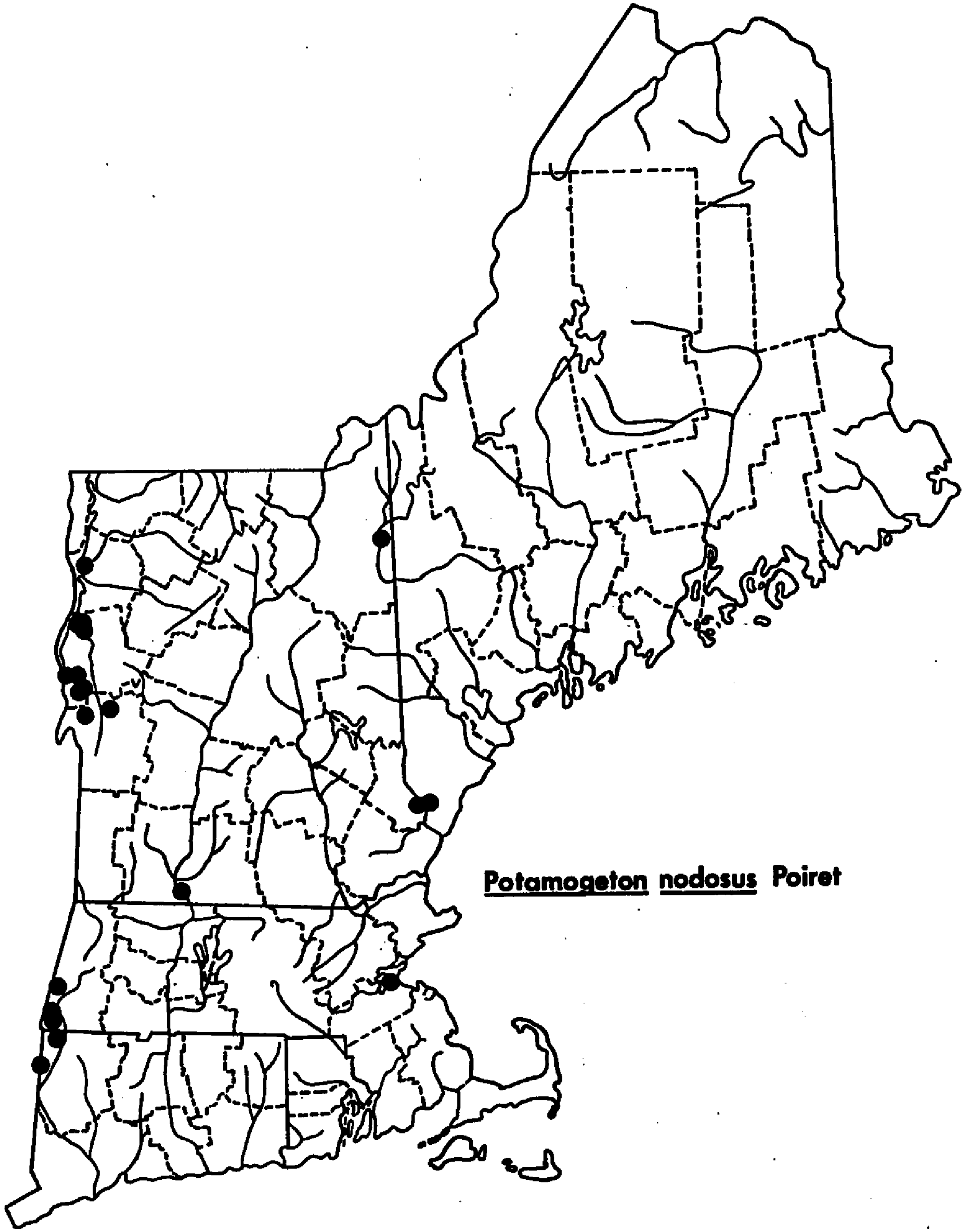


Figure 40. Sampling locations for Potamogeton nodosus.

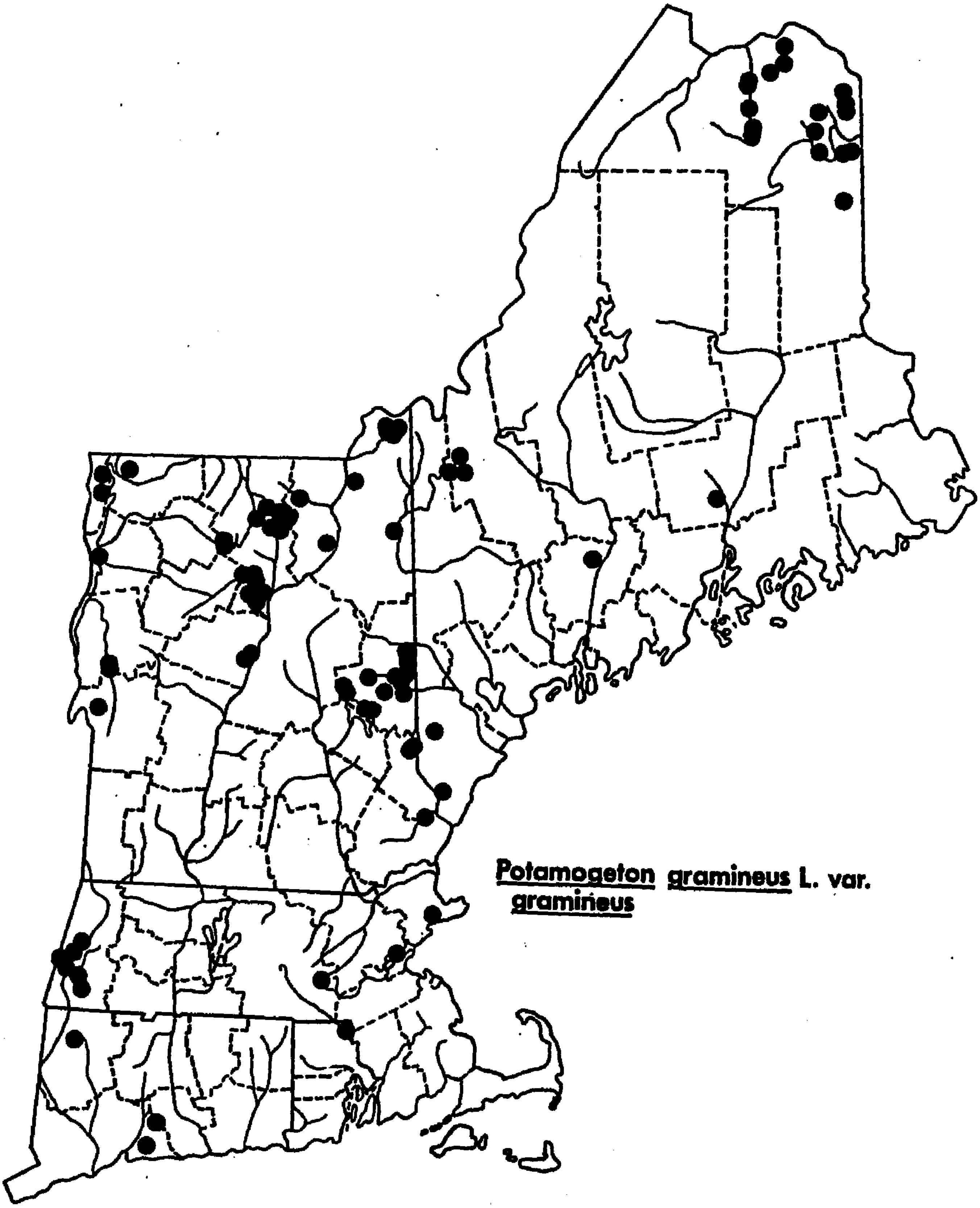


Figure 41. Sampling locations for *Potamogeton gramineus* var. *gramineus*.

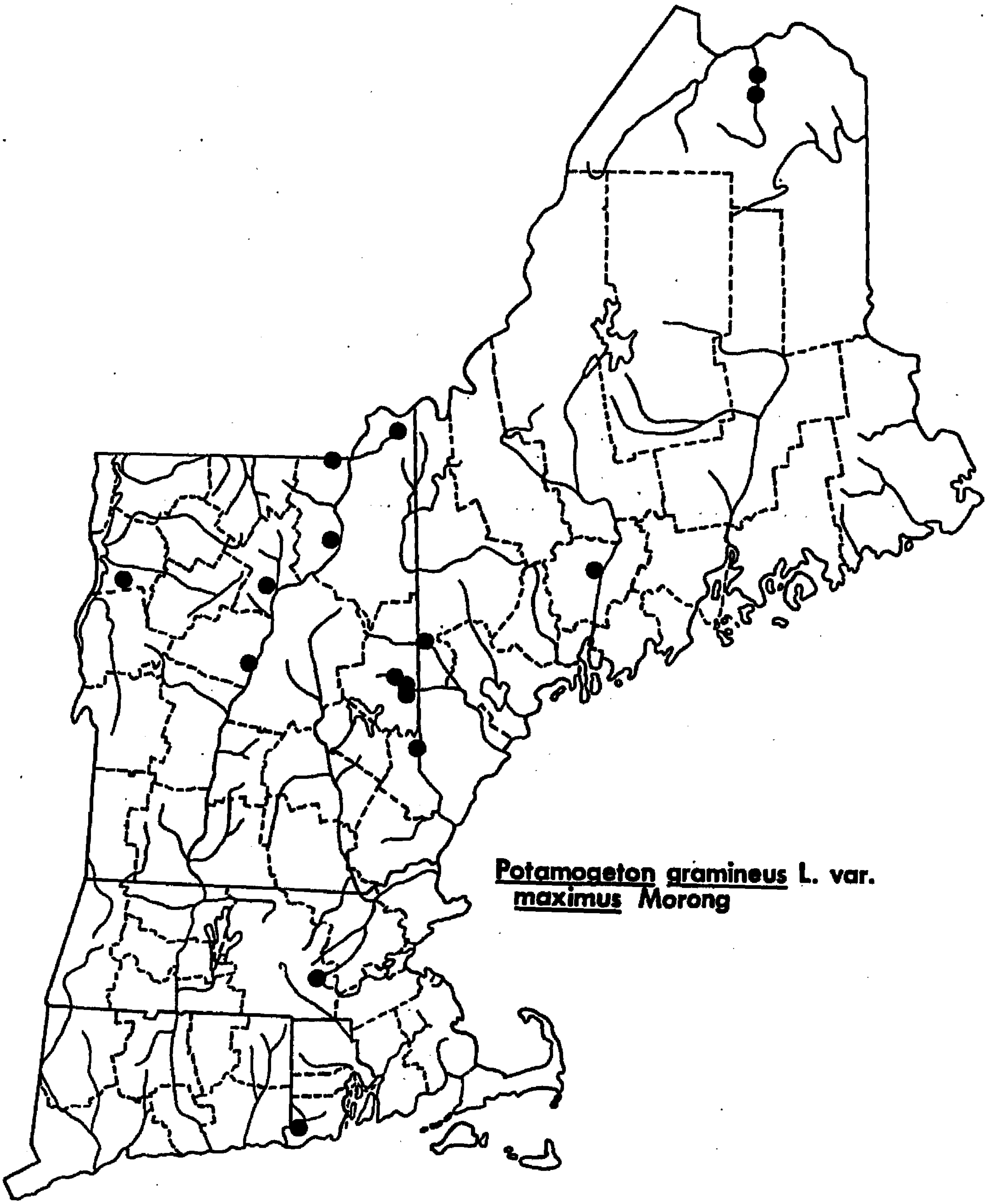


Figure 42. Sampling locations for Potamogeton gramineus var. maximus.

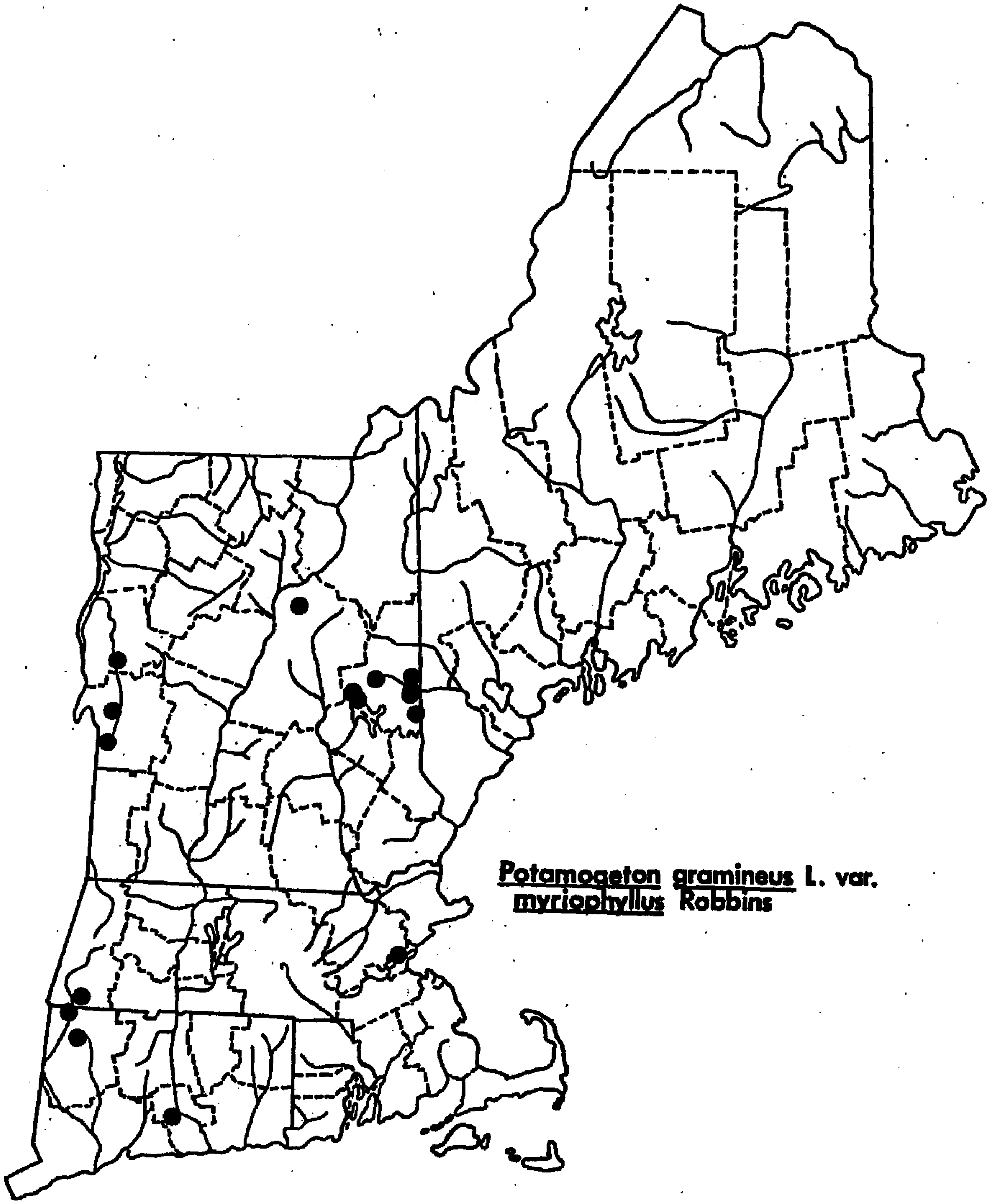


Figure 43. Sampling locations for Potamogeton gramineus var. myriophyllus.

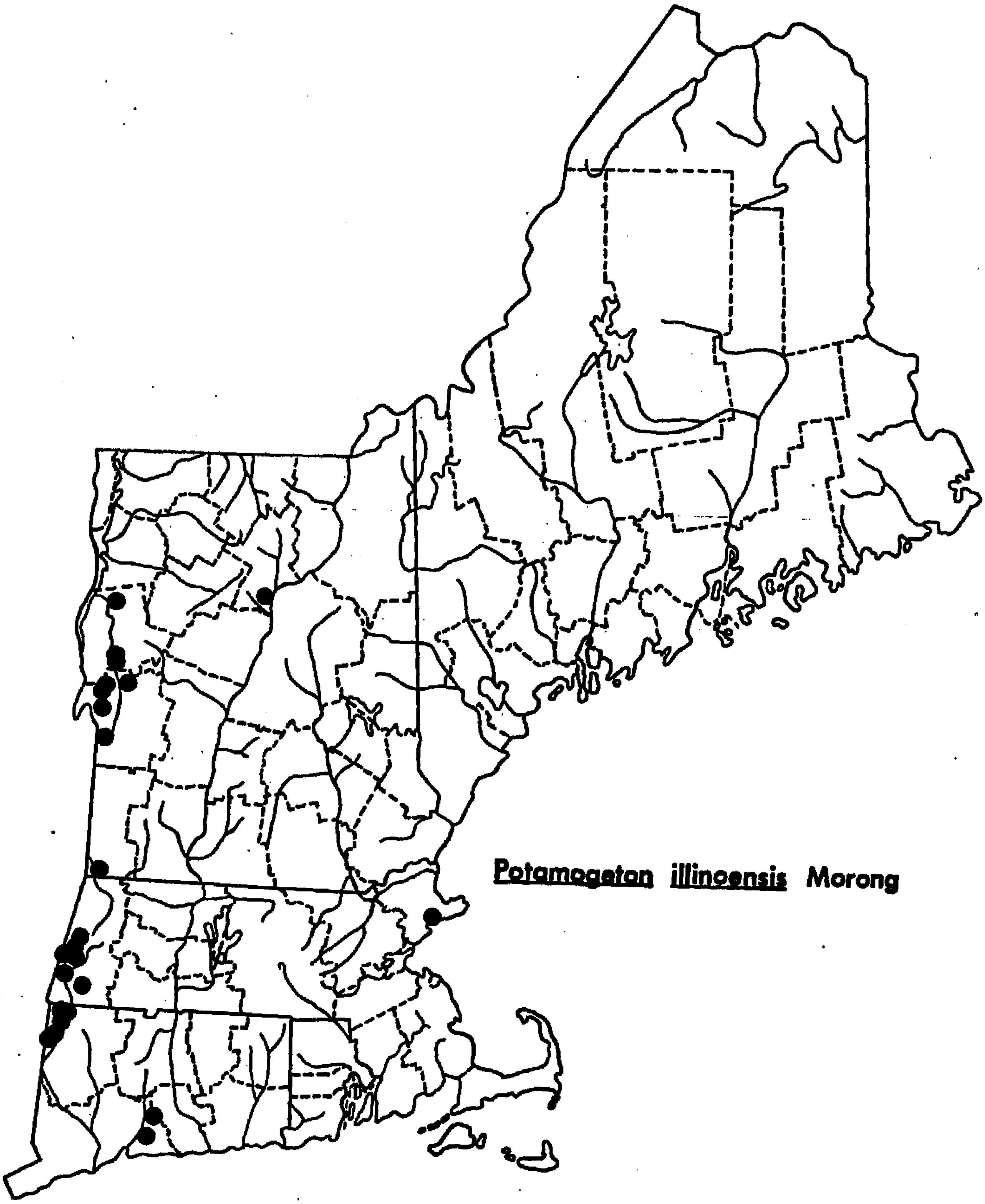


Figure 44. Sampling locations for Potamogeton illinoensis.

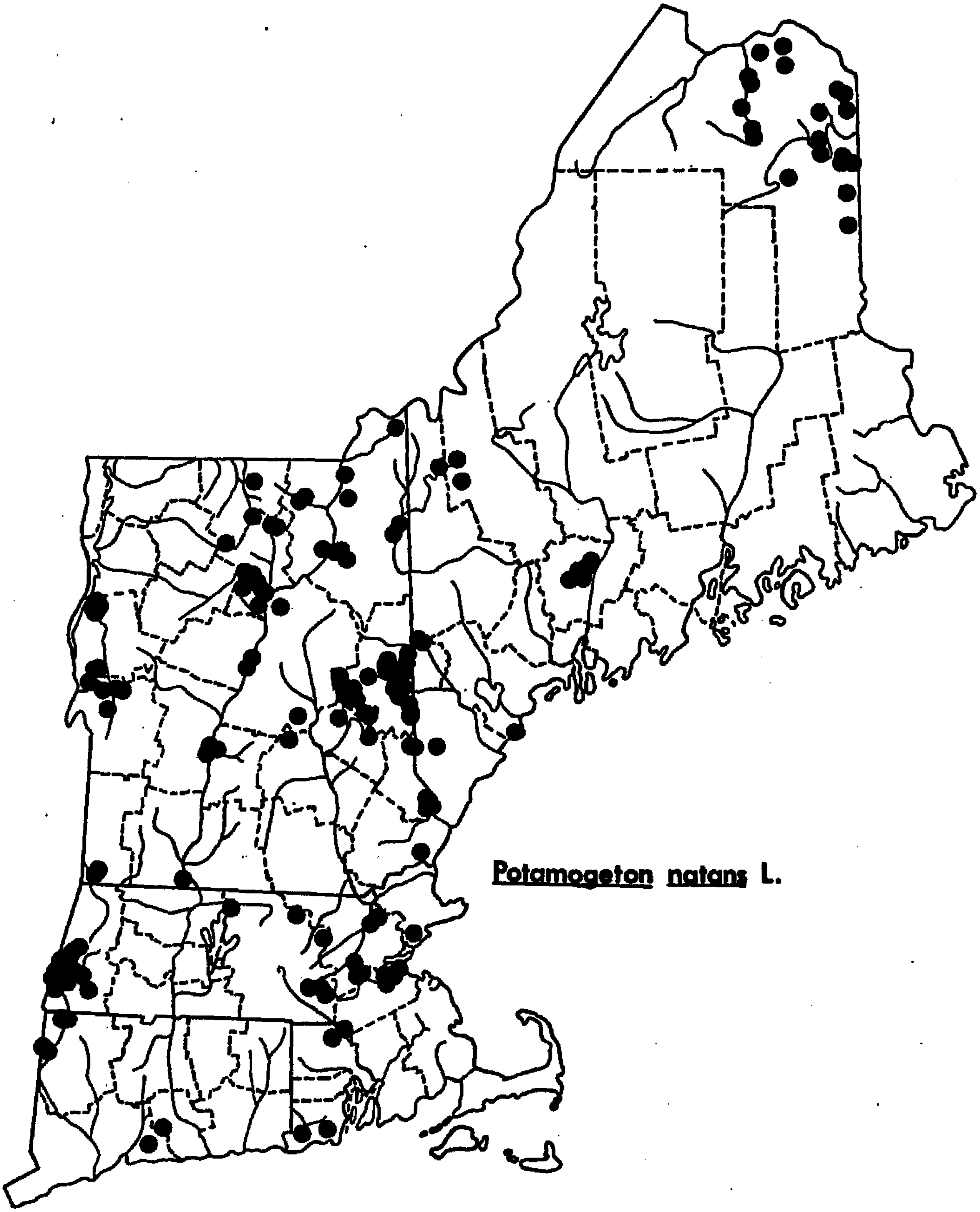


Figure 45. Sampling locations for <u>Potamogeton</u> <u>natans</u>.

