AQUATIC WEED IDENTIFICATION IN NEW ZEALAND

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THE IDENTIFICATION of water plants is often thought to be difficult and not without reason. Some species vary greatly in form according to the conditions under which they grow and different species in some circumstances may appear very much alike. A plant may form an important part of the vegetation yet be lacking in flowers and fruit, and it is flower and fruit characters that are most used in identification keys and synopses in floras. Some will only flower when part of the plant is above water yet may spread extensively where water is too deep for them to reach the surface; others may flourish vegetatively where the climate or conditions do not permit flowering or fruiting. A plant may require to be identified outside the flowering or fruiting season.

There is no clear-cut division between water and land plants nor between those considered to be weeds and others, as has been said often enough. This paper aims to be practically useful rather than to be rigid in definition and therefore includes, besides plants that are undoubtedly both aquatic and often a nuisance, some that are no problem but which may be confused with those that are, and some that are better described as plants of wet places than as water plants, but which are a common nuisance. Included are a few adventives that have only recently been found in the country but which seem capable of spreading fairly quickly.

In the following key, vegetative characters are used as far as possible so that most plants can be identified in the absence of flowers or fruits, at least as to genus. Creeping stems and rhizomes, which are common in water plants and often account for their rapid spread, are often useful in identification and are referred to in the key. Some species appear in the key more than once as they may occur in very different forms. Where the underwater or younger leaves and the older and above water leaves are strikingly different, both or only one type of leaf may occur according to the stage of growth of the plant. It should be kept in mind that floating plants may become stranded on soft mud in which their roots may anchor, and some species which typically grow in water may grow sub-aerially in mud in a rather different form. To have taken this into account in the key would have extended it unduly. Most water plants that are not troublesome or conspicuous are not included and some of these may fit in the key, but it is believed that a reference to the descriptions should provide some feature that will verify or contradict the determination.

Names of adventive plants are preceded by an asterisk in the descriptions.

KEY TO NEW ZEALAND WATER PLANTS

1. Stems one cell thick, collapsing when punctured 2
 Stems many cells thick, not collapsing when injured 3
2. Branches undivided 1. *Chara australis*
 Branches 2-3 times forked 2. *Nitella hookeri*
3. Plants without roots or rhizoids 4
 Plants with roots or rhizoids 5
4. Stems long, plant submerged, free or sometimes with base in
 mud 12. *Ceratophyllum demersum*
 Plant an undifferentiated frond, about size of a pinhead, float-
 ing on surface 50. *Wolffia arrhiza*
5. Plants floating 6
 Plants not floating 11
6. Plant upright, up to 12 in. tall, flowers conspicuous in a tall
 spike 47. *Eichhornia crassipes*
 Plant horizontal, less than 1½ in. long, flowers absent or
 inconspicuous 7
7. Plants with leaves inserted on an axis 8
 Plants leafless, consisting of one or two flat fronds 9
8. Plant mossy, leaves about 1/20 in. long, curved and over-
 lapping 5. *Azolla rubra*
 Leaves flat, about ¼ in. long, lying on surface of water 6. *Salvinia natans*
9. Fronds forked, furrowed above, with purple scales hanging
 beneath 4. *Ricciocarpus* sp.
 Fronds more or less elliptical, smooth, without scales 10
10. Fronds with only one root each, white below 48. *Lemna* sp.
 Fronds with 3-8 roots each, purple below 49. *Spirodela oligorrhiza*
11. Leaves wanting or reduced to scales or sheaths at base of
 stem 12
 Plants leafy 15
12. Plants tufted 57. *Scirpus inundatus*
 Plants with creeping rhizomes 13
13. Stems tall (2-8 ft), glaucous, inflorescence an umbel of
 spikelets 58. *Scirpus lacustris*
 Stems short (½-3 ft), green, inflorescence a terminal spike 14
14. Stems stout (½ in. diam.), tall (15-36 in.) 55. *Eleocharis sphacelata*
 Stems slender (up to ⅛ in. diam.), short (4-20 in.) 56. *Eleocharis acuta*
15. Leaves cylindrical, or more or less cylindrical and septate 16
 Leaves not at all cylindrical, never septate 21
16. Plants with a slender, smooth, creeping rhizome from which
 leaves arise often in pairs 26. *Lilaeopsis* sp.
 Plants with a short rootstock or with a scaly rhizome ⅓ in. or
 more thick 17