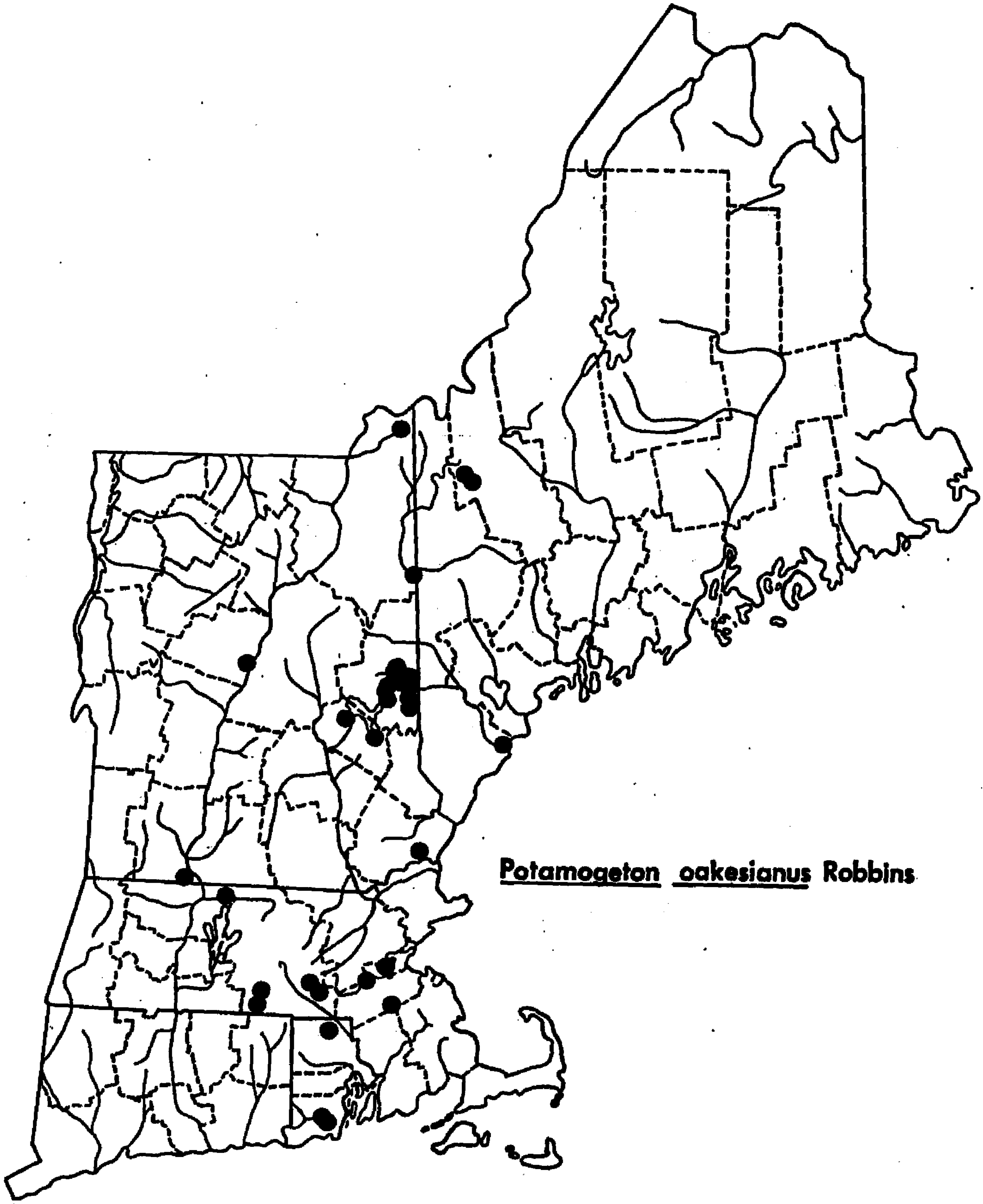


Figure 46. Sampling locations for Potamogeton oakesianus.

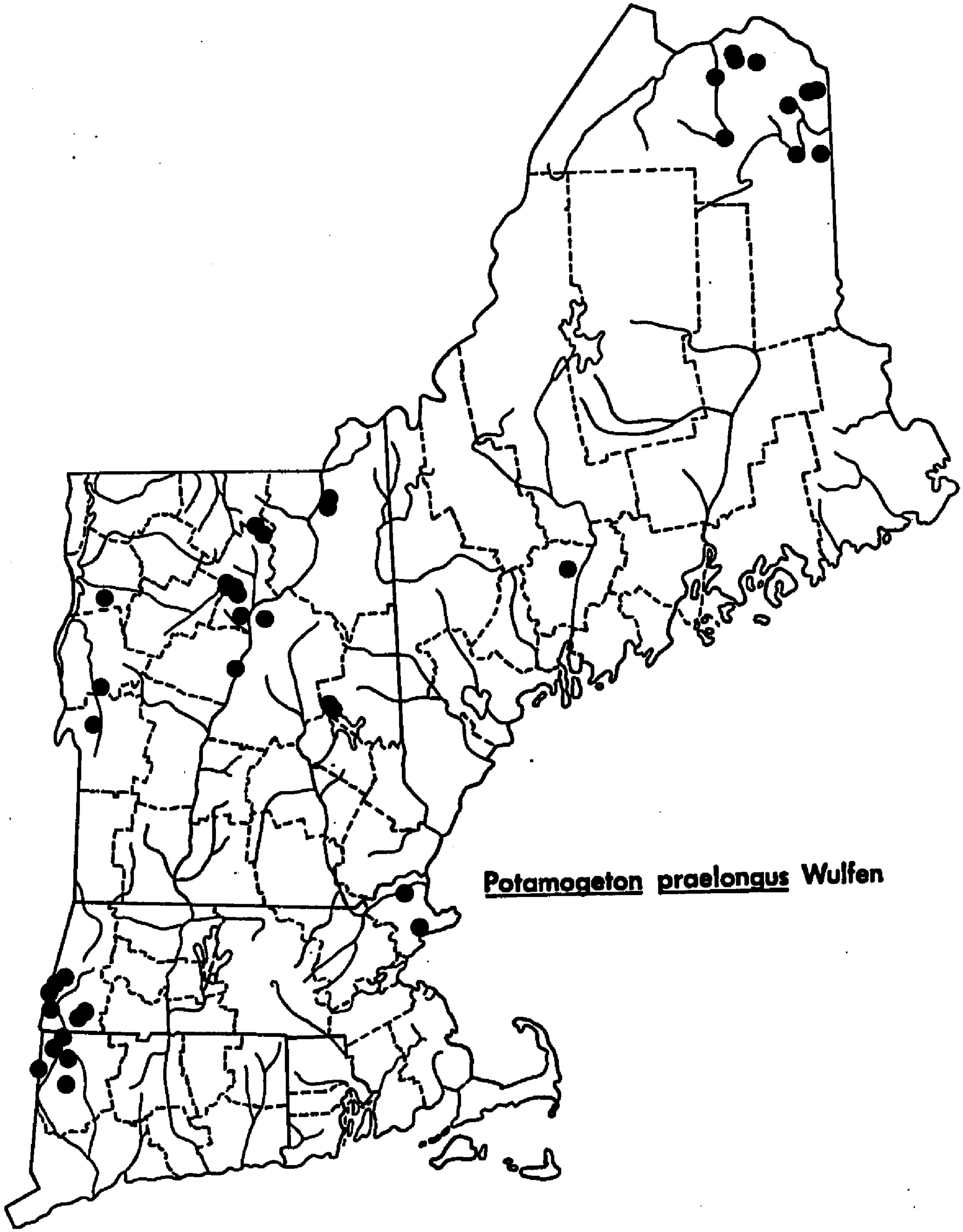


Figure 47. Sampling locations for Potamogeton praelongus.

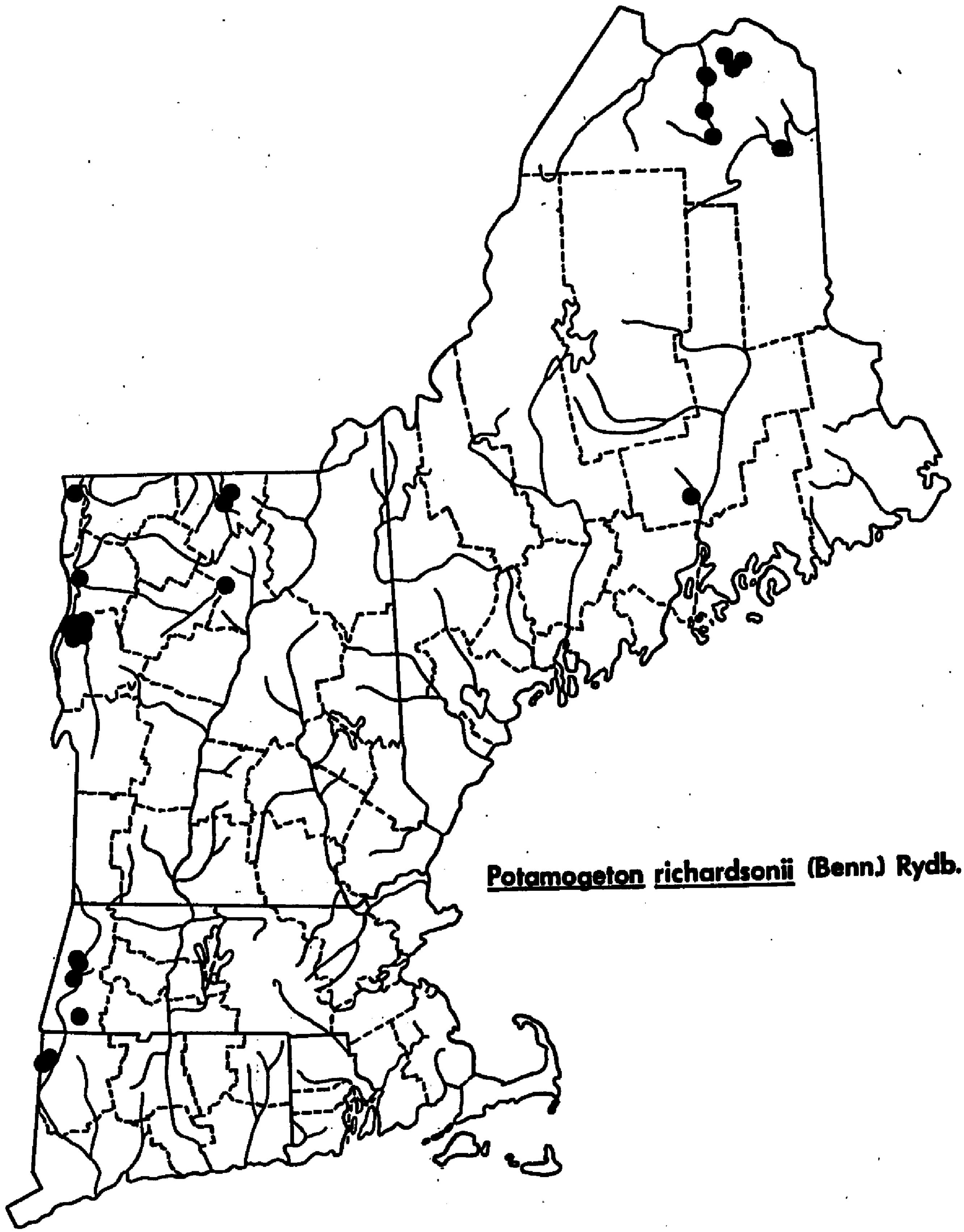


Figure 48. Sampling locations for Potamogeton richardsonii.

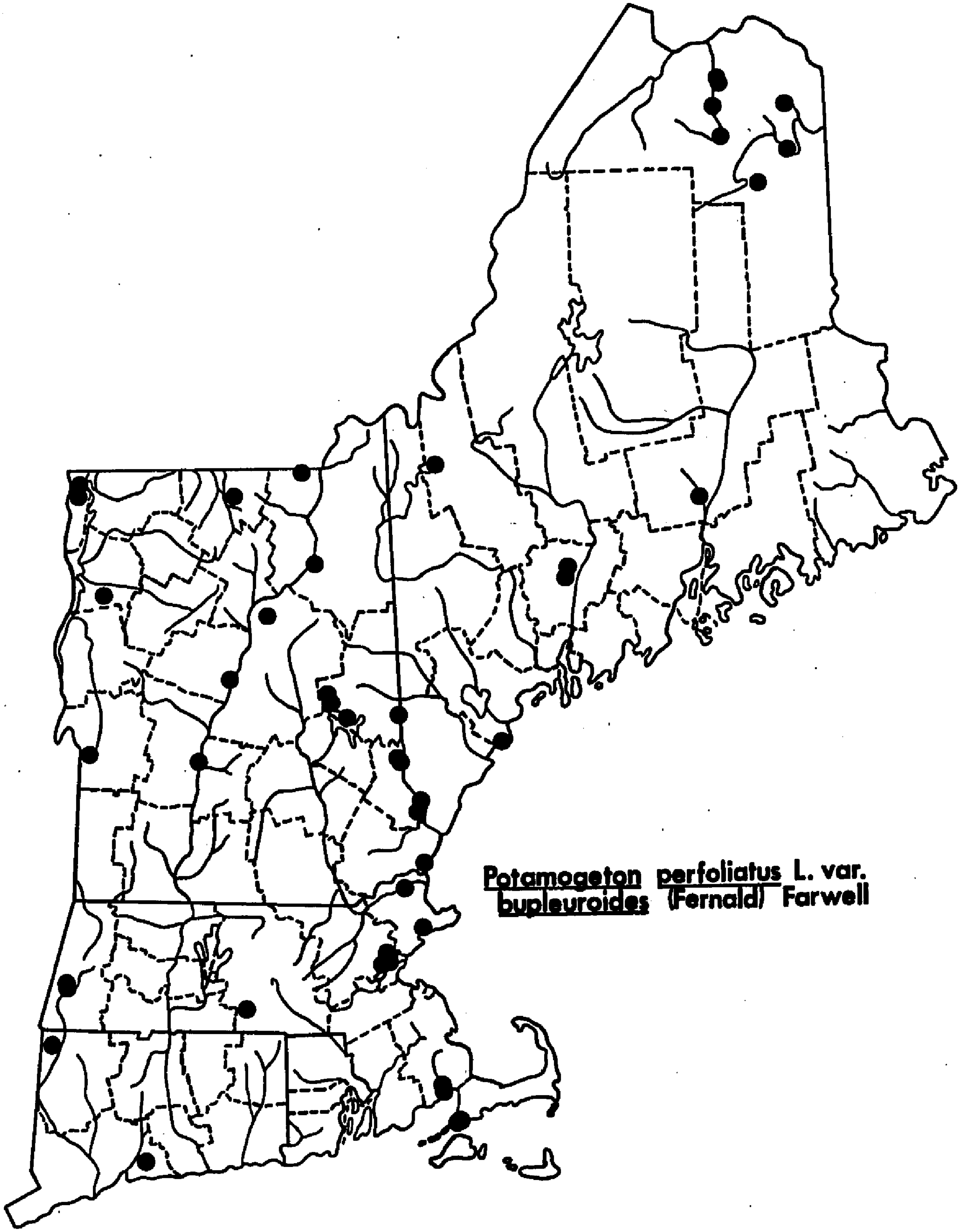


Figure 49. Sampling locations for Potamogeton perfoliatus var. bupleuroides.

APPENDIX III

Chemical Data

Table 15. Chemical characteristics of sampling locations.

Sampling location*	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
		milligrams/liter				
SquaPan Lake, Ashland, Me.	6.6	9.5	2.0	2.5	.00	1.6
Whitehead Lake, Bridgewater, Me.	7.3	82.5	2.5	17.5	.10	15.3
Butterfield Lake, Caswell, Me.	7.3	63.5	3.0	17.5	.02	7.1
Gerrard Pond, Caswell, Me.	9.2	49.0	0.0	4.7	.02	7.2
ditch (49°59'28"N., 67°54'6"W.), Caswell, Me.	6.5	32.5	14.5	18.0	.06	3.3
Pierce Lake, Caswell, Me.	7.6	80.0	2.0	23.0	.08	24.0
man-made pond near Pierce Lake, Caswell, Me.	9.1	24.0	0.0	32.5	.04	22.9
Masters Daggett Brook, Caswell, Me.	7.5	73.0	2.0	4.8	.02	4.4
Butterfield Brook, Caswell, Me.	7.0	53.0	6.0	3.9	.10	6.6
Eagle Lake, Eagle Lake, Me.	6.8	14.0	3.0	6.0	.02	2.9
Fish River near Eagle Lake, Eagle Lake, Me.	6.9	14.0	3.0	3.5	.02	2.2
Fischer Lake, Fort Fairfield, Me.	9.5	34.5	0.0	5.5	.15	14.5
Howard Brook near Monson Lake, Fort Fairfield, Me.	7.3	68.5	3.0	6.5	.10	10.9
Monson Lake, Fort Fairfield, Me.	6.9	48.0	7.0	2.0	.15	5.5
Nadeau Pond stream, Fort Fairfield, Me.	8.0	105.0	0.5	8.0	.04	18.5
Page Pond, Fort Fairfield, Me.	8.2	86.5	0.0	17.5	.78	24.0
south Nadeau Pond, Fort Fairfield, Me.	7.3	90.0	7.0	17.5	.06	21.3
stream (46°42'17"N., 67°50'26"W.), Fort Fairfield, Me.	7.2	83.0	18.0	5.0	.15	12.6
stream (46°40'42"N., 67°47'56"W.), Fort Fairfield, Me.	6.9	77.5	7.0	3.8	.18	3.8
Black Lake, Fort Kent, Me.	7.8	17.5	0.5	4.5	.04	8.2
south branch, Meduxenekeag River, Hodgdon, Me.	7.3	28.5	5.0	5.3	.10	3.3
farm pond (46°10'9"N., 67°50'34"W.), Littleton, Me.	7.2	104.5	6.5	11.5	.18	12.0
Prestile Stream pond, Mars Hill, Me.	7.3	103.5	4.0	20.0	.25	13.1

*A complete description of each location given in coordinate form is provided in Appendix I.

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
Gentle Lake, Monticello, Me.	7.5	42.5	2.0	4.8	.10	6.6
Gentle Lake stream, Monticello, Me.	7.3	95.0	4.0	15.8	.06	26.2
Jewel Pond, Monticello, Me.	8.2	40.0	0.0	5.7	.14	14.7
Daigle Pond, New Canada, Me.	7.3	19.5	1.5	5.0	.08	10.9
Mosquito Brook, Portage Lake, Me.	7.0	31.5	3.5	2.5	.10	2.2
Portage Lake, Portage Lake, Me.	6.7	13.5	4.0	4.3	.06	3.3
Echo Lake, Presque Isle, Me.	7.4	41.0	2.0	9.0	.20	9.8
swamp (46°40'16"N., 68°59'15"W.), Presque Isle, Me.	6.5	77.5	4.0	19.0	.20	5.5
Brishlotte Pond, St. Agatha, Me.	6.9	27.5	8.0	4.3	.02	1.6
Madawaska Lake, T16-R4, Me.	7.1	9.0	1.0	6.0	.16	5.5
Long Lake, T17-R4, Me.	7.3	13.5	1.0	6.5	.16	7.6
Mud Lake, T17-R4, Me.	7.0	14.0	0.5	5.0	.04	5.5
Caribou Lake, Washburn, Me.	7.5	50.0	2.0	17.5	.50	9.8
pond (68°3'30"N., 46°45'13"W.), Washburn, Me.	7.4	35.0	1.5	5.5	.16	84.6
Red River near St. Froid Lake, Winterville, Me.	7.0	24.0	3.0	2.5	.00	1.6
St. Froid Lake, Winterville, Me.	7.0	16.5	4.0	4.0	.06	2.9
Pushaw Lake, Orono, Me.	6.7	13.5	3.0	5.3	.06	5.5
Beaver Pond, Township D, Me.	6.1	3.0	2.5	1.4	.10	4.4
Gull Pond, Dallas (T2-R2), Me.	7.1	10.0	1.0	2.0	.12	2.7
Haley Pond, Rangeley-Dallas (T2-R2), Me.	7.0	10.0	0.5	2.2	.04	9.8
Long Pond, (44°53'30"N., 70°35'21"W.), Sandy River, Me.	6.6	6.0	2.5	3.0	.10	4.4
Long Pond stream, Sandy River (T2-R1), Me.	6.6	4.0	2.0	2.2	.10	3.3
Cold Brook, T4-R3, Me.	6.5	6.0	2.5	1.4	.10	2.2
Charles River, Fryeburg Harbor, Me.	5.0	3.0	2.5	6.0	.19	3.8
old course, Saco River, Fryeburg Harbor, Me.	6.8	20.0	5.0	6.5	.17	15.3
horseshoe pond, North Fryeburg, Me.	6.6	11.0	6.0	3.3	.17	15.3
Belgrade Stream, Belgrade, Me.	6.6	13.0	3.5	3.5	.20	4.4
Echo Lake, Mt. Vernon, Me.	6.9	7.0	1.0	3.3	.12	7.1
Maranacook Lake, Readfield, Me.	7.1	11.0	1.0	2.4	.10	8.4
Tingley Brook, Readfield, Me.	6.7	16.0	4.5	3.0	.10	8.7

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
Torsey Lake, Readfield, Me.	6.9	8.0	1.0	5.3	.02	6.6
Lake Annabessacook, Winthrop, Me.	7.1	13.0	1.0	2.4	.16	8.7
pond (43°34'1"N., 70°23'0"W.), Scarborough, Me.	7.0	28.5	6.0	6.0	.03	103.7
Dunstan River, Scarborough, Me.	6.5	7.5	5.0	2.5	.50	185.0
Stuart Brook above dam, Scarborough, Me.	6.7	22.5	9.0	5.0	.18	27.3
Lord's Pond, Biddeford, Me.	7.6	31.5	1.5	3.5	.04	2162.2
pond (43°36'0"N., 70°21'5"W.), Biddeford, Me.	10.0	169.0	0.0	2.9	.10	4095.0
Etherington Pond, Biddeford, Me.	6.9	11.0	1.5	1.5	.04	873.6
Long Pond, Saco, Me.	5.4	1.5	5.5	4.0	.16	30.6
Shoreup Brook. Eliot, Me.	6.6	20.0	5.0	0.4	.16	36.0
Great Works River, South Berwick, Me.	6.8	14.0	2.0	1.8	.02	14.7
Little Ossipee River backwater, Waterboro, Me.	5.7	9.0	6.0	2.5	.10	60.1
Clarksville Pond, Clarksville, N.H.	7.1	15.0	2.0	3.0	.02	2.0
Lombard Pond, Colebrook, N.H.	7.9	67.0	1.0	4.0	.04	3.8
Fish Pond, Columbia, N.H.	7.2	28.0	1.5	2.5	.14	3.8
Lime Pond, Columbia, N.H.	7.9	52.5	1.0	3.1	.10	2.7
Island Brook, Dummer, N.H.	6.4	9.0	4.0	2.4	.16	2.2
Androscoggin River, Errol, N.H.	6.8	5.0	1.0	5.0	.12	2.7
Baker Pond, Lancaster, N.H.	6.7	23.0	5.0	2.2	.08	13.1
Martin Meadow Pond, Lancaster, N.H.	6.5	12.0	4.5	2.4	.08	14.2
oxbow pond (44°29'50"N., 71°2'6"W.), Lancaster, N.H.	6.4	13.5	4.0	3.3	.12	245.7
East Inlet stream, Pittsburg, N.H.	7.0	13.5	2.0	2.5	.10	2.2
East Inlet pond, Pittsburg, N.H.	6.7	12.5	3.0	2.2	.10	3.8
Connecticut River at Bench Mark 1880, Pittsburg, N.H.	6.9	16.0	2.0	3.0	.05	1.6
Moose Falls, Connecticut River, Pittsburg, N.H.	6.5	12.0	5.0	2.5	.10	2.2
West Inlet stream, Pittsburg, N.H.	6.9	16.0	2.0	2.5	.10	2.6
pond (44°24'29"N., 71°2'6"W.), Shelburne, N.H.	5.9	2.5	4.0	3.0	.05	5.5
Cross farm pond, Stewartstown, N.H.	9.9	32.0	0.0	3.5	.08	2.2
Back Pond, Stewartstown, N.H.	6.6	7.0	1.5	1.2	.10	4.4
Church Pond outlet, Albany, N.H.	5.9	5.0	3.5	1.8	.16	3.3

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
Lake Pequaket, Conway, N.H.	6.4	4.0	3.0	2.2	.02	7.6
Conway Lake, Eaton, N.H.	6.7	2.5	1.5	1.5	.10	5.5
Province Lake, Wakefield, N.H.	6.8	5.0	3.0	3.1	.19	21.8
Hoyt Brook, Freedom, N.H.	6.5	8.5	6.0	2.4	.10	3.8
Shaw Pond, Freedom, N.H.	6.5	3.0	1.5	2.7	.18	2.2
Square Brook, Freedom, N.H.	6.5	4.5	2.0	3.1	.20	7.6
Berry Bay-Ossipee Lake, Freedom, N.H.	6.5	4.5	2.0	3.1	.20	7.6
Silver Lake, Madison, N.H.	6.6	4.0	2.5	7.0	.19	6.0
Cooks Pond, Madison, N.H.	6.5	7.0	5.0	3.2	.21	3.3
Lake Kanasatka, Moultonboro, N.H.	7.3	10.0	1.0	1.9	.10	10.4
Meadow Brook, Moultonboro, N.H.	5.7	6.0	5.0	3.3	.10	8.7
Moultonboro Bay-Lake Winnipesaukee, Moultonboro, N.H.	6.8	9.0	1.0	2.4	.10	9.8
Shannon Brook, Lake Winnipesaukee, Moultonboro, N.H.	6.5	7.0	3.0	3.0	.10	8.2
stream (43°43'50"N., 71°23'9"W.), Moultonboro, N.H.	5.8	4.5	4.5	3.5	.16	6.6
swamp (43°45'4"N., 71°29'13"W.), Moultonboro, N.H.	6.6	5.5	2.0	2.3	.11	15.8
Lake Wakondah, Moultonboro, N.H.	7.7	12.0	1.5	2.1	.09	10.4
Bearcamp River, Ossipee, N.H.	6.8	8.0	1.5	3.2	.18	8.7
Big Dan Hole Pond, Ossipee-Tuftonboro, N.H.	6.7	3.5	1.0	8.5	.02	3.3
Branch Brook, Ossipee, N.H.	6.6	4.5	2.0	2.5	.10	4.4
Connor Pond, Ossipee, N.H.	6.8	4.0	1.0	3.0	.02	3.3
Little Dan Hole Pond, Ossipee-Tuftonboro, N.H.	6.8	5.0	1.0	8.5	.02	3.3
Ossipee Lake, Ossipee-Freedom, N.H.	6.6	3.5	2.0	8.5	.20	7.1
Pine River, Ossipee, N.H.	6.4	6.5	2.0	6.0	.08	6.5
pond (43°38'32"N., 71°4'4"W.), Ossipee, N.H.	6.2	6.0	6.5	6.0	.10	38.2
stream (43°47'57"N., 71°9'26"W.), Ossipee, N.H.	5.9	7.0	1.0	2.5	.20	28.4
Taylor Pond, Sandwich, N.H.	6.6	0.5	10.0	6.5	.08	3.8
Bearcamp Pond, Sandwich, N.H.	6.6	3.5	1.5	1.7	.08	2.2
Chocorua Lake, Tamworth, N.H.	6.4	4.5	2.0	3.1	.30	6.0
horseshoe pond (43°47'57"N., 71°13'30"W.), Tamworth, N.H.	6.5	3.5	2.5	2.5	.10	2.7

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
Little Lake, Tamworth, N.H.	6.5	4.5	2.0	3.0	.17	6.0
Nineteen Mile Brook, Tuftonboro, N.H.	6.7	8.5	4.0	1.2	.19	14.9
Twenty Mile Brook, Tuftonboro, N.H.	6.9	14.5	6.5	1.5	.15	26.2
pond (43°38'11"N., 70°58'55"W.), Wakefield, N.H.	6.5	8.0	9.0	3.3	.26	9.3
pond (43°38'11"N., 71°3'23"W.), Wakefield, N.H.	5.8	3.0	7.0	3.3	.08	2.7
Stump Pond, Wakefield, N.H.	6.8	7.0	1.5	3.0	.10	8.7
beaver pond (43°40'0"N., 71°8'37"W.), Wolfeboro, N.H.	6.4	15.0	7.0	2.4	.10	40.4
Wiley Brook pond, Wolfeboro, N.H.	6.0	3.0	3.5	2.4	.08	25.1
Newfound Lake, Hebron, N.H.	6.6	4.0	1.0	3.0	.12	6.5
Lily Pond, Livermore, N.H.	6.5	3.5	4.0	4.0	.08	21.8
Ogontz Lake, Lyman, N.H.	7.1	16.5	2.0	7.8	.09	7.6
Post Pond, Lyme, N.H.	7.1	12.5	1.5	6.5	.08	7.1
Winkley Pond, Barrington, N.H.	6.0	2.5	2.5	2.7	.17	25.1
Cocheco River, Dover, N.H.	6.9	9.0	1.5	10.5	.50	20.8
Beard's Creek, Durham, N.H.	7.8	39.0	1.0	2.3	.20	52.4
Johnson Creek, Durham, N.H.	7.0	22.5	2.0	9.0	.10	21.8
Lamprey River, Durham, N.H.	6.6	13.0	6.0	12.0	.10	31.7
Mill Pond, Durham, N.H.	7.0	26.0	3.0	7.0	.20	60.1
Bellamy River below dam, Madbury, N.H.	9.5	57.5	0.0	1.6	.02	9.8
Branch River, Milton, N.H.	6.8	10.5	2.5	6.5	.18	12.0
Northeast Pond, Milton, N.H.	7.0	7.0	1.5	5.5	.12	10.9
Isinglass River, Rochester, N.H.	6.7	6.0	2.0	1.6	.15	8.7
Fresh Creek, Rollinsford, N.H.	7.5	27.0	2.0	8.0	.20	38.2
Merrymeeting River, Alton, N.H.	5.9	5.5	9.0	3.0	.12	5.5
Wickwas Lake, Meredith, N.H.	6.3	5.5	2.0	1.6	.08	7.6
beaver pond (43°22'54"N., 71°32'22"W.), Sanbornton, N.H.	6.0	3.0	3.5	2.4	.08	25.1
Danbury Bog Pond, Danbury, N.H.	6.0	5.0	7.0	6.0	.18	5.5
Blow-Me-Down Pond, Cornish, N.H.	7.2	40.0	2.0	5.5	.02	13.1

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
Meadow Pond, Hampton Beach, N.H.	6.4	27.5	3.0	2.1	.40	234.8
Taylor Brook Pond, Hampton-Hampton Falls, N.H.	7.3	27.0	2.5	2.3	.60	36.0
Pow-Wow Pond, Kingston, N.H.	5.6	9.0	9.5	0.0	.02	18.0
Connecticut River, Hinsdale, N.H.	8.9	30.0	0.0	4.5	.20	10.9
Island Pond, Brighton, Vt.	7.5	12.5	2.0	12.5	.15	7.6
Nulhegan Pond, Brighton, Vt.	6.9	10.0	2.0	2.5	.00	7.6
Spectacle Pond, Brighton, Vt.	6.9	8.5	2.0	14.5	.10	10.4
Wallace Pond, Canaan, Vt.	7.4	12.5	1.0	3.1	.10	4.4
Neal Pond, Lunenberg, Vt.	6.9	7.0	1.0	2.7	.08	1.7
Crystal Lake, Barton, Vt.	7.5	17.0	1.0	8.0	.18	8.2
Pensioner Pond, Charleston, Vt.	7.4	23.5	1.5	3.3	.05	8.7
Barton River backwater, Irasburg, Vt.	7.6	51.5	1.5	4.0	.09	7.6
Seymour Lake, Morgan, Vt.	8.1	20.0	0.5	7.8	.12	4.9
Bald Hill Pond, Westmore, Vt.	7.7	34.0	1.0	3.0	.17	2.2
Long Pond, Westmore, Vt.	7.6	27.0	1.0	3.0	.02	2.2
Alder Run, Franklin, Vt.	6.7	45.0	27.5	0.5	.15	3.3
Dillenbeck Bay, Alburg, Vt.	7.9	31.5	2.5	2.3	.06	6.0
Lake Champlain, North Hero, Vt.	7.7	35.0	2.0	5.5	.02	8.2
swamp (44°49'24"N., 73°16'42".), North Hero, Vt.	7.5	127.0	2.0	4.5	.01	10.4
Harvey Lake, Barnet, Vt.	7.8	60.5	1.0	2.2	.00	7.1
Sarah Moor Pond, Barnet, Vt.	7.8	55.0	1.0	2.4	.10	6.0
Warden Pond, Barnet, Vt.	7.6	55.0	0.0	3.0	.09	2.7
Little Eligo Pond, Hardwick, Vt.	8.0	67.5	0.0	2.8	.12	10.4
Center Pond, Newark, Vt.	7.7	36.0	0.5	3.0	.08	2.2
Newark Pond, Newark, Vt.	7.8	25.0	0.5	2.5	.17	2.2
swamp (44°22'54"N., 72°10'25"W.), Peacham, Vt.	8.2	73.5	0.0	4.0	.16	1.6
Ewell Pond, Peacham, Vt.	7.5	88.0	3.0	0.5	.16	2.2
Fosters Pond, Peacham, Vt.	7.9	33.0	0.5	7.8	.10	2.7
Keiser Pond, Peacham-Danville, Vt.	7.7	85.0	1.0	0.0	.02	2.2

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
Martins Pond, Peacham, Vt.	7.8	20.0	0.5	22.5	.02	1.6
Peacham Pond, Peacham, Vt.	7.2	10.5	1.0	2.0	.04	2.2
Bean Pond, Sutton, Vt.	7.9	54.0	1.0	1.0	.10	6.6
south Dolloff Pond, Sutton, Vt.	7.2	53.0	3.0	0.5	.23	1.6
Lake Iroquois, Hinesburg, Vt.	7.4	37.5	2.0	2.5	.16	10.9
Mallets Bay-Lake Champlain, Colchester, Vt.	7.6	25.0	2.0	10.5	.16	8.2
Pond Brook, Colchester, Vt.	7.5	62.5	4.0	7.5	.12	8.7
Shelburne Pond, Shelburne, Vt.	7.0	76.0	12.0	5.0	.48	10.9
Lake Morey, Fairlee, Vt.	7.5	27.5	1.0	5.3	.01	3.8
Lake Fairlee, West Fairlee, Vt.	7.1	19.5	1.0	5.3	.20	5.5
Joes Brook, Cabot, Vt.	7.2	49.5	3.0	7.0	.00	7.6
Joes Pond, Cabot, Vt.	7.6	33.5	1.0	3.0	.18	4.9
East Branch Dead Creek, Addison, Vt.	7.4	153.0	3.0	3.0	.42	15.3
McCuen Slang, Addison, Vt.	7.5	120.0	2.0	4.5	.20	18.6
East Branch Dead Creek, Bridport, Vt.	8.1	231.5	0.0	1.5	1.65	9.8
Lake Champlain near Otter Creek, Ferrisburg, Vt.	7.4	36.0	2.5	6.6	.10	7.6
Dead Creek, Ferrisburg, Vt.	7.6	57.5	1.5	6.0	.20	14.2
Hawkins Bay-Lake Champlain, Ferrisburg, Vt.	7.4	36.0	2.5	6.6	.10	7.6
Lewis Creek, Ferrisburg, Vt.	7.5	47.5	2.5	6.6	.20	3.3
Little Otter Creek, Ferrisburg, Vt.	7.4	75.0	4.5	4.6	.28	10.9
Otter Creek, Ferrisburg, Vt.	7.5	55.0	3.0	6.6	.18	8.7
South Slang, Ferrisburg, Vt.	7.1	65.5	2.5	4.6	.32	4.4
swamp (44°12'36"N., 73°19'11"W.), Ferrisburg, Vt.	7.3	71.5	3.0	5.5	.30	13.1
Lake Dunmore, Leicester-Salisbury, Vt.	7.1	20.0	1.0	2.1	.02	3.3
Fern Lake, Leicester, Vt.	8.4	42.0	1.0	1.3	.10	8.7
Cedar Lake, Monkton, Vt.	8.6	78.5	0.0	1.8	.02	27.8
East Creek, Orwell, Vt.	7.8	90.0	8.5	1.5	.16	2.7
ditch along Swamp Road, Salisbury, Vt.	7.1	110.5	8.0	0.2	.10	3.3
stream (43°51'48"N., 73°18'28"W.), Shoreham, Vt.	7.1	98.5	7.0	0.9	.42	17.5

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
Richville Pond, Shoreham Center, Vt.	7.3	93.5	6.5	1.8	.20	15.3
stream (43°51'48"N., 73°13'28"W.), Whiting Vt.	7.5	127.5	7.0	2.5	.20	12.0
Evarts's Pond (Lake Runnemede), Windsor, Vt.	8.4	71.5	0.0	2.5	.12	22.9
Mill Pond, Windsor, Vt.	8.0	50.0	0.5	2.1	.02	10.9
Hubbardton River, Benson, Vt.	9.5	62.0	0.0	2.5	.20	6.6
Sunrise Lake, Benson, Vt.	8.3	29.5	0.5	1.5	.02	5.5
Glen Lake, Castleton, Vt.	7.5	35.0	3.0	1.0	.10	5.5
Lake Bomoseen, Hubbardton-Castleton, Vt.	7.7	36.0	1.0	5.5	.02	8.7
Black Pond, Hubbardton, Vt.	8.6	57.5	0.0	1.0	.02	6.6
Breese Pond, Hubbardton, Vt.	7.1	45.5	7.5	1.8	.02	3.3
Lake Hortonia, Hubbardton, Vt.	8.6	69.5	0.0	4.3	.18	8.7
swamp (43°41'7"., 73°13'37"W.), Hubbardton, Vt.	6.8	66.5	10.0	0.4	.00	3.3
Lake St. Catherine, Poultney, Vt.	7.8	30.5	4.0	3.0	.02	25.1
Jones Mill Pond, Rutland, Vt.	7.7	60.0	0.0	5.5	.10	10.4
Burr Lake, Sudbury, Vt.	8.5	59.5	0.0	7.0	.10	4.4
Little Pond, Wells, Vt.	6.8	29.0	7.5	1.0	.00	9.8
Lily Pond, Vernon, Vt.	6.3	2.5	2.5	4.0	.10	2.2
Battenkill River, Arlington, Vt.	7.5	115.0	5.0	13.0	.02	11.8
Barber Pond, Pownel, Vt.	9.5	85.0	0.0	1.1	.16	8.7
South Stream, Pownel, Vt.	7.1	111.0	10.0	8.0	.06	8.2
Shawsheen River, Andover, Ma.	6.7	17.0	5.0	6.8	.30	57.9
Lily Pond, Gloucester, Ma.	6.6	2.5	1.5	2.5	.16	15.8
Beck Pond, Hamilton, Ma.	6.6	11.5	3.5	2.5	.16	19.1
Chadwicks Lake, Haverhill, Ma.	7.4	21.0	1.0	0.8	.02	13.1
Colonial Pond, Lynnfield, Ma.	7.1	44.0	4.0	3.3	.10	67.7
Pleasant Pond, Wenham, Ma.	7.8	40.5	0.5	6.0	.16	33.3
pond (42°26'28"N., 71°8'53"W.), Arlington, Ma.	8.1	33.5	0.0	8.5	.16	174.7
Winter Pond, Arlington, Ma.	6.8	11.5	2.0	6.5	.10	135.4
marsh (32°35'14"N., 71°15'23"W.), Billerica, Ma.	6.9	30.0	4.5	10.0	.18	57.9

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
Fresh Pond, Cambridge, Ma.	6.9	20.5	5.0	8.5	.10	52.4
pond (42°23'21"N., 71°9'14"W.), Cambridge, Ma.	8.2	137.5	0.0	8.8	.14	48.0
pond (42°23'21"N., 71°9 27"W.), Cambridge, Ma.	7.4	170.0	6.5	2.2	.10	15.8
Concord River at Rt. 225, Carlisle-Concord, Ma.	6.8	12.0	2.5	10.3	.68	45.9
Russell Mill Pond, Chelmsford, Ma.	6.5	12.0	3.5	6.0	.10	31.7
Assabet River, Concord, Ma.	6.7	15.0	4.0	6.0	1.12	29.5
Concord River, Concord, Ma.	6.8	12.0	2.5	10.3	.68	45.9
Sudbury River, Concord, Ma.	6.8	15.0	4.0	6.2	.20	51.3
Mill Pond, Littleton, Ma.	6.7	20.0	5.0	9.2	.10	90.6
Lower Mystic Lake, Medford, Ma.	7.1	53.5	4.0	9.0	.10	56.8
Mystic River, Medford, Ma.	7.1	53.5	4.0	9.0	.10	56.8
Fisk Pond, Natick, Ma.	6.7	26.0	7.0	9.5	.18	62.1
pond (42°16'55"N., 71°22'39"W.), Natick, Ma.	7.4	21.0	1.0	9.8	.08	53.5
Sucker Pond, Framingham, Ma.	7.1	17.0	1.5	8.0	.12	85.2
Sudbury River, Framingham, Ma.	6.7	12.0	2.5	8.5	.10	60.1
Icehouse Pond, Hopkinton, Ma.	6.1	3.5	10.0	6.5	.25	17.4
North Pond, Hopkinton, Ma.	6.2	5.5	5.0	8.0	.10	10.9
Whitehall Reservoir, Hopkinton, Ma.	6.6	3.5	8.0	5.5	.10	6.6
Charles River, Newton, Ma.	7.2	20.0	2.0	13.0	.20	49.2
Neponset River, Readville, Ma.	6.9	19.0	3.0	6.6	.16	62.8
Houghton's Pond, Canton, Ma.	6.8	3.0	1.5	7.2	.08	202.0
Ponkapoag Pond, Canton, Ma.	6.8	3.0	2.5	5.5	.10	41.5
Charles River, Dover, Ma.	6.8	15.0	2.5	8.5	.45	34.9
Trout Brook, Dover, Ma.	6.4	11.0	6.5	7.6	.08	43.7
Hemenway Pond, Milton, Ma.	7.5	9.0	0.5	4.3	.08	15.3
Ames Long Pond, Stoughton, Ma.	6.8	3.0	1.5	3.0	.05	14.2
Agawam River, Wareham, Ma.	6.5	5.0	2.5	4.0	.16	12.0
Agawam River near tidal exchange, Wareham, Ma.	6.7	7.0	2.0	7.2	.14	191.1
Mill Pond, Wareham, Ma.	6.5	5.0	2.5	7.2	.16	12.0

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
		milligrams/liter				
Nobska Pond, Falmouth, Ma.	7.7	30.0	0.5	10.5	.15	3822.0
Oyster Pond, Falmouth, Ma.	7.2	19.5	0.5	1.5	.04	1201.2
Red Brook, Falmouth, Ma.	6.2	5.0	4.0	6.8	.10	16.4
pond (41°32'8"N., 70°38'31"W.), Falmouth, Ma.	10.7	38.5	0.0	11.5	.08	2375.1
Still River, Bolton, Ma.	6.6	22.0	6.0	3.8	.20	18.6
Brookfield River, East Brookfield, Ma.	6.7	9.5	2.0	9.0	.25	16.5
stream (42°10'57"N., 72°4'12"W.), East Brookfield, Ma.	7.5	7.5	1.0	2.5	.25	7.6
Lake Ripple, Grafton, Ma.	6.8	16.0	4.5	3.8	.10	48.1
Silver Lake, Grafton, Ma.	6.5	8.0	7.0	3.3	.20	38.2
Hopedale Pond, Hopedale, Ma.	6.5	3.5	6.0	10.0	.02	87.2
Lake Nipmuc, Mendon, Ma.	7.0	9.0	0.5	5.5	.16	61.5
Mill Pond, Milford, Ma.	6.5	2.5	3.5	1.6	.10	42.6
Pratt Pond, Upton, Ma.	6.6	3.0	5.0	5.5	.15	6.6
Walker Pond, Sturbridge, Ma.	5.9	3.0	2.0	4.8	.02	40.4
inlet of Lake Chauncy, Westborough, Ma.	6.1	15.0	12.5	7.2	1.05	69.9
Lake Chauncy, Westborough, Ma.	7.3	12.0	0.5	8.5	.16	43.7
Hocomonco Pond, Westborough, Ma.	7.5	21.0	1.0	10.0	.02	13.1
pond west of Wyman Lake, Rt. 140, Westminster, Ma.	6.1	4.0	4.0	4.5	.16	6.6
Lake Rohunta, Orange, Ma.	5.9	4.0	6.0	3.8	.20	14.2
Laurel Lake, Erving, Ma.	6.6	2.0	1.0	6.0	.10	1.6
Millers River, Erving, Ma.	6.7	16.0	4.0	3.0	.23	16.9
Mill Pond, Egremont, Ma.	7.7	92.5	9.0	15.5	.23	20.7
Prospect Lake, Egremont, Ma.	7.5	50.5	1.5	15.5	.05	4.4
Fountain Pond, Great Barrington, Ma.	6.8	35.0	6.5	6.0	.05	42.5
Mansfield Pond, Great Barrington, Ma.	8.0	62.5	0.0	4.3	.10	7.1
Pontosuc Lake, Lanesborough, Ma.	8.2	80.0	0.5	5.0	.10	13.1
Goose Pond, Lee, Ma.	7.5	18.0	2.0	13.0	.17	14.2
Laurel Lake, Lee-Lenox, Ma.	8.0	97.0	0.0	2.0	.04	37.1

Table 1. (Continued)

Sampling locations	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
Wood's Pond-Housatonic River, Lenox, Ma.	7.3	108.5	8.5	3.0	1.00	15.8
Lake Buel, Monterey, Ma.	7.9	81.5	0.0	19.5	.16	11.0
Lake Garfield, Monterey, Ma.	7.6	25.0	1.0	5.0	.20	10.9
Harmon Pond, New Marlborough, Ma.	6.7	17.0	2.5	17.5	.10	4.4
northern end of Onota Lake, Pittsfield, Ma.	7.8	32.5	0.5	11.0	.12	4.4
outlet to Onota Lake, Pittsfield, Ma.	10.2	56.0	0.0	4.0	.05	6.6
Cone Brook, Richmond, Ma.	7.4	132.5	15.0	2.0	.10	12.0
Richmond Pond, Richmond, Ma.	8.4	111.5	0.0	24.0	.21	15.3
Schenab Brook, Sheffield, Ma.	7.4	102.5	6.0	3.0	.12	9.8
Stockbridge Bowl, Stockbridge, Ma.	7.5	102.5	0.0	17.4	.10	10.9
Lily Brook, Stockbridge, Ma.	8.3	99.5	0.0	4.3	.20	10.9
Card Pond, West Stockbridge, Ma.	7.8	76.5	0.0	7.7	.04	123.4
Cranberry Pond, West Stockbridge, Ma.	7.2	100.0	3.5	8.3	.10	33.3
Shaker Mill Pond, West Stockbridge, Ma.	9.8	123.5	0.0	19.0	.58	18.5
Bridge's Pond, Williamstown, Ma.	9.8	79.5	0.0	1.5	.02	13.1
Abbott Run Brook, Cumberland, R.I.	6.8	12.0	2.0	1.0	.23	14.2
Sneech Pond, Cumberland, R.I.	6.7	13.5	2.5	2.0	.05	25.1
Todds Pond, North Smithfield, R.I.	6.6	13.0	4.0	3.0	.40	18.0
Tucker Pond, South Kingstown, R.I.	5.8	3.5	5.0	2.5	.10	10.9
Warden Pond, South Kingstown, R.I.	5.9	4.0	5.0	2.5	.40	18.0
Pawcatuck River, Bradford, R.I.	6.3	6.0	3.5	2.5	.60	14.2
stream along Rt. 1A, Westerly, R.I.	6.1	12.0	14.0	1.5	.53	107.0
Black Pond, Middlefield, Ct.	7.6	32.5	0.5	6.5	.10	26.2
Coginchaug River, Middlefield, Ct.	6.7	50.0	10.5	5.5	1.00	14.2
Crystal Lake, Middletown, Ct.	7.0	21.0	2.5	8.7	.10	6.6
Graniss Pond, East Haven, Ct.	7.5	41.5	0.0	8.5	.10	28.4
Lake Quonnipaug, North Guilford, Ct.	6.8	38.0	6.5	7.0	.40	10.9
Dog Pond, Goshen, Ct.	7.4	31.0	1.0	4.8	.45	13.1

Table 1. (Continued)

Sampling location	pH	$CaCO_3$	CO_2	NO_3^-	PO_4^{-3}	Cl^-
			milligrams/liter			
West Side Pond, Goshen, Ct.	7.4	26.0	1.0	4.0	.18	8.7
Bantam Lake, Morris, Ct.	7.5	25.0	1.0	2.5	.16	10.9
Lake Washinee, Salisbury, Ct.	8.0	77.5	0.0	12.0	.18	12.0
Lake Washining, Salisbury, Ct.	8.0	78.0	0.0	11.0	.18	10.9
Wononpakook Lake, Salisbury, Ct.	8.2	111.0	0.0	6.0	.12	9.8
Wononskopomuc Lake, Salisbury, Ct.	9.8	114.5	0.0	12.5	.35	14.2
Indian Lake, Sharon, Ct.	9.5	89.0	0.0	4.5	.41	9.8
Mudge Pond, Sharon, Ct.	7.8	107.0	0.0	2.8	.08	9.8
marsh (41°52'1"N., 73°28'1"W.), Sharon, Ct.	6.7	125.0	18.5	7.5	.10	13.1

The frequency intervals for Tables 2-34 follow: hydrogen ion concentration (pH), .1; total alkalinity ($CaCO_3$), 5.0 mg/l; free carbon dioxide (CO_2), 1.0 mg/l; nitrates (NO_3^-), 2.0 mg/l; total phosphates (PO_4^{-3}), .02 mg/l; and chlorides (Cl^-), 5.0 mg/l.

Table 16. Frequency of occurrence of *Potamogeton filiformis* var. *borealis* along tested chemical gradients.

pH		$CaCO_3$		CO_2		NO_3^-		PO_4^{-3}		Cl^-	
				milligrams per liter							
	f		f		f		f		f		f
7.3 -	1	25.0 -	1	0.0 -	3	0.0 -	1	.00 -	1	5.0 -	4
7.5 -	2	50.0 -	1	1.0 -	3	2.0 -	1	.02 -	2	10.0 -	3
7.6 -	2	55.0 -	1	2.0 -	2	4.0 -	2	.04 -	2	20.0 -	3
7.7 -	1	60.0 -	2	3.0 -	2	6.0 -	1	.08 -	2		
7.8 -	1	65.0 -	1			18.0 -	3	.16 -	1		
7.9 -	1	80.0 -	1			24.0 -	1	.50 -	1		
8.2 -	1	85.0 -	3					.78 -	1		
9.1 -	1										

f-frequency

Table 17. Frequency of occurrence of *Potamogeton pectinatus* along tested chemical gradients.

pH		$CaCO_3$		CO_2		NO_3^-		PO_4^{-3}		Cl^-	
				milligrams per liter							
	f		f		f		f		f		f
7.1	2	30.0	1	0.0	14	2.0	3	.02	4	5.0	2
7.2	2	40.0	2	0.5	3	4.0	6	.04	1	10.0	4
7.4	1	50.0	3	1.5	1	6.0	5	.08	2	15.0	10
7.5	4	60.0	1	2.0	2	8.0	3	.10	3	20.0	4
7.6	1	70.0	1	2.5	1	10.0	1	.12	1	25.0	1
7.7	2	80.0	4	3.0	1	12.0	3	.14	1	30.0	1
8.0	4	95.0	1	3.5	1	14.0	2	.18	1	35.0	1
8.2	2	100.0	4	7.0	2	16.0	1	.20	5	2380.0	1
8.6	2	105.0	2	7.5	1	18.0	1	.24	1	3825.0	1
9.8	2	115.0	2	9.0	1	20.0	1	.36	1	4095.0	1
10.0	1	125.0	1					.42	1		
10.7	1	130.0	1					.58	1		
		155.0	1					1.65	1		
		170.0	1								
		235.0	1								

f-frequency

Table 18. Frequency of occurrence of *Potamogeton robbinsii* along tested chemical gradients.

pH		$CaCO_3$		CO_2		NO_3^-		PO_4^{-3}		Cl^-	
				milligrams per liter							
	f		f		f		f		f		f
6.3 -	1	5.0 -	3	0.0 -	2	2.0 -	7	.00 -	1	5.0 -	5
6.5 -	2	10.0 -	10	0.5 -	4	4.0 -	16	.02 -	8	10.0 -	16
6.6 -	2	15.0 -	6	1.0 -	18	6.0 -	9	.08 -	3	15.0 -	12
6.7 -	3	20.0 -	5	1.5 -	2	8.0 -	8	.10 -	13	20.0 -	2
6.8 -	6	25.0 -	6	2.0 -	7	10.0 -	4	.12 -	2	25.0 -	1
6.9 -	4	30.0 -	5	2.5 -	2	12.0 -	1	.16 -	9	30.0 -	1
7.0 -	1	35.0 -	7	3.0 -	4	14.0 -	1	.18 -	5	40.0 -	2
7.1 -	4	40.0 -	3	3.5 -	3	16.0 -	1	.20 -	5	45.0 -	2
7.2 -	3	45.0 -	1	4.5 -	1	18.0 -	1	.26 -	1	60.0 -	1
7.3 -	3	50.0 -	2	5.0 -	2	20.0 -	1	.40 -	1	80.0 -	2
7.4 -	4	85.0 -	1	6.0 -	1			.46 -	1	170.0 -	1
7.5 -	6	100.0 -	1	6.5 -	1						
7.6 -	4			7.0 -	1						
7.7 -	2			7.5 -	1						
7.8 -	1										
7.9 -	1										
8.1 -	1										
8.3 -	1										

f-frequency

Table 19. Frequency of occurrence of <u>Potamogeton crispus</u> along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
				milligrams per liter							
6.7	4	15.0	3	0.0	12	2.0	5	.02	1	5.0	2
6.8	2	20.0	1	0.5	2	4.0	5	.04	2	10.0	5
7.0	1	25.0	1	1.0	2	6.0	6	.06	1	15.0	10
7.3	1	30.0	1	1.5	2	8.0	4	.08	1	20.0	4
7.4	3	35.0	1	2.0	1	10.0	4	.10	6	25.0	1
7.5	3	40.0	3	2.5	4	12.0	1	.12	2	30.0	1
7.6	2	55.0	2	3.0	1	14.0	2	.14	1	40.0	1
7.7	2	60.0	1	4.0	1	16.0	1	.16	2	50.0	3
7.8	3	80.0	5	5.0	1	18.0	2	.18	4	65.0	2
7.9	1	85.0	1	6.5	1	24.0	1	.20	3	65.0	2
8.0	3	95.0	1	7.0	1			.22	1	95.0	1
8.2	3	100.0	2	8.5	1			.24	1	125.0	1
8.3	1	105.0	1	9.0	1			.48	1		
8.4	1	110.0	2	12.0	1			.58	1		
9.8	1	115.0	2					.68	2		
		125.0	1					1.00	1		
		140.0	1					1.12	1		
		155.0	1								
		175.0	1								

f-frequency

Table 20. Frequency of occurrence of <u>Potamogeton confervoides</u> along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
				milligrams per liter							
5.3	1	5.0	10	1.0	2	2.0	2	.02	1	5.0	5
5.9	2	10.0	2	1.5	2	4.0	6	.06	2	10.0	4
6.0	1			2.0	2	6.0	1	.08	4	15.0	1
6.4	2			2.5	1	8.0	3	.10	1	25.0	1
6.5	2			3.5	1			.16	1	30.0	1
6.6	2			4.0	2			.18	1		
6.8	2			10.0	1			.22	1		
								.30	1		

f-frequency

Table 21. Frequency of occurrence of <u>Potamogeton zosteriformis</u> along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
				milligrams per liter							
5.8 -	1	5.0 -	1	0.0 -	16	2.0 -	12	.02 -	7	5.0 -	14
5.9 -	1	10.0 -	4	0.5 -	3	4.0 -	19	.04 -	1	10.0 -	27
6.4 -	1	15.0 -	9	1.0 -	11	6.0 -	19	.06 -	7	15.0 -	18
6.6 -	1	20.0 -	3	1.5 -	4	8.0 -	9	.08 -	2	20.0 -	6
6.7 -	5	25.0 -	2	2.0 -	4	10.0 -	2	.10 -	14	25.0 -	1
6.8 -	5	30.0 -	3	2.5 -	5	12.0 -	5	.12 -	4	30.0 -	2
6.9 -	1	35.0 -	11	3.0 -	7	14.0 -	2	.14 -	1	35.0 -	1
7.0 -	1	40.0 -	4	3.5 -	2	16.0 -	1	.16 -	12	40.0 -	1
7.1 -	6	45.0 -	3	4.0 -	5	18.0 -	1	.18 -	7	45.0 -	1
7.2 -	2	50.0 -	3	4.5 -	3	20.0 -	1	.20 -	5	65.0 -	1
7.3 -	9	55.0 -	2	5.0 -	2	22.0 -	1	.22 -	1	85.0 -	1
7.4 -	5	60.0 -	4	6.5 -	2	24.0 -	1	.24 -	1	250.0 -	1
7.5 -	5	70.0 -	4	7.0 -	1			.26 -	1		
7.6 -	4	75.0 -	2	7.5 -	2			.28 -	1		
7.7 -	6	80.0 -	3	8.5 -	2			.30 -	1		
7.8 -	3	85.0 -	3	9.0 -	2			.32 -	1		
7.9 -	3	90.0 -	3	10.0 -	1			.42 -	1		
8.0 -	3	95.0 -	2	27.5 -	1			.58 -	1		
8.2 -	1	100.0 -	1					.68 -	1		
8.4 -	1	105.0 -	1					1.00 -	1		
8.5 -	1	110.0 -	1								
8.6 -	2	115.0 -	3								
8.9 -	1	125.0 -	1								
9.5 -	2										
9.8 -	2										
10.2 -	1										

f-frequency

Table 22. Frequency of occurrence of *Potamogeton foliosus* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
6.5	1	15.0	1	0.0	23	2.0	5	.00	2	5.0	12
6.7	2	20.0	3	1.5	4	4.0	13	.02	5	10.0	19
6.8	1	25.0	2	2.0	5	6.0	20	.04	6	15.0	15
6.9	1	30.0	5	2.5	2	8.0	6	.06	2	20.0	4
7.0	2	35.0	3	3.0	2	10.0	5	.08	3	25.0	5
7.1	1	40.0	5	3.5	2	12.0	2	.10	12	30.0	3
7.2	4	45.0	4	4.0	4	16.0	2	.12	3	35.0	3
7.3	6	50.0	4	6.0	1	18.0	4	.14	3	50.0	1
7.4	5	55.0	3	7.0	2	20.0	4	.16	10	85.0	1
7.5	5	60.0	3	9.0	1	24.0	2	.18	3	105.0	1
7.6	5	65.0	1	10.0	1	34.0	1	.20	5	125.0	1
7.7	4	70.0	3	18.0	1			.22	1		
7.8	7	75.0	2	18.5	1			.24	1		
7.9	1	80.0	5	27.5	1			.26	1		
8.0	3	85.0	5					.30	1		
8.2	5	90.0	4					.42	1		
8.3	1	95.0	2					.50	1		
8.4	2	100.0	4					.58	1		
8.5	1	110.0	2					.78	1		
8.6	1	115.0	2								
9.1	1	125.0	1								
9.2	1	130.0	1								
9.5	3	140.0	1								
9.8	1										

f-frequency

Table 23. Frequency of occurrence of *Potamogeton friesii* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
				milligrams per liter							
7.0 -	1	35.0 -	1	0.0 -	4	6.0 -	5	.02 -	1	5.0 -	1
7.3 -	1	40.0 -	2	1.0 -	1	8.0 -	3	.10 -	2	10.0 -	4
7.4 -	3	55.0 -	1	1.5 -	1	14.0 -	1	.16 -	1	15.0 -	3
7.5 -	1	60.0 -	1	2.5 -	1	20.0 -	2	.18 -	2	20.0 -	1
7.7 -	1	70.0 -	1	3.0 -	1			.26 -	1	85.0 -	1
8.5 -	1	75.0 -	1	4.0 -	1			.28 -	1		
8.6 -	1	80.0 -	1	4.5 -	1			.36 -	1		
9.8 -	2	105.0 -	1	12.0 -	1			.48 -	1		
		115.0 -	1					.58 -	1		
		125.0 -	1								

f-frequency

Table 24. Frequency of occurrence of *Potamogeton strictifolius* along tested chemical gradients.

pH	f[1]	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
				milligrams per liter							
7.0 -	1	55.0 -	2	0.0 -	2	2.0 -	1	.10 -	2	5.0 -	2
7.6 -	1	75.0 -	1	1.0 -	1	4.0 -	3	.12 -	1	10.0 -	1
7.8 -	2	80.0 -	1	8.5 -	1	6.0 -	1	.16 -	1	15.0 -	1
8.4 -	1	90.0 -	1	12.0 -	1			.48 -	1	25.0 -	1

f-frequency

Table 25. Frequency of occurrence of Potamogeton pusillus var. pusillus along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
				milligrams per liter							
7.3 -	1	25.0 -	1	0.0 -	8	2.0 -	4	.02 -	4	5.0 -	3
7.4 -	1	35.0 -	4	0.5 -	3	4.0 -	3	.06 -	2	10.0 -	6
7.5 -	3	40.0 -	1	1.0 -	3	6.0 -	7	.10 -	4	15.0 -	10
7.6 -	3	45.0 -	1	1.5 -	2	8.0 -	1	.12 -	1	25.0 -	2
7.7 -	2	50.0 -	2	3.0 -	2	12.0 -	3	.18 -	3	30.0 -	1
7.8 -	2	55.0 -	1	4.0 -	1	14.0 -	1	.20 -	2		
8.0 -	3	70.0 -	1	4.5 -	1	16.0 -	2	.24 -	1		
8.4 -	1	75.0 -	2	9.0 -	1	18.0 -	1	.28 -	1		
8.6 -	1	80.0 -	3					.30 -	1		
9.5 -	1	90.0 -	1					.36 -	1		
9.8 -	1	95.0 -	1					.42 -	1		
10.2 -	1	115.0 -	1								

f-frequency

Table 26. Frequency of occurrence of Potamogeton pusillus var. gemmiparus along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
				milligrams per liter							
6.3 -	1	5.0 -	2	1.0 -	1	2.0 -	1	.08 -	1	5.0 -	2
6.6 -	4	10.0 -	2	1.5 -	1	4.0 -	6	.10 -	2	10.0 -	3
6.9 -	1	15.0 -	4	3.5 -	2	6.0 -	1	.18 -	1	15.0 -	2
7.1 -	1			4.0 -	1			.20 -	1	20.0 -	1
				6.0 -	1			.40 -	1		
				7.0 -	1			.60 -	1		

f-frequency

Table 27. **Frequency of occurrence of *Potamogeton pusillus* var. *tenuissimus* along tested chemical gradients.**

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
5.7	2	5.0	25	0.0	19	0.0	1	.00	2	5.0	26
5.8	2	10.0	23	0.5	7	2.0	21	.02	13	10.0	44
5.9	3	15.0	23	1.0	21	4.0	61	.04	5	15.0	24
6.0	1	20.0	9	1.5	14	6.0	25	.06	8	20.0	9
6.1	3	25.0	8	2.0	19	8.0	16	.08	9	25.0	4
6.2	1	30.0	5	2.5	17	10.0	8	.10	38	30.0	9
6.3	2	35.0	10	3.0	9	12.0	6	.12	11	35.0	2
6.4	6	40.0	3	3.5	6	16.0	1	.14	1	40.0	3
6.5	11	45.0	3	4.0	9	18.0	2	.16	18	40.0	3
6.6	11	50.0	5	4.5	4	20.0	1	.18	5	45.0	4
6.7	12	55.0	3	5.0	4	24.0	1	.20	16	50.0	3
6.8	11	60.0	6	6.0	2			.22	1	55.0	4
6.9	7	65.0	1	6.5	3			.24	1	60.0	1
7.0	5	70.0	3	7.0	3			.26	3	65.0	3
7.1	8	75.0	1	7.5	1			.30	2	85.0	1
7.2	5	80.0	2	8.0	2			.32	1	90.0	1
7.3	6	85.0	3	9.0	3			.40	4	125.0	1
7.4	6	90.0	2	10.5	1			.46	1	175.0	1
7.5	9	95.0	2	12.5	1			.50	1	235.0	1
7.6	6	100.0	3					.58	1	250.0	1
7.7	1	105.0	1					.60	3	1205.0	1
7.8	6	115.0	2					.68	2	2165.0	1
7.9	1	125.0	1					1.00	1	4095.0	1
8.0	5	130.0	1					1.06	1		
8.1	1	170.0	1								
8.3	1										
8.4	2										
8.5	1										
8.6	2										
9.5	2										
9.8	1										
10.0	1										
10.2	1										

f-frequency

Table 28. Frequency of occurrence of *Potamogeton obtusifolius* along tested chemical gradients.

pH		$CaCO_3$		CO_2		NO_3^-		PO_4^{-3}		Cl^-	
				milligrams per liter							
	f		f		f		f		f		f
6.7 -	1	15.0 -	1	0.0 -	2	0.0 -	1	.00 -	2	5.0 -	5
6.9 -	2	20.0 -	2	0.5 -	2	2.0 -	1	.02 -	1	10.0 -	7
7.2 -	3	30.0 -	3	1.0 -	3	4.0 -	6	.04 -	1	15.0 -	3
7.3 -	3	35.0 -	1	1.5 -	4	6.0 -	5	.06 -	1	35.0 -	1
7.4 -	1	45.0 -	1	2.5 -	1	8.0 -	3	.08 -	1	40.0 -	1
7.6 -	2	50.0 -	3	3.0 -	3	10.0 -	1	.10 -	4	60.0 -	1
7.7 -	1	55.0 -	3	4.5 -	1	12.0 -	1	.14 -	1	85.0 -	1
7.8 -	3	65.0 -	1	6.5 -	1			.16 -	4		
7.9 -	1	70.0 -	1	7.0 -	1			.18 -	2		
8.2 -	1	75.0 -	1					.60 -	1		
		85.0 -	1								
		105.0 -	1								

f-frequency

Table 29. Frequency of occurrence of *Potamogeton vaseyi* along tested chemical gradients.

pH		$CaCO_3$		CO_2		NO_3^-		PO_4^{-3}		Cl^-	
				milligrams per liter							
	f		f		f		f		f		f
6.7 -	1	10.0 -	3	1.0 -	6	0.0 -	1	.02 -	2	5.0 -	1
7.0 -	2	20.0 -	2	1.5 -	1	2.0 -	1	.10 -	2	10.0 -	5
7.1 -	2	25.0 -	4	2.0 -	2	4.0 -	7	.12 -	1	15.0 -	5
7.2 -	1	40.0 -	1	2.5 -	1	6.0 -	5	.16 -	3		
7.3 -	1	45.0 -	1	27.5 -	1	8.0 -	3	.18 -	1		
7.4 -	1					10.0 -	1	.20 -	2		
7.5 -	1										
7.6 -	2										

f-frequency

Table 30. Frequency of occurrence of *Potamogeton spirillus* along tested chemical gradients.

pH		$CaCO_3$		CO_2		NO_3^-		PO_4^{-3}		Cl^-	
		milligrams per liter									
	f		f		f		f		f		f
5.9 -	2	5.0 -	10	0.0 -	3	2.0 -	16	.00 -	1	5.0 -	17
6.0 -	1	10.0 -	25	0.5 -	3	4.0 -	29	.02 -	8	10.0 -	31
6.3 -	2	15.0 -	21	1.0 -	19	6.0 -	18	.04 -	2	15.0 -	16
6.4 -	3	20.0 -	4	1.5 -	10	8.0 -	8	.06 -	2	20.0 -	3
6.5 -	4	25.0 -	5	2.0 -	18	10.0 -	4	.08 -	5	25.0 -	1
6.6 -	10	30.0 -	3	2.5 -	8	12.0 -	4	.10 -	20	30.0 -	1
6.7 -	10	35.0 -	3	3.0 -	2	14.0 -	1	.12 -	6	35.0 -	1
6.8 -	11	40.0 -	3	3.5 -	3			.14 -	1	50.0 -	2
6.9 -	5	45.0 -	2	4.0 -	2			.16 -	11	55.0 -	1
7.0 -	5	50.0 -	1	4.5 -	1			.18 -	5	65.0 -	3
7.1 -	6	60.0 -	2	5.0 -	3			.20 -	5	85.0 -	1
7.2 -	4			6.0 -	3			.24 -	1	140.0 -	1
7.3 -	2			6.5 -	1			.26 -	1	195.0 -	1
7.4 -	5			7.0 -	1			.30 -	1	235.0 -	1
7.5 -	2			9.0 -	1			.40 -	3		
7.6 -	2			27.5 -	1			.46 -	1		
7.7 -	2							.50 -	1		
8.3 -	1							.60 -	1		
8.4 -	1							.68 -	1		
9.5 -	1							1.12 -	1		
10.2 -	1										

f-frequency

Table 31. Frequency of occurrence of *Potamogeton diversifolius* var. *trichophyllus* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
5.4	1	5.0	18	0.5	1	2.0	5	.02	1	5.0	4
5.8	2	10.0	8	1.0	2	4.0	14	.06	1	10.0	13
5.9	2	15.0	4	1.5	6	6.0	8	.10	10	20.0	2
6.0	1	25.0	1	2.0	6	8.0	3	.12	1	30.0	1
6.1	2			2.5	3	10.0	2	.16	5	35.0	1
6.2	1			3.0	1			.18	3	45.0	1
6.3	2			3.5	1			.20	3	65.0	2
6.4	1			4.0	3			.40	1	110.0	1
6.5	3			5.0	3			.54	1	140.0	1
6.6	7			5.5	1			.60	1	205.0	1
6.7	5			6.0	2						
6.8	5			7.0	2						
7.0	2			14.0	1						

f-frequency

Table 32. Frequency of occurrence of *Potamogeton epihydrus* var. *epihydrus* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
6.9 -	1	10.0 -	2	0.0 -	4	0.0 -	1	.02 -	2	5.0 -	3
7.1 -	3	20.0 -	2	0.5 -	1	2.0 -	3	.04 -	1	10.0 -	6
7.2 -	1	35.0 -	1	1.0 -	3	4.0 -	2	.08 -	1	15.0 -	4
7.3 -	2	50.0 -	1	1.5 -	1	6.0 -	8	.10 -	2	35.0 -	1
7.4 -	1	55.0 -	1	2.5 -	1	10.0 -	1	.12 -	2	85.0 -	1
7.6 -	1	60.0 -	1	3.0 -	1			.16 -	2		
7.7 -	1	70.0 -	3	3.5 -	1			.18 -	1		
7.8 -	1	75.0 -	1	7.0 -	1			.20 -	1		
8.0 -	1	85.0 -	1					.30 -	1		
8.3 -	1	100.0 -	2					.32 -	1		
8.6 -	1										

f-frequency

Table 33. Frequency of occurrence of *Potamogeton epihydrus* var. *ramosus* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
5.0	1	5.0	38	0.0	5	0.0	1	.00	4	5.0	42
5.6	2	10.0	36	0.5	6	2.0	21	.02	17	10.0	46
5.7	2	15.0	30	1.0	24	4.0	70	.04	2	15.0	21
5.8	1	20.0	9	1.5	14	6.0	35	.06	9	20.0	10
5.9	6	25.0	10	2.0	24	8.0	12	.08	13	25.0	3
6.0	3	30.0	8	2.5	15	10.0	11	.10	42	30.0	8
6.1	2	35.0	5	3.0	11	12.0	2	.12	9	35.0	2
6.2	2	40.0	5	3.5	10	16.0	1	.14	2	40.0	3
6.3	3	45.0	2	4.0	13	18.0	1	.16	17	45.0	6
6.4	6	50.0	2	4.5	2			.18	6	50.0	1
6.5	15	55.0	1	5.0	9			.20	16	55.0	2
6.6	16	60.0	2	6.0	6			.22	1	60.0	1
6.7	21	65.0	5	6.5	5			.24	2	65.0	6
6.8	15	70.0	1	7.0	2			.26	3	85.0	1
6.9	12	80.0	1	8.0	1			.30	2	195.0	1
7.0	9	100.0	2	9.0	3			.40	3		
7.1	5	105.0	1	9.5	1			.50	1		
7.2	5	135.0	1	10.5	1			.60	1		
7.3	3			15.0	1			.68	1		
7.4	8			27.5	1			1.00	1		
7.5	7							1.12	1		
7.6	2										
7.8	3										
8.0	1										
8.2	1										
8.3	2										
8.6	1										
8.9	1										
9.5	1										

f-frequency

Table 34. Frequency of occurrence of *Potamogeton alpinus* var. *tenuifolius* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
					milligrams per liter						
6.6 -	1	5.0 -	1	0.0 -	1	2.0 -	2	.00 -	2	5.0 -	10
6.7 -	1	10.0 -	2	0.5 -	2	4.0 -	8	.02 -	2	10.0 -	10
6.8 -	1	15.0 -	5	1.0 -	5	6.0 -	6	.04 -	1	15.0 -	3
6.9 -	2	20.0 -	4	1.5 -	2	8.0 -	5	.06 -	3	85.0 -	1
7.0 -	4	25.0 -	2	2.0 -	4	10.0 -	1	.08 -	1		
7.1 -	2	35.0 -	2	3.0 -	6	12.0 -	1	.10 -	5		
7.2 -	3	45.0 -	1	4.0 -	1	14.0 -	1	.16 -	4		
7.4 -	3	50.0 -	2	5.0 -	1			.18 -	2		
7.5 -	2	55.0 -	2	6.5 -	1			.20 -	2		
7.6 -	1	70.0 -	1	7.0 -	1			.24 -	1		
7.8 -	1	105.0 -	1								
9.9 -	1	115.0 -	1								

f-frequency

Table 35. Frequency of occurrence of *Potamogeton alpinus* var. *subellipticus* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
6.5 -	1	10.0 -	1	0.0 -	2	0.0 -	1	.00 -	1	5.0 -	6
6.9 -	2	20.0 -	2	0.5 -	2	2.0 -	1	.02 -	4	10.0 -	11
7.0 -	2	25.0 -	2	1.0 -	3	4.0 -	7	.04 -	1	15.0 -	1
7.1 -	1	35.0 -	1	1.5 -	2	6.0 -	3	.06 -	3		
7.2 -	2	45.0 -	1	2.0 -	2	8.0 -	2	.10 -	1		
7.3 -	1	50.0 -	3	3.0 -	2	10.0 -	1	.16 -	2		
7.4 -	2	55.0 -	2	6.5 -	1	18.0 -	2	.18 -	4		
7.5 -	2	65.0 -	1	7.0 -	2			.20 -	2		
7.6 -	1	75.0 -	2	14.5 -	1						
7.7 -	1	80.0 -	1								
7.8 -	1	85.0 -	1								
8.2 -	1	115.0 -	1								
9.2 -	1	120.0 -	1								

f-frequency

Table 36. Frequency of occurrence of *Potamogeton amplifolius* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
					milligrams per liter						
5.7	1	5.0	3	0.0	7	0.0	1	.00	1	5.0	24
5.8	1	10.0	14	0.5	8	2.0	18	.02	11	10.0	32
5.9	1	15.0	12	1.0	15	4.0	29	.04	3	15.0	16
6.5	3	20.0	8	1.5	6	6.0	14	.06	2	20.0	1
6.6	4	25.0	7	2.0	11	8.0	10	.08	7	30.0	4
6.7	4	30.0	7	2.5	2	10.0	1	.10	18	35.0	1
6.8	5	35.0	6	3.0	8	14.0	3	.12	5	50.0	1
6.9	4	40.0	4	4.0	4	16.0	1	.14	2	60.0	1
7.0	4	45.0	3	4.5	2	18.0	1	.16	9	85.0	1
7.1	8	50.0	1	5.0	4	20.0	1	.18	5		
7.2	3	55.0	1	6.0	1	22.0	1	.20	6		
7.3	5	60.0	3	6.5	1			.26	1		
7.4	7	70.0	1	7.5	2			.36	1		
7.5	8	75.0	1	8.5	2			.40	1		
7.6	4	85.0	1	9.0	1			.46	1		
7.7	2	110.0	2	11.0	1			.58	1		
7.8	5	115.0	1					.60	1		
8.0	2	125.0	1					1.00	1		
8.1	1										
8.2	1										
8.3	1										
8.5	1										
8.6	1										
9.5	1										
9.8	2										

f-frequency

Table 37. Frequency of occurrence of *Potamogeton pulcher* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
5.6 -	1	5.0 -	8	1.0 -	2	0.0 -	1	.02 -	4	5.0 -	1
5.8 -	1	10.0 -	6	1.5 -	2	2.0 -	2	.06 -	2	10.0 -	3
5.9 -	1	15.0 -	4	2.0 -	4	4.0 -	9	.10 -	5	15.0 -	6
6.1 -	2	20.0 -	1	2.5 -	2	6.0 -	3	.12 -	1	20.0 -	5
6.3 -	1	25.0 -	1	3.5 -	2	8.0 -	2	.16 -	1	30.0 -	1
6.5 -	3	40.0 -	1	4.0 -	1	10.0 -	4	.20 -	2	45.0 -	1
6.6 -	3			4.5 -	1			.26 -	2	50.0 -	1
6.7 -	2			5.0 -	1			.40 -	2	90.0 -	1
6.8 -	5			6.0 -	2			.54 -	1	110.0 -	1
7.0 -	1			6.5 -	1			.60 -	1		
7.5 -	1			9.5 -	1						
				10.0 -	1						
				14.0 -	1						

f-frequency

Table 38. Frequency of occurrence of *Potamogeton nodosus* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
6.8 -	2	5.0 -	1	0.0 -	7	2.0 -	3	.02 -	1	5.0 -	3
6.9 -	2	10.0 -	1	1.0 -	1	4.0 -	3	.10 -	1	10.0 -	6
7.3 -	1	15.0 -	1	1.5 -	2	6.0 -	6	.12 -	3	15.0 -	6
7.4 -	1	20.0 -	1	2.0 -	2	8.0 -	5	.16 -	1	20.0 -	2
7.5 -	5	30.0 -	1	2.5 -	2	12.0 -	2	.18 -	2	25.0 -	2
7.6 -	1	50.0 -	1	3.0 -	2	16.0 -	1	.20 -	8	65.0 -	1
7.7 -	1	55.0 -	1	4.0 -	1			.24 -	1		
8.0 -	1	60.0 -	2	4.5 -	1			.42 -	1		
8.1 -	1	65.0 -	2	6.0 -	2			.50 -	1		
8.3 -	1	80.0 -	1	6.5 -	1			1.66 -	1		
8.5 -	1	90.0 -	1	7.0 -	1						
9.0 -	1	95.0 -	2								
9.5 -	2	100.0 -	1								
		105.0 -	1								
		120.0 -	1								
		130.0 -	1								
		235.0 -	1								

f-frequency

Table 39. Frequency of occurrence of *Potamogeton gramineus* var. *gramineus* along tested chemical gradients.

pH		$CaCO_3$		CO_2		NO_3^-		PO_4^{-3}		Cl^-	
				milligrams per liter							
	f		f		f		f		f		f
5.7	1	5.0	8	0.0	9	0.0	1	.00	2	5.0	33
6.4	3	10.0	10	0.5	11	2.0	16	.02	12	10.0	31
6.5	2	15.0	17	1.0	19	4.0	28	.04	5	15.0	10
6.6	6	20.0	7	1.5	5	6.0	15	.06	6	20.0	4
6.7	8	25.0	3	2.0	13	8.0	9	.08	5	25.0	2
6.8	4	30.0	5	2.5	6	10.0	4	.10	23	30.0	4
6.9	8	35.0	9	3.0	9	12.0	3	.12	4	35.0	1
7.0	4	40.0	2	3.5	1	14.0	2	.16	12	40.0	2
7.1	4	45.0	3	4.0	4	18.0	3	.18	5	45.0	1
7.2	3	50.0	4	5.0	2	20.0	2	.20	5	50.0	1
7.3	4	55.0	4	6.0	2	24.0	1	.22	1	65.0	1
7.4	2	65.0	1	6.5	2	26.0	1	.24	1	85.0	1
7.5	7	70.0	2	7.0	1			.40	1		
7.6	6	85.0	3	8.0	1			.50	1		
7.7	4	90.0	2	27.5	1			.58	1		
7.8	5	100.0	1					.78	1		
7.9	5	105.0	1								
8.0	3	115.0	1								
8.2	1										
8.4	2										
9.2	1										
9.8	1										

f-frequency

Table 40. Frequency of occurrence of Potamogeton gramineus var. maximus along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
				milligrams per liter							
5.0 -	1	5.0 -	3	0.0 -	1	2.0 -	1	.02 -	2	5.0 -	11
6.3 -	1	10.0 -	4	1.0 -	3	4.0 -	10	.06 -	2	10.0 -	1
6.4 -	1	15.0 -	2	1.5 -	1	6.0 -	5	.08 -	2	15.0 -	3
6.5 -	1	20.0 -	3	2.0 -	4			.10 -	5	50.0 -	1
6.6 -	1	30.0 -	1	2.5 -	2			.12 -	1		
6.8 -	1	40.0 -	1	3.0 -	1			.18 -	2		
6.9 -	3	60.0 -	1	3.5 -	1			.60 -	1		
7.0 -	2			4.0 -	1						
7.4 -	2			4.5 -	1						
7.5 -	1										
7.6 -	1										

f-frequency

Table 41. Frequency of occurrence of Potamogeton gramineus var. myriophyllus along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
				milligrams per liter							
6.4 -	1	5.0 -	2	0.0 -	2	2.0 -	7	.00 -	1	5.0 -	3
6.5 -	1	10.0 -	6	1.0 -	7	4.0 -	4	.02 -	3	10.0 -	10
6.6 -	1	20.0 -	2	1.5 -	1	6.0 -	5	.08 -	2	15.0 -	2
6.7 -	2	25.0 -	3	2.0 -	3	8.0 -	3	.10 -	7	55.0 -	1
6.8 -	3	30.0 -	2	2.5 -	2	12.0 -	2	.18 -	2		
6.9 -	2	40.0 -	1	5.0 -	2	14.0 -	1	.20 -	1		
7.0 -	1	80.0 -	1	7.5 -	1	20.0 -	2	.22 -	1		
7.1 -	2					24.0 -	1				
7.3 -	1										
7.4 -	1										
7.7 -	1										
8.0 -	1										

f-frequency

Table 42. Frequency of occurrence of <u>Potamogeton illinoensis</u> along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
6.8	2	20.0	1	0.0	15	2.0	7	.00	2	5.0	3
7.1	2	30.0	2	0.5	3	4.0	4	.02	4	10.0	10
7.6	1	35.0	2	1.0	3	6.0	4	.04	1	15.0	5
7.8	3	40.0	1	6.5	1	8.0	3	.08	1	20.0	2
7.9	1	45.0	2	7.5	2	12.0	2	.10	4	30.0	2
8.0	4	50.0	1			14.0	1	.16	3	35.0	1
8.3	1	60.0	2			20.0	2	.18	3	40.0	1
8.4	2	65.0	1			24.0	1	.22	1	45.0	1
8.5	1	70.0	2					.36	1		
8.6	2	80.0	3					.40	1		
9.5	2	85.0	2					.42	1		
9.8	2	90.0	1					.58	1		
10.2	1	100.0	1								
		110.0	1								
		115.0	2								
		125.0	1								

f-frequency

Table 43. Frequency of occurrence of *Potamogeton natans* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
5.0	1	5.0	21	0.0	22	0.0	2	.00	5	5.0	35
5.6	1	10.0	39	0.5	5	2.0	19	.02	13	10.0	49
5.7	2	15.0	23	1.0	20	4.0	59	.04	14	15.0	26
5.8	1	20.0	13	1.5	11	6.0	34	.06	6	20.0	11
5.9	3	25.0	7	2.0	13	8.0	16	.08	8	25.0	7
6.0	1	30.0	9	2.5	13	10.0	6	.10	33	30.0	2
6.1	1	35.0	4	3.0	14	12.0	5	.12	9	35.0	3
6.3	3	40.0	5	3.5	6	14.0	1	.14	2	40.0	2
6.4	6	45.0	4	4.0	8	16.0	2	.16	16	45.0	3
6.5	12	50.0	8	4.5	4	18.0	4	.18	11	50.0	2
6.6	13	55.0	1	5.0	6	20.0	3	.20	14	55.0	2
6.7	12	60.0	8	6.0	4	24.0	1	.22	2	65.0	5
6.8	11	65.3	3	6.5	5			.24	1	70.0	1
6.9	10	70.0	5	7.0	6			.26	2	85.0	1
7.0	6	75.0	2	8.0	1			.28	1	125.0	1
7.1	9	80.0	6	8.5	2			.30	1	250.0	1
7.2	8	85.0	4	9.0	4			.32	1		
7.3	6	90.0	3	9.5	2			.40	4		
7.4	4	95.0	1	10.0	1			.42	2		
7.5	6	100.0	4	10.5	1			.46	1		
7.6	1	110.0	1	15.0	1			.50	1		
7.7	4	115.0	2	18.5	1			.58	1		
7.8	7	125.0	1					.60	1		
7.9	3							.68	1		
8.0	5							.78	1		
8.2	2							1.00	2		
8.3	1										
8.4	2										
8.5	1										
8.6	1										
9.2	1										
9.5	4										
9.8	1										

f-frequency

Table 44. Frequency of occurrence of *Potamogeton oakesianus* along tested chemical gradients.

pH		$CaCO_3$		CO_2		NO_3^-		PO_4^{-3}		Cl^-	
				milligrams per liter							
	f		f		f		f		f		f
5.6 -	1	5.0 -	17	1.0 -	4	0.0 -	1	.02 -	5	5.0 -	9
5.8 -	2	10.0 -	8	1.5 -	3	2.0 -	3	.04 -	1	10.0 -	9
5.9 -	4	15.0 -	4	2.0 -	7	4.0 -	16	.06 -	2	15.0 -	2
6.0 -	1	20.0 -	4	2.5 -	5	6.0 -	5	.08 -	3	20.0 -	4
6.1 -	1			3.0 -	1	8.0 -	1	.10 -	9	30.0 -	1
6.2 -	1			3.5 -	1	10.0 -	6	.12 -	1	35.0 -	1
6.3 -	2			4.0 -	2	14.0 -	1	.18 -	2	50.0 -	3
6.4 -	1			4.5 -	2			.20 -	4	875.0 -	1
6.5 -	3			5.0 -	3			.26 -	1		
6.6 -	5			6.0 -	1			.40 -	2		
6.7 -	3			6.5 -	1			.46 -	1		
6.8 -	6			7.0 -	1						
6.9 -	1			9.0 -	1						
7.1 -	1			9.5 -	1						
7.2 -	1										

f-frequency

Table 45. Frequency of occurrence of Potamogeton praelongus along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
6.7	1	10.0	5	0.0	7	0.0	1	.00	2	5.0	10
6.8	1	15.0	4	0.5	3	2.0	6	.02	8	10.0	15
6.9	2	20.0	3	1.0	16	4.0	9	.04	2	15.0	9
7.1	2	30.0	4	1.5	4	6.0	13	.06	2	20.0	2
7.2	4	35.0	3	2.0	3	8.0	3	.08	2	35.0	2
7.3	4	40.0	3	3.0	4	10.0	2	.10	5	40.0	1
7.4	4	45.0	3	3.5	1	12.0	1	.14	1		
7.5	4	50.0	3	4.0	1	14.0	1	.16	8		
7.6	2	55.0	1	7.0	1	16.0	1	.18	3		
7.7	4	65.0	2			18.0	1	.20	2		
7.8	3	70.0	1			20.0	2	.22	1		
7.9	2	80.0	1			24.0	1	.36	1		
8.0	1	85.0	2					.42	1		
8.4	2	90.0	2					.46	1		
9.2	1	105.0	1					.58	1		
9.5	1	115.0	1								
9.8	2	120.0	1								
		125.0	1								

f-frequency

Table 46. Frequency of occurrence of *Potamogeton richardsonii* along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
6.7 -	2	10.0 -	1	0.0 -	5	2.0 -	1	.00 -	2	5.0 -	7
6.8 -	1	15.0 -	5	0.5 -	2	4.0 -	9	.02 -	2	10.0 -	14
6.9 -	1	20.0 -	1	1.0 -	1	6.0 -	9	.04 -	2	15.0 -	4
7.0 -	2	35.0 -	3	1.5 -	5	8.0 -	6	.06 -	5	35.0 -	1
7.1 -	1	40.0 -	2	2.0 -	1	12.0 -	2	.08 -	2	85.0 -	1
7.2 -	1	45.0 -	2	2.5 -	5	20.0 -	1	.10 -	4		
7.3 -	2	55.0 -	2	3.0 -	6			.16 -	4		
7.4 -	5	60.0 -	2	4.0 -	1			.18 -	1		
7.5 -	2	70.0 -	1	4.5 -	1			.20 -	2		
7.6 -	3	85.0 -	1					.28 -	1		
7.8 -	2	90.0 -	1					.32 -	1		
7.9 -	2	100.0 -	1					.42 -	1		
8.0 -	1	110.0 -	1								
9.5 -	1										
10.2 -	1										

f-frequency

Table 47. Frequency of occurrence of <u>Potamogeton perfoliatus</u> var. <u>bupleuroides</u> along tested chemical gradients.

pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
6.5 -	2	5.0 -	2	0.0 -	6	2.0 -	5	.00 -	2	5.0 -	5
6.6 -	1	10.0 -	9	0.5 -	4	4.0 -	16	.02 -	5	10.0 -	14
6.7 -	5	15.0 -	9	1.0 -	8	6.0 -	12	.04 -	2	15.0 -	13
6.8 -	5	20.0 -	4	1.5 -	4	8.0 -	5	.06 -	5	25.0 -	3
6.9 -	2	25.0 -	4	2.0 -	6	10.0 -	4	.08 -	1	35.0 -	1
7.0 -	4	30.0 -	4	2.5 -	4	12.0 -	1	.10 -	7	40.0 -	2
7.1 -	5	35.0 -	4	3.0 -	4	14.0 -	1	.12 -	2	50.0 -	1
7.2 -	2	40.0 -	3	4.0 -	4	16.0 -	1	.16 -	8	60.0 -	1
7.3 -	2	45.0 -	1	5.0 -	2	18.0 -	1	.18 -	2	85.0 -	1
7.4 -	5	55.0 -	1	6.5 -	1			.20 -	4	175.0 -	2
7.5 -	2	70.0 -	1	7.5 -	1			.26 -	1	190.0 -	1
7.7 -	2	75.0 -	1					.36 -	1	195.0 -	1
7.8 -	1	100.0 -	1					.40 -	1	1205.0 -	1
7.9 -	1	115.0 -	1					.50 -	1	3820.0 -	1
8.1 -	1	140.0 -	1					.60 -	1		
8.2 -	2										
8.3 -	1										
9.8 -	1										

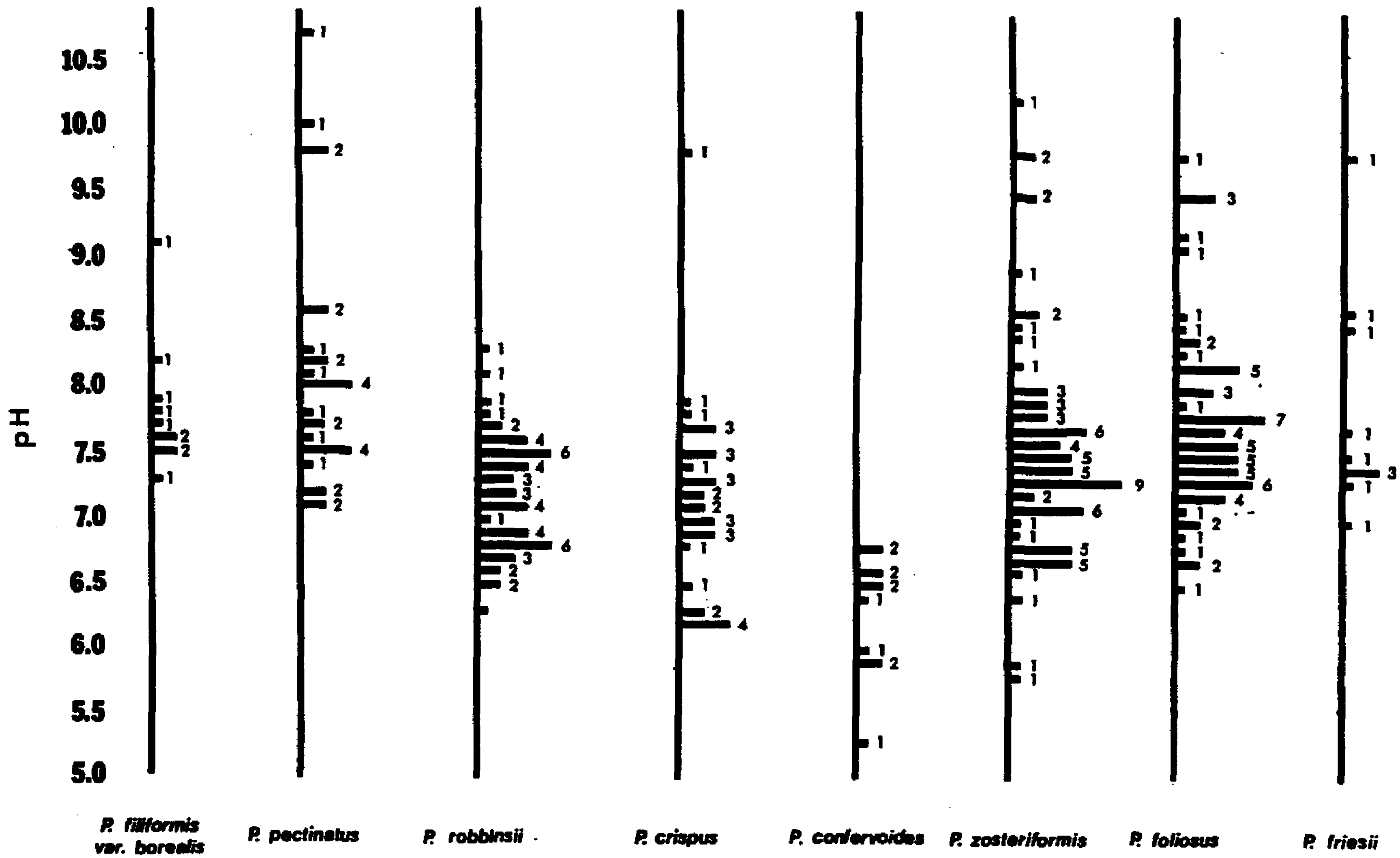
f-frequency

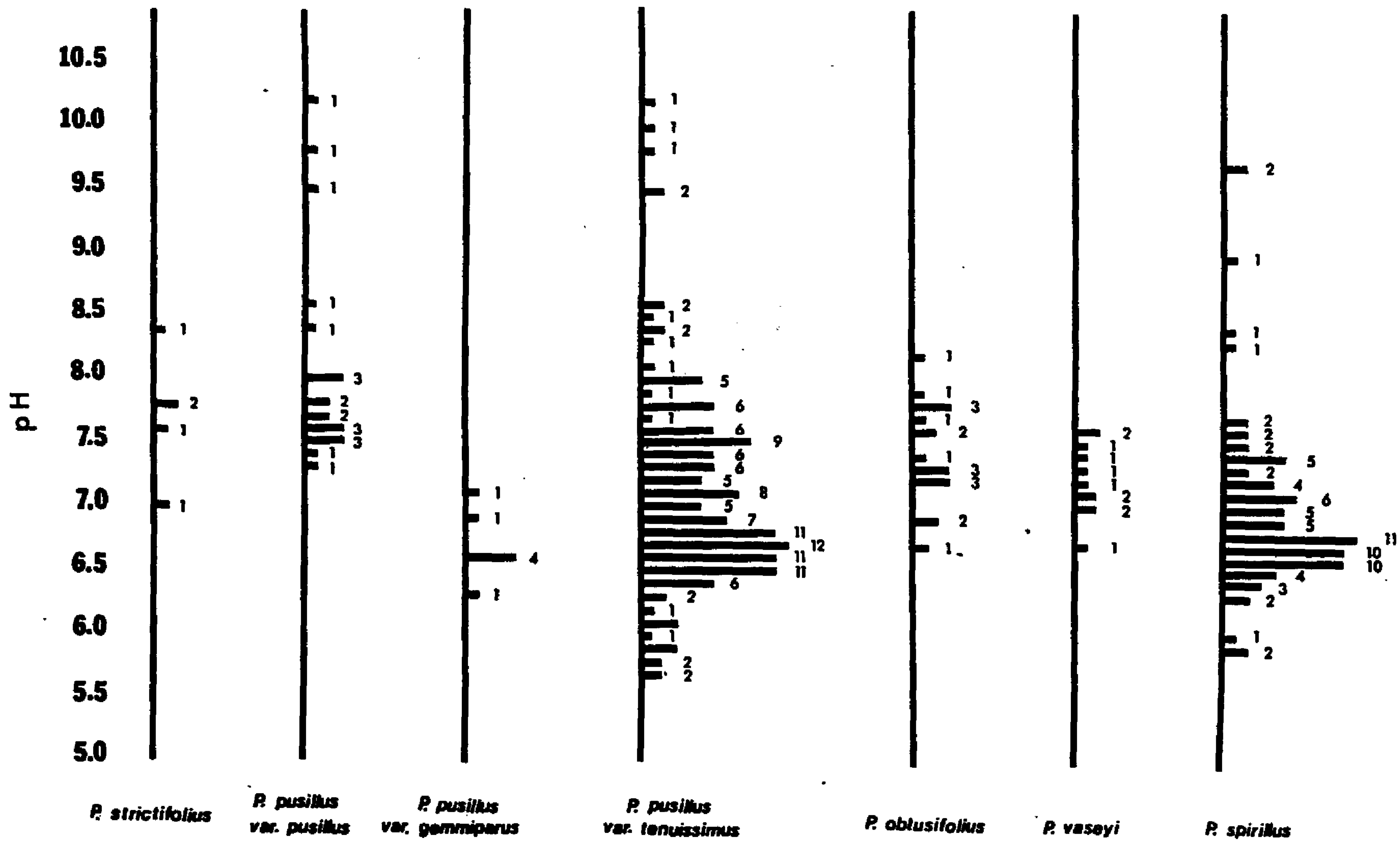
Table 48. Frequency of occurrence of sampling locations along tested chemical gradients.

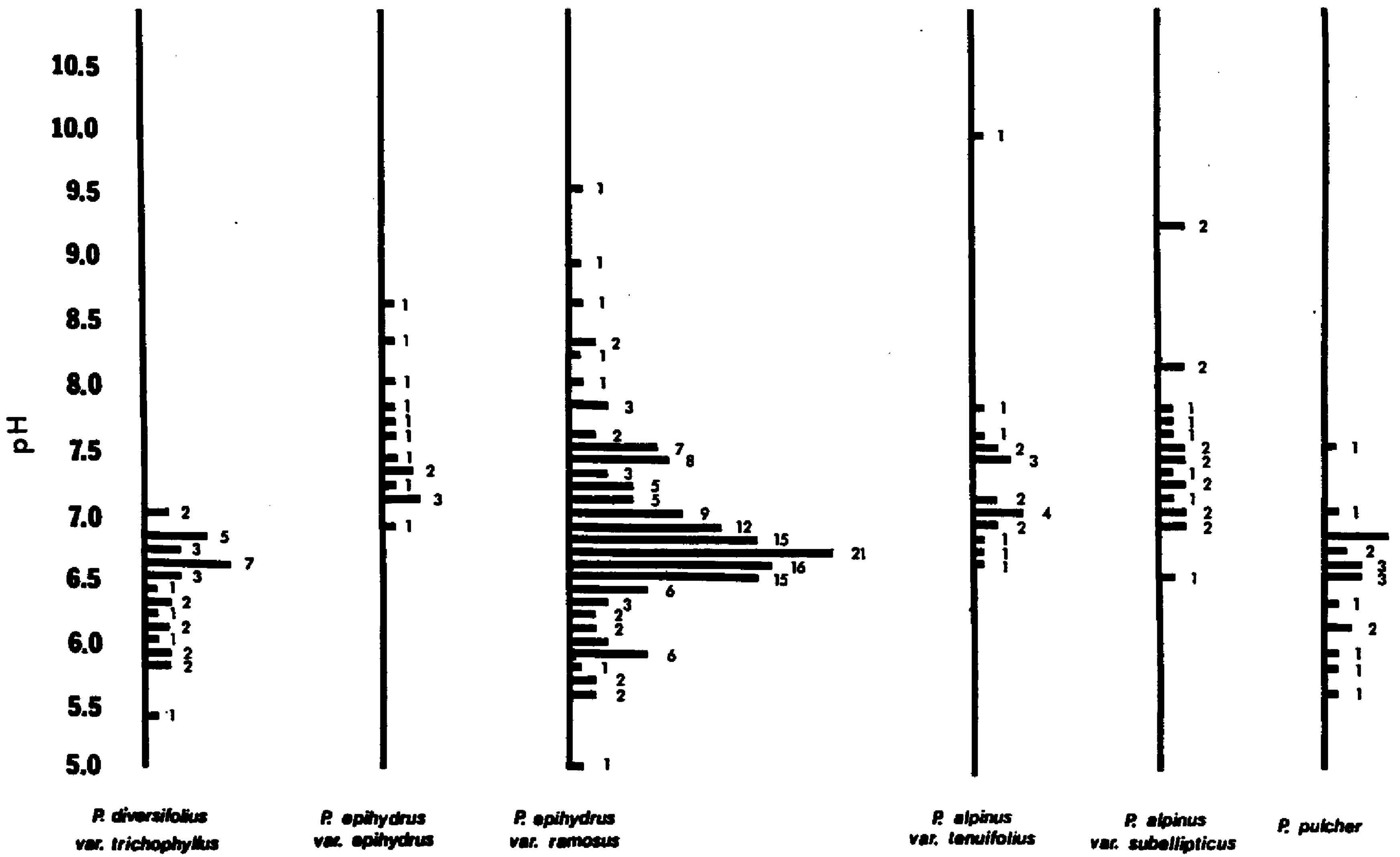
pH	f	$CaCO_3$	f	CO_2	f	NO_3^-	f	PO_4^{-3}	f	Cl^-	f
		milligrams per liter									
5.0	1	5.0	51	0.0	41	0.0	2	.00	7	5.0	75
5.3	1	10.0	44	0.5	20	2.0	42	.02	36	10.0	86
5.4	1	15.0	43	1.0	43	4.0	120	.04	14	15.0	54
5.6	1	20.0	21	1.5	24	6.0	61	.06	15	20.0	25
5.7	2	25.0	18	2.0	41	8.0	41	.08	22	25.0	9
5.8	3	30.0	17	2.5	26	10.0	21	.10	76	30.0	13
5.9	7	35.0	16	3.0	20	12.0	10	.12	17	35.0	6
6.0	4	40.0	11	3.5	10	14.0	5	.14	5	40.0	7
6.1	5	45.0	10	4.0	20	16.0	4	.16	35	45.0	6
6.2	3	50.0	6	4.5	6	18.0	8	.18	23	50.0	5
6.3	3	55.0	8	5.0	16	20.0	4	.20	29	60.0	3
6.4	8	60.0	7	6.0	10	22.0	1	.22	2	65.0	6
6.5	23	65.0	5	6.5	8	24.0	2	.24	4	70.0	2
6.6	21	70.0	8	7.0	10	34.0	1	.26	5	85.0	1
6.7	23	75.0	5	7.5	2			.28	1	90.0	2
6.8	25	80.0	9	8.0	3			.30	3	95.0	1
6.9	17	85.0	9	8.5	2			.32	1	105.0	1
7.0	14	90.0	4	9.0	4			.36	1	110.0	1
7.1	17	95.0	4	9.5	1			.40	4	125.0	1
7.2	11	100.0	4	10.0	4			.42	3	140.0	1
7.3	15	105.0	5	10.5	1			.46	2	175.0	1
7.4	16	110.0	5	12.0	1			.48	1	190.0	1
7.5	24	115.0	5	12.5	1			.50	3	195.0	1
7.6	10	120.0	1	14.0	1			.54	1	205.0	1
7.7	8	125.0	2	14.5	1			.58	1	235.0	1
7.8	12	130.0	3	15.0	1			.60	2	250.0	1
7.9	6	135.0	1	18.0	1			.68	2	875.0	1
8.0	7	140.0	1	18.5	1			.78	1	1205.0	1
8.1	3	155.0	1	27.5	1			1.00	2	2160.0	1
8.2	6	170.0	1					1.06	1	2380.0	1
8.3	2	175.0	1					1.12	1	3825.0	1
8.4	3	235.0	1					1.66	1	4095.0	1
8.5	1										
8.6	3										
8.9	1										
9.1	1										
9.2	1										
9.5	5										
9.8	3										
9.9	1										
10.0	1										
10.2	1										
10.7	1										

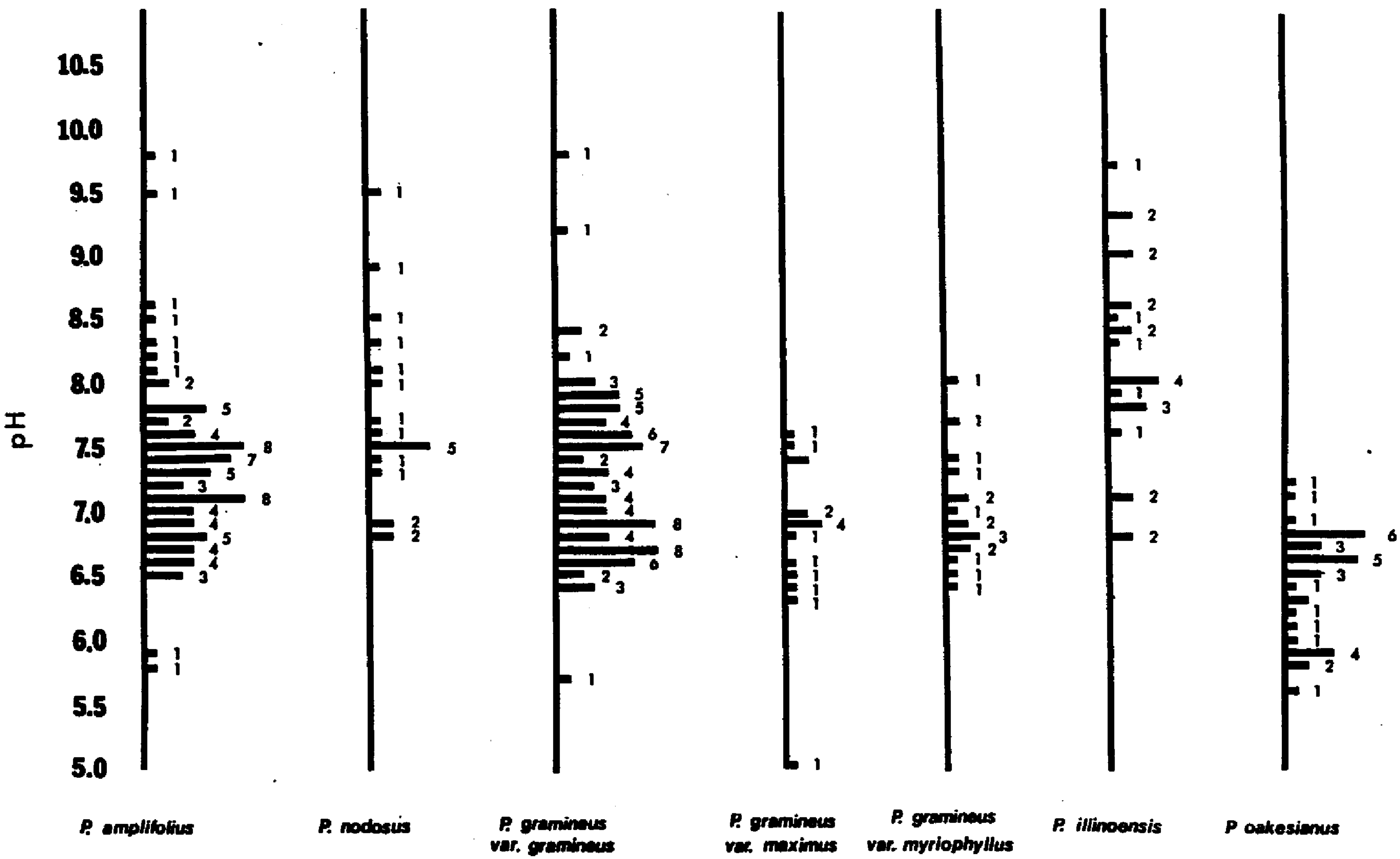
f-frequency

Figure 50. Frequency of occurrence of *Potamogeton* taxa along hydrogen ion concentration (pH) gradient.


pH
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
P. filiformis var. borealis
P. pectinatus
P. robbinsii
P. crispus
P. confervoides
P. zosteriformis
P. foliosus
P. friesii


pH
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
P. strictifolius
P. pusillus var. pusillus
P. pusillus var. gemmiparus
P. pusillus var. tenuissimus
P. obtusifolius
P. vaseyi
P. spirillus


pH
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
P. diversifolius var. trichophyllus
P. epihydrus var. epihydrus
P. epihydrus var. ramosus
P. alpinus var. tenuifolius
P. alpinus var. subellipticus
P. pulcher


pH
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
P. amplifolius
P. nodosus
P. gramineus var. gramineus
P. gramineus var. maximus
P. gramineus var. myriophyllus
P. illinoensis
P oakesianus

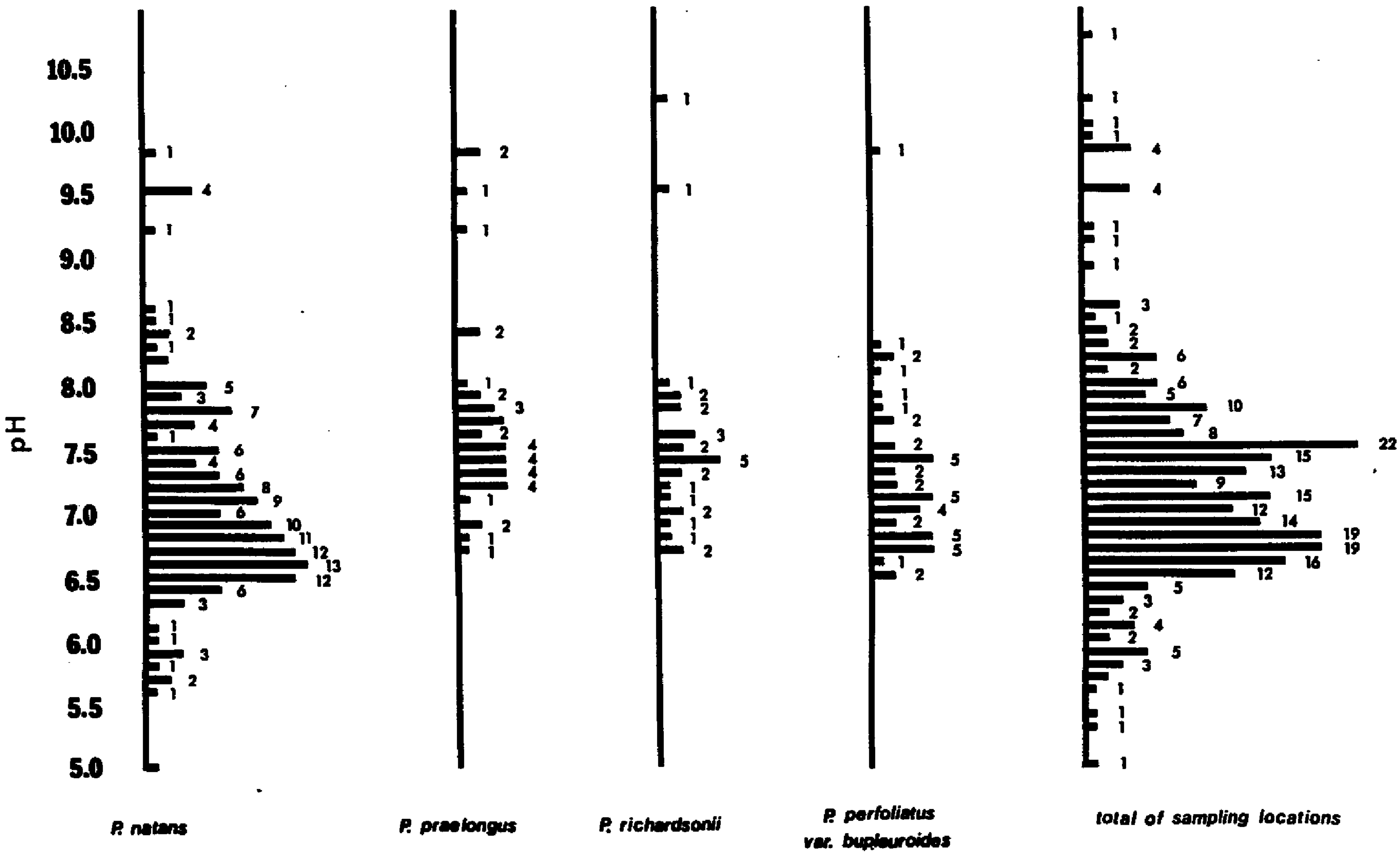
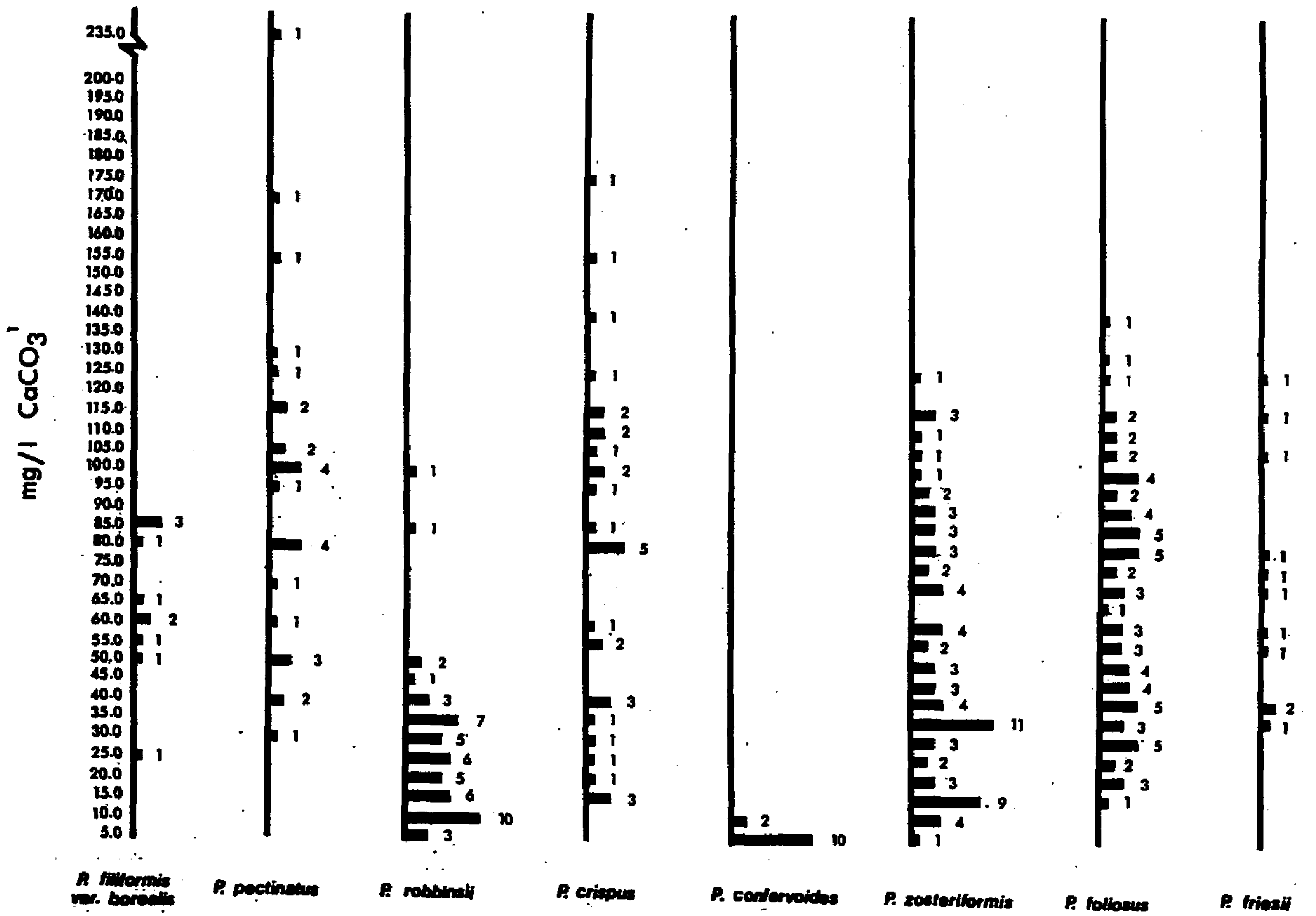
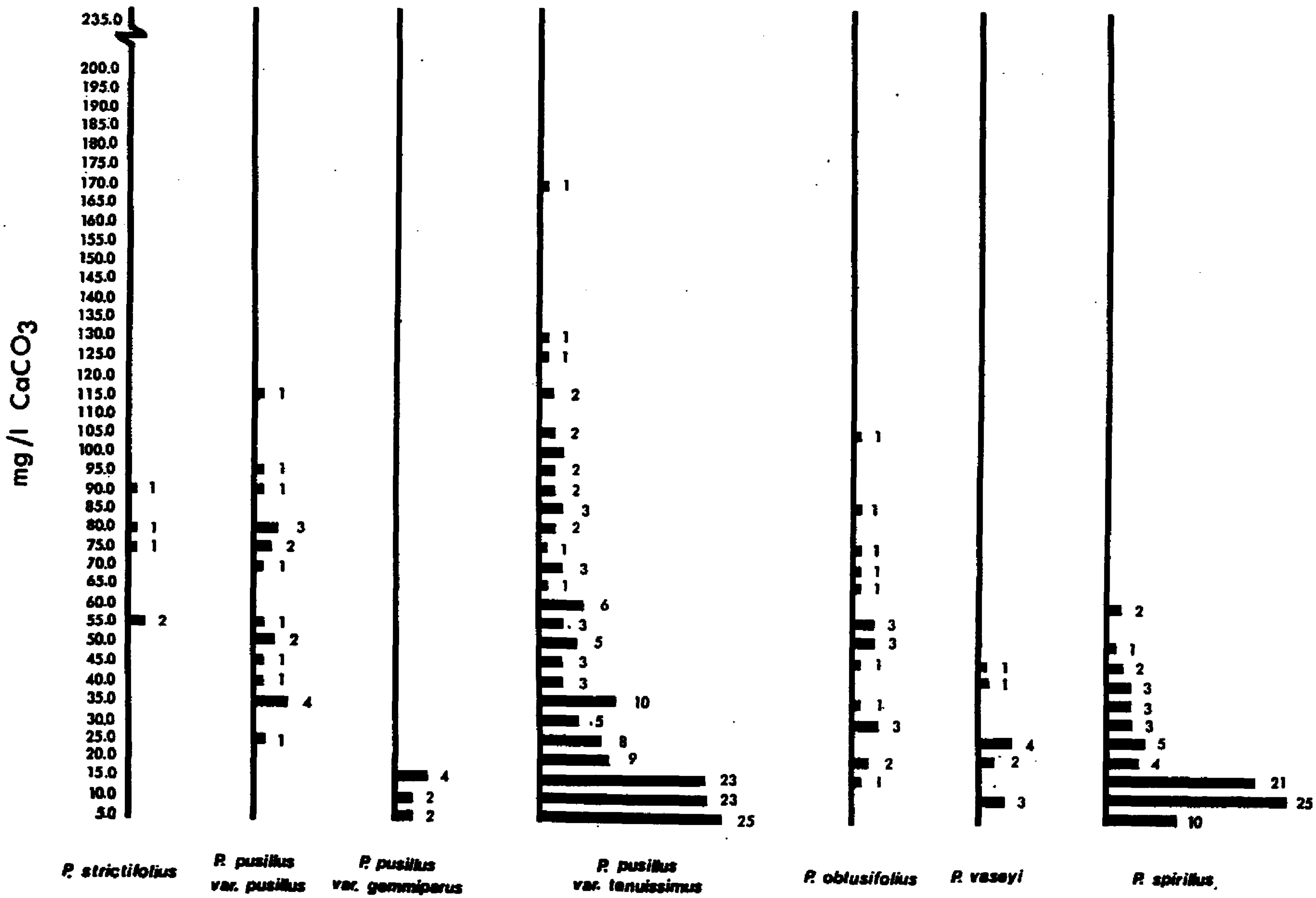
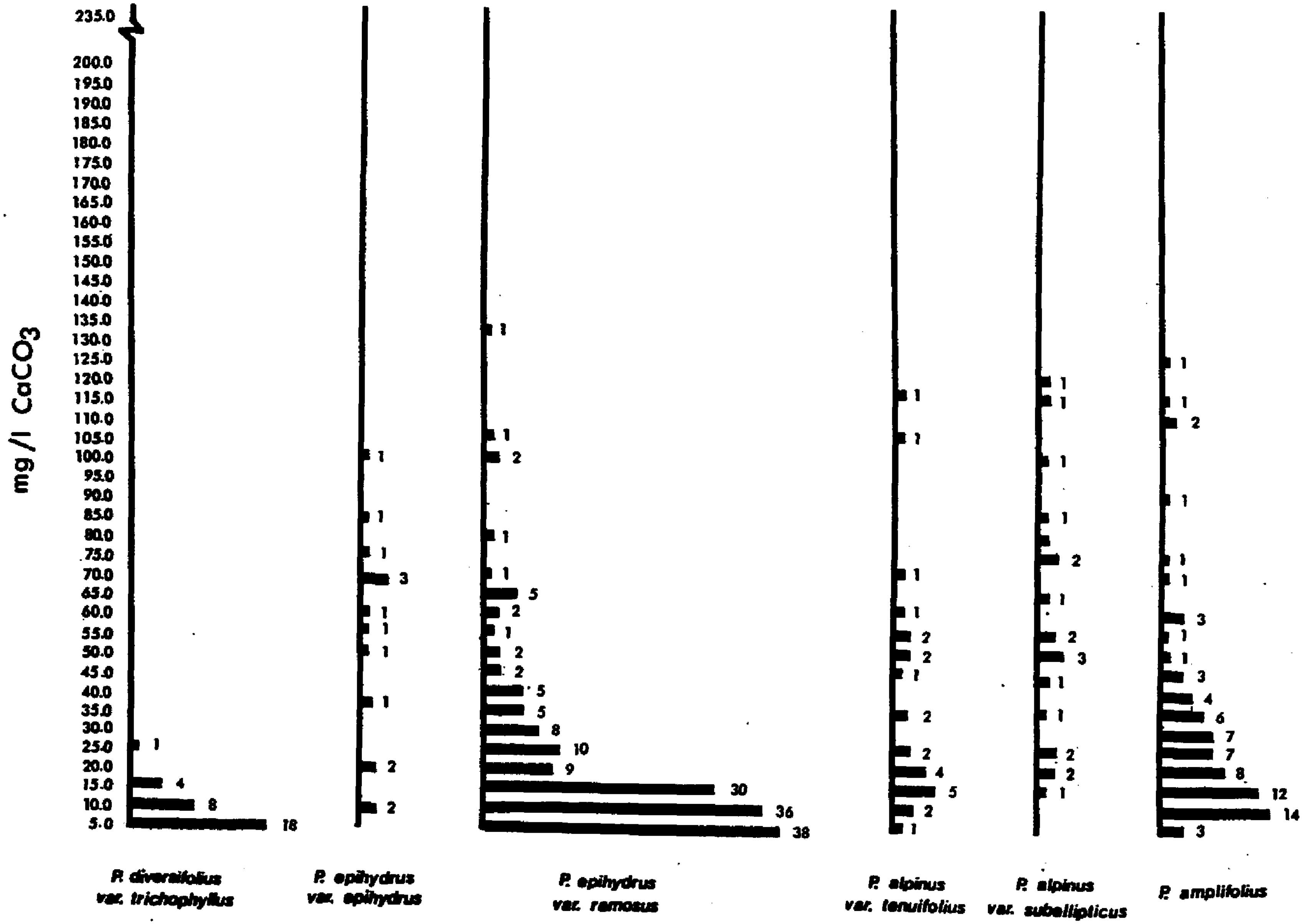

pH
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
P. natans
P. praelongus
P. richardsonii
P. perfoliatus var. bupleuroides
total of sampling locations

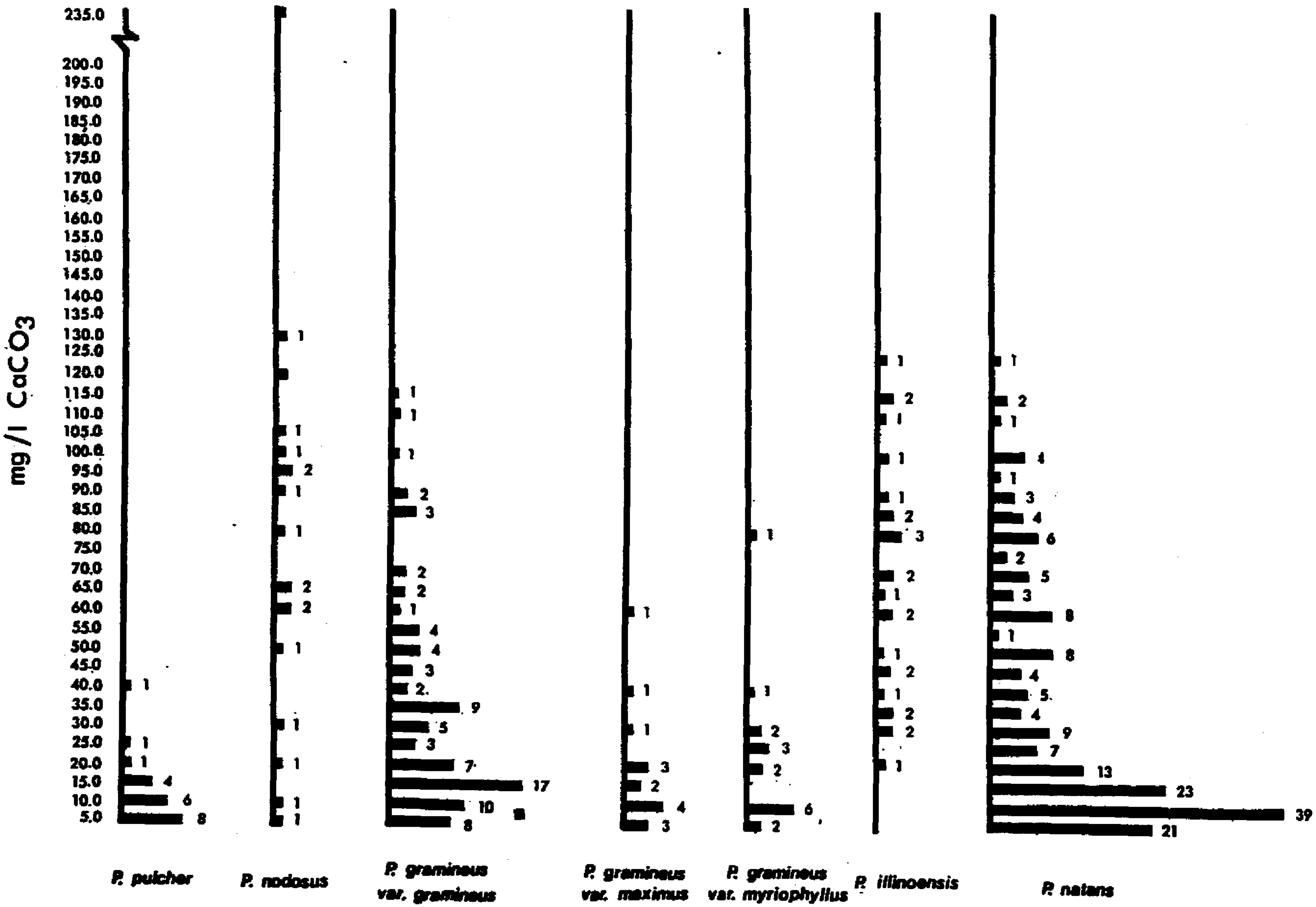
Figure 51. Frequency of occurrence of *Potamogeton* taxa along total alkalinity ($CaCO_3$) gradient.

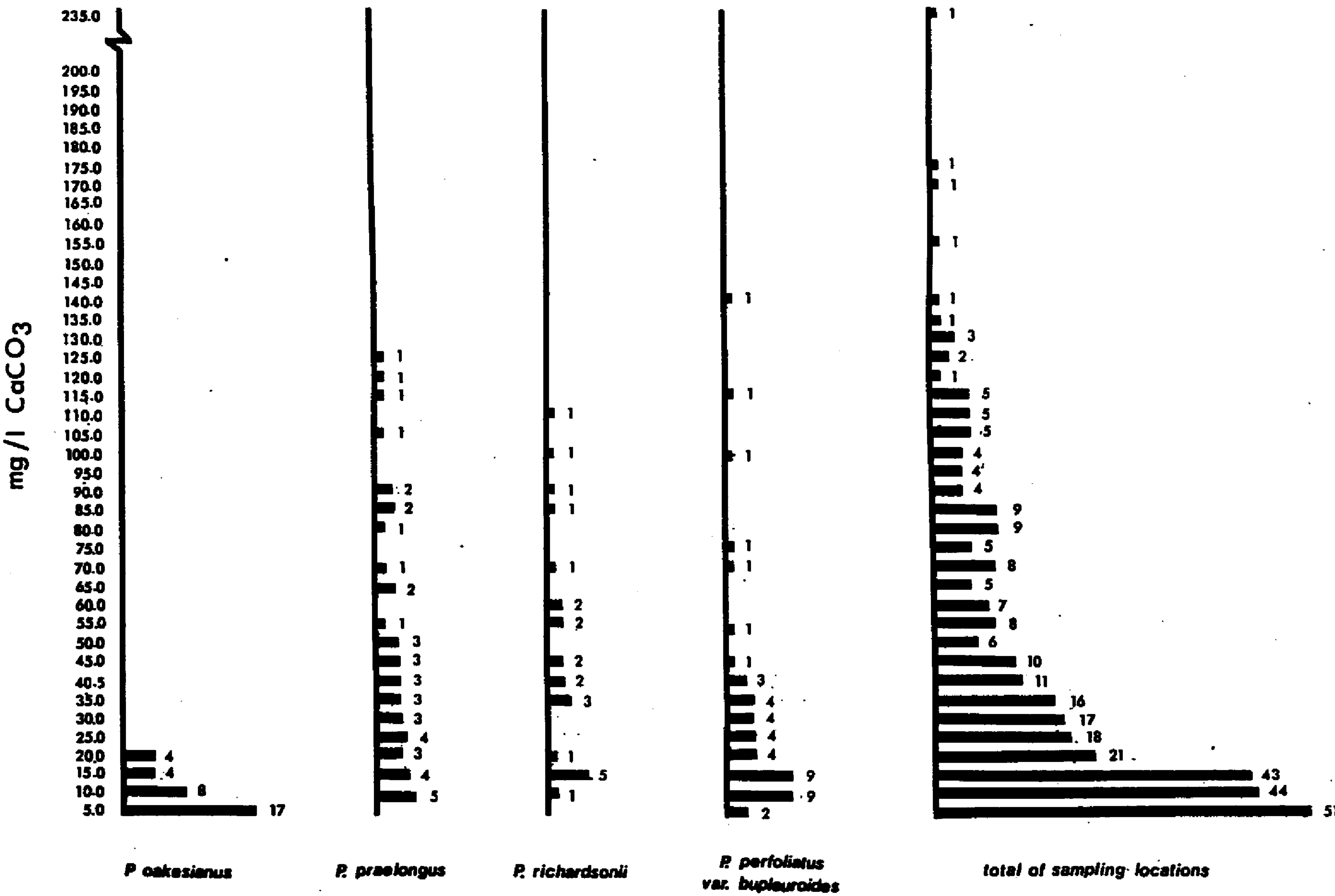


[1]increments of 5.0 mg/l


mg/l CaCO3
P. strictifolius
P. pusillus var. pusillus
P. pusillus var. gemmiparus
P. pusillus var. tenuissimus
P. obtusifolius
P. vaseyi
P. spirillus


mg /l CaCO3
235.0
200.0
195.0
190.0
185.0
180.0
175.0
170.0
165.0
160.0
155.0
150.0
145.0
140.0
135.0
130.0
125.0
120.0
115.0
110.0
105.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
P. diversifolius var. trichophyllus
P. epihydrus var. epihydrus
P. epihydrus var. ramosus
P. alpinus var. tenuifolius
P. alpinus var. subellipticus
P. amplifolius


mg/l $CaCO_3$
235.0
200.0
195.0
190.0
185.0
180.0
175.0
170.0
165.0
160.0
155.0
150.0
145.0
140.0
135.0
130.0
125.0
120.0
115.0
110.0
105.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
P. pulcher
P. nodosus
P. gramineus var. gramineus
P. gramineus var. maximus
P. gramineus var. myriophyllus
P. illinoensis
P. natans


mg/l CaCO3
P oakesianus
P. praelongus
P. richardsonii
P. perfoliatus var. bupleuroides
total of sampling locations

APPENDIX IV

Computation of the z Value for Cluster Determination

Computation of the z Value for Cluster Determination

$\bar{x}-\bar{x}_2$
21.077
1.523
1.646
.081
1.542
2.008
2.740
1.448
7.995
3.961
.461
1.595
1.500
2.639
9.690
.338
1.618
1.696
.508
.594
5.585
1.809
3.038
1.056
1.974
.205
5.905
.970
1.428
1.003
2.739

$$z = \frac{x - \bar{x}}{\sigma}$$

x - required absolute value of the difference at the .05 level

$\bar{x}$ - mean

σ - standard deviation

$$z = \frac{21.077 - 2.310}{4.035} = 4.514 \text{ (discard)}$$

this is a cluster of a single species

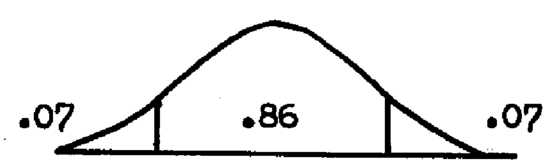
$$1.96 = \frac{x - 2.310}{2.257} = 6.734$$

value at the .05 level for separating clusters

computation of values at .05 level for differences between means below 6.734

$$z = \frac{5.585 - 2.310}{2.257} = 1.45$$

ρ = .0735 from Table A.4, Steel and Torrie, 1960)



$$z = \frac{5.905 - 2.310}{2.257} = 1.59$$

ρ = .0559 (from Table A.4, Steel and Torrie, 1960)

N =	31	N =	30
$\bar{x}$ =	2.915	$\bar{x}$ =	2.310
Σx^2 =	752.090690	Σx^2 =	307.850761
σ^2 =	16.287863	σ^2 =	5.096236
σ =	4.035	σ =	2.257
Σx =	90.372	Σx =	69.295

APPENDIX V

Analysis of Variance Tables

Table 49. Analysis of variance between clusters based upon total alkalinity.

	Sum of squares	df	Mean square	F ratio
Between clusters	486120.00	5	97224.00	125.94**
Within clusters	1044537.75	1353	772.02	
Total	1530657.00	1358		

Table 50. Analysis of variance between clusters based upon free carbon dioxide.

	Sum of squares	df	Mean square	F ratio
Between clusters	168.93	5	33.79	3.81*
Within clusters	11991.91	1353	8.86	
Total	12160.84	1358		

Table 51. Analysis of variance between clusters based upon nitrates.

	Sum of squares	df	Mean square	F ratio
Between clusters	1447.29	5	289.46	15.42**
Within clusters	25401.52	1353	18.77	
Total	26848.80	1358		

Table 52. Analysis of variance between clusters based upon phosphates.

	Sum of squares	df	Mean square	F ratio
Between clusters	0.45	5	0.09	3.45*
Within clusters	35.45	1353	0.03	
Total	35.90	1358		

Table 53. Analysis of variance between clusters based upon chlorides.

	Sum of squares	df	Mean square	F ratio
Between clusters	3906032.00	5	781206.38	14.57**
Within clusters	72530624.00	1353	53607.26	
Total	76436656.00	1358		

Table 54. Analysis of variance between clusters based upon chlorides (brackish water values deleated).

	Sum of squares	df	Mean square	F ratio
Between clusters	4103.26	5	820.65	1.24
Within clusters	892902.38	1344	664.36	
Total	897005.63	1349		

Table 55. Analysis of variance within clusters based upon total alkalinity.

	Sum of squares	df	Mean square	F ratio
Between clusters	494326.00	31	15946.00	20.42**
Within clusters	1036347.75	1327	780.97	
Total	1530673.00	1358		

Table 56. Analysis of variance within clusters based upon free carbon dioxide.

	Sum of squares	df	Mean square	F ratio
Between clusters	520.33	31	16.78	1.91*
Within clusters	11640.57	1327	8.77	
Total	12160.90	1358		

Table 57. Analysis of variance within clusters based upon nitrates.

	Sum of squares	df	Mean square	F ratio
Between clusters	2186.90	31	70.55	3.80*
Within clusters	24662.28	1327	18.59	
Total	26849.19	1358		

Table 58. Analysis of variance within clusters based upon phosphates.

	Sum of squares	df	Mean square	F ratio
Between clusters	1.32	31	0.04	1.63*
Within clusters	34.58	1327	0.03	
Total	35.90			

Table 59. Analysis of variance within clusters based upon chlorides.

	Sum of squares	df	Mean square	F ratio
Between clusters	4751085.00	31	153260.75	2.84*
Within clusters	71686176.00	1327	54021.23	
Total	76437248.00	1358		

Table 60. Analysis of variance within clusters based upon chlorides (brackish water values deleated).

	Sum of squares	df	Mean square	F ratio
Between clusters	34659.60	31	1118.05	1.71
Within clusters	862361.56	1318	654.30	
Total	897021.13			

APPENDIX VI

Observations on Some Uncommon *Potamogeton* Taxa

Observations on Some Uncommon *Potamogeton* Taxa

During the summers of 1971-1974 a number of uncommon species of *Potamogeton* were discovered. Pertinent information concerning these taxa and their ranges are given here. Locations for the specimens referred to, unless otherwise noted, may be found in Appendix II.

Potamogeton filiformis Balbis

Two varieties were found in New England. I found *Potamogeton filiformis* var. *borealis* (Raf.) St. John at numerous locations in Aroostook County, Maine, one location in Coos County, New Hampshire, and four locations in Caledonia County, Vermont. The only verified specimens from Vermont previously reported are from Lake Champlain at North Hero and Charlotte. These are on deposit in the Pringle Herbarium at the University of Vermont.

Three of the four ponds in Caledonia County also contained the breader-leaved *Potamogeton filiformis* var. *macounii* Morong., which are new records for New England. A specimen reported by me (Hellquist, 1972) from Lombard Pond, Colebrook, New Hampshire as var. *borealis* may, in fact, be var. *macounii*. The *P. filiformis* var. *borealis* collected by G. D. Chamberlain 2278, from Butterfield Lake, Caswell, Aroostook County, Maine, also may be var. *macounii*. The Vermont plants are from shallow water (60.0 cm.). The lower leaves are slightly broader than the upper leaves.

Stipules of the lower leaves on some plants are inflated up to 2.9 mm. in width, as is P. vaginatus Turcz., but are shorter in length (maximum 7.4 mm.). Stipules higher on the stem were longer (maximum 14.0 mm.). Fruits from the broader-leaved plants were identical to those of var. borealis.

Potamogeton vaginatus Turcz.

Potamogeton vaginatus has been reported in eastern Canada, especially from Newfoundland and Prince Edward Island (St. John, 1916). It was thought to be absent from New England, appearing again to the west in the St. Lawrence River and the Finger Lakes region of New York. Muenscher (1944) indicates its presence in northern Maine, but I have seen no voucher specimens from this region.

During the summer of 1973 I discovered an extensive population of what appears to be Potamogeton vaginatus growing at a depth of 1.5 meters in Prestile Stream, north of the dam at Mars Hill, Aroostook County, Maine. The leaves are broad (lower leaves 1.5 mm. and upper leaves .6 mm.) and blunt-tipped. Stipule length is up to 4.5 cm. and twice as great as the stem width. The spikes consist of seven to nine whorls of flowers. No fruits were found. The species is known to produce fruit rarely.

Alkalinity studies on this site, one in New York, and four in Michigan indicate this to be a species of highly alkaline water. The range of the alkalinity at the six sites was 87.5-127.5 mg/l $CaCO_3$ with a mean of 103.5 mg/l $CaCO_3$ and a median of 109.0 mg/l $CaCO_3$.

Potamogeton hillii Morong

Fernald (1932) considered Potamogeton hillii one of the rarer species of Potamogeton, occurring in ten locations in five states. Since publication of Fernald's monograph additional locations for this species have been reported in New England including four locations in Vermont, one in Connecticut, and one in Massachusetts. The most recent report from New England is that of Weber (1940) from Karner Brook, South Egremont, Massachusetts.

A survey of the previously reported collection stations in New England has failed to uncover Potamogeton hillii. The population I discovered in 1972 at Cone Brook, Richmond, Massachusetts, was revisited in 1973 by Dr. Ogden and me. We found the plant to be scarce. However, in 1974 I found it to be abundant again. The area at South Stream, Pownal, Vermont, where the species was extremely abundant in 1973, was completely devoid of the plant in 1974. It appears that this species is sporadic and may be common only occasionally at certain locations.

Observations I have made on Potamogeton hillii indicate that it is usually found in highly alkaline, (Table 61) shallow, muddy waters of ponds and streams. The populations at Tom Ball Brook, Massachusetts are in waters as deep as 1.5 meters, where it takes on the appearance in growth habit of P. strictifolius. In both shallow and deep

Table 61. Tolerance of *Potamogeton hillii* to total alkalinity from New England and United States waters.

Location	Mean	Median	Range
		mg/l $CaCO_3$	
New England (7 locations)	159.1	130.0	86.0-290.0
United States (11 locations)	143.2	130.0	86.0-290.0

water P. *hillii* was found fruiting freely. Collection locations: Massachusetts: Berkshire Co.: small pond along Tom Ball Brook, West Street, Alford, 9694, (BOSC); marsh west of pond along Tom Ball Brook, Alford, 9697, (BOSC, CHSC, ISC, VT); Muddy Brook at Blue Hill Road, Great Barrington, 9946, (BOSC, VT); Muddy Brook at Stoney Brook Road, 9705, (BOSC, VT); swamp along south branch of Lily Brook at Bean Hill Road, Stockbridge, 9684, (BOSC, VT).

Potamogeton X *longiligulatus* Fernald

This perplexing plant has received much attention by Voss (1972), Haynes (1974), and Haynes and Williams (1975). Fernald (1932) originally described *Potamogeton longiligulatus* from Newfoundland and indicated that no fruit was found. This suggested the possibility that this taxon may be a hybrid. *Potamogeton longiligulatus* from Michigan was believed to be a hybrid between P. *strictifolius* and P. *zosteriformis* (Voss, 1972; Haynes, 1974). Haynes and Williams (1975) later found this to be the case. *Potamogeton longiligulatus* from East Creek, Orwell, Vermont, is apparently the cross between P. *strictifolius* and P. *zosteriformis*, since both were present.

Ogden (1974) proposed the possibility of *Potamogeton hillii* as one of the parent species of P. X *longiligulatus*. The apparent hybrid was found in fruit by Smith and Ogden 45590, from Beebe Pond, Canaan, New York, Columbia County. During the summer of 1974, I visited this pond and a small number of fruits were collected. *Potamogeton zosteriformis* was abundant, and *P. hillii* was located thus indicating the possibility of these species being parents. *Potamogeton strictifolius* was not found here.

I found *Potamogeton* X *longiligulatus* from Evarts' Pond, Windsor, Vermont and the Mill Pond, South Egremont, Massachusetts. The parents of the two populations were not clear, since only one of the three possible parental species was found in each pond. *Potamogeton strictifolius* was common in Evarts' Pond and *P. zosteriformis* was common at the Mill Pond. *Potamogeton hillii* was collected previously from both ponds and possibly may be one of the parents. During 1974 an extensive population of *P.* X *longiligulatus* from Muddy Brook, Great Barrington, Massachusetts, Hellquist 9704, 9947, was found among fruiting *P. hillii*. *Potamogeton zosteriformis* was not located although it appeared to be the other parent. The stipules of this hybrid were brown and slightly fibrous, which is similar to *P. hillii*. The leaves are broad (2.0-3.6 mm.) with 5-7 veins. This particular population appears similar to *P. hillii* and may be a backcross of the hybrid with *P. hillii*.

One of the supposed parents of some of the *Potamogeton* X *longiligulatus* from eastern United States (*P. strictifolius*) rarely fruits, while *P. hillii* fruits abundantly. This may help to substantiate the parentage, particularly of the Beebe Pond, New York, population which has been found in fruit.

Potamogeton longiligulatus has been shown to be a hybrid of *P. strictifolius* and *P. zosteriformis* in Michigan, but in New England and New York more than one set of parents may give rise to a hybrid of the same description. Perhaps the name *P. X longiligulatus* should not be utilized for all the different possible hybrids.

Potamogeton lateralis Morong

Potamogeton lateralis is one of the rarest pondweeds in the United States. Fernald (1932) noted only two locations from New England. They were the Charles River, Dedham-Needham, Massachusetts and Salisbury, Connecticut. I discovered *P. lateralis* in a small unnamed pond along the north side of U. S. Route 2 in Lancaster, New Hampshire, Hellquist 6387. It was extremely abundant, forming an extensive mat over most of the pond. The leaves were narrow (0.5-0.8 mm.) and acute-tipped. Sterile plants with floating leaves and fruiting plants without floating leaves were found. The fruits were similar to the isotype at the Gray Herbarium. During the summers of 1973 and 1974 I visited this pond again. *Potamogeton lateralis* was not observed in 1973 but in 1974 a few specimens were located. The sterile plants without floating leaves could easily be confused with *P. vaseyi*. This would tend to support the statement of Ogden (1974), "Apparently closely related to *P. vaseyi*, it may be merely a variant of that species."

BIOGRAPHICAL DATA

Carl Barre Hellquist

Date of Birth: December 8, 1940

Place of Birth: Summit, New Jersey

Secondary Education: Summit High School

Colleges attended:

Paul Smith's College, 1960-1962, A.A.S.

University of New Hampshire, 1962-1964, B.S.

University of New Hampshire, 1964-1966, M.S.

Honors and awards:

Alpha Zeta

Phi Sigma

Sigma Xi

Publications:

Colt, L. C. Jr., and C. B. Hellquist. 1971. Seventy-five years later, a second station for Micrasterias nordstediana. Rhodora. 73: 56-57.

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