17. Plants tall (2 ft and more), with rhizomes with overlapping scales	18
Plants short (less than 1½ ft), stems arising from short root-stocks	19
18. Plants up to 6 ft tall, stems and leaves conspicuously septate, inflorescence a large (9–18 in. long) drooping, much branched panicle	61. <i>Cladium articulatum</i>
Plants up to 3 ft tall, not septate, inflorescence a narrow contracted panicle	62. <i>Cladium glomeratum</i>
19. Inflorescence lateral, of 2–15 crowded spikelets, fruit a 3-sided nut	57. <i>Scirpus inundatus</i>
Inflorescence terminal, branched and spreading, fruit a capsule with minute seeds	20
20. Leaves threadlike, inflorescence leafy and irregularly branched	54. <i>Juncus bulbosus</i>
Leaves usually curved, septate, inflorescence branched, not leafy	53. <i>Juncus articulatus</i>
21. Plants entirely submerged	22
Plants with floating leaves or stems or leaves raised above the water	35
22. Leaves finely divided	23
Leaves entire	24
23. Leaves pinnately divided	20–22. <i>Myriophyllum</i> spp.
Leaves palmately divided	11. <i>Ranunculus fluitans</i>
24. Leaves in whorls	25
Leaves alternate or opposite	26
25. Leaves in whorls of 3, up to ½ in. long	36. <i>Elodea canadensis</i>
Leaves in whorls of 4–5, ½–1¼ in. long	38. <i>Egeria densa</i>
26. Leaves not greater than 1 in. long	27
Leaves 1½ in. or more long	29
27. Leaves opposite, 3 veins or more present	23. <i>Callitriche stagnalis</i>
Leaves alternate, one or no veins	28
28. Leaves stiff, recurved, midrib present	37. <i>Lagarosiphon major</i>
Leaves lax, erect or spreading, no midrib	3. <i>Drepanocladus fontinaliopsis</i> var. <i>flaccidus</i>
29. Leaves threadlike or very narrow and ribbonlike	30
Leaves not at all threadlike	32
30. Leaves opposite	46. <i>Zannichellia palustris</i>
Leaves alternate	31
31. Rhizome bearing tubers, flowers in spikes, submerged	41. <i>Potamogeton pectinatus</i>
Plant without tubers, flowers floating on the surface at the end of a long white stalk which contracts into a spiral after fertilization	45. <i>Ruppia spiralis</i>
32. Leaves long and straplike, arising from base of plant	35. <i>Ottelia ovalifolia</i>
Leaves not long, arising from an upright stem	33

33. Leaves narrow with 20 or more veins parallel to edge, ligules many-veined 42. *Potamogeton ochreatus*
 Leaves broader, with about 5 veins parallel to edge of leaf, ligules without veins 34
34. Leaves without stalks, blunt, toothed and strongly crisped when older, flowering and fruiting under water 43. *Potamogeton crispus*
 Leaves stalked, usually tapered at both ends, never toothed and at most faintly wavy, without flower or fruit 44. *Potamogeton cheesemanii* (young plants)
35. Plants with leaves floating on the surface, not upright above it 36
 Plants with leaves and stems upright above surface 41
36. Floating leaves long, straplike, grassy 66. *Glyceria fluitans*
 Floating leaves otherwise 37
37. Floating leaves under $\frac{1}{2}$ in. long, forming a rosette, light green 23. *Callitriche stagnalis*
 Floating leaves more than $\frac{3}{4}$ in. long, not in a rosette, dark green, bronzy, or olive 38
38. Leaves rarely longer than 2 in., arising from an upright, often branched stem; inflorescence a short spike of inconspicuous flowers 44. *Potamogeton cheesemanii*
 Leaves over 2 in. long, often much more, radical or from an underground rootstock; flowers or inflorescence striking and ornamental 39
39. Leaves almost circular with a deep notch at the base, 4–12 in. long 13. *Nymphaea alba*
 Leaves oval or oblong 40
40. Leaves oval, seldom as much as 3 times as long as broad, flowers borne singly, about $1\frac{1}{2}$ in. diam. 35. *Ottelia ovalifolia*
 Leaves oblong, usually more than 3 times as long as broad, flowers smaller, borne on a 2-forked spike 40. *Aponogeton distachyus*
41. Leaves in whorls 42
 Leaves not in whorls 44
42. Upper leaves always finely divided, about 1 in. long 22. *Myriophyllum robustum*
 Upper leaves entire, or at most serrate, seldom more than $\frac{3}{4}$ in. long 43
43. Upper leaves successively simpler than lower ones, ultimately entire and linear 20. *Myriophyllum propinquum*
 Upper leaves become rather abruptly broader, ovate-oblong, toothed or entire, often red 21. *Myriophyllum elatinoideis*
44. Leaves opposite 45
 Leaves not opposite 51
45. Leaves compound 27. *Bidens frondosa*
 Leaves not compound 46
46. Leaves with strong smell and with glandular dots, stems square, erect from creeping rhizomes 34. *Mentha* sp.
 Leaves not strong smelling, stems not both square and erect from creeping rhizomes 47

47. Flowers in long racemes	48
Flowers singly in leaf axils	49
48. Leaves clasping stem	32. <i>Veronica anagallis-aquatica</i>
Leaves definitely stalked	33. <i>Veronica americana</i>
49. Leaves entire, flowers with green sepals but no petals, incon- spicuous	16. <i>Ludwigia palustris</i>
Leaves toothed, flowers yellow, conspicuous	50
50. Plant without hairs	30. <i>Mimulus guttatus</i>
Plant hairy all over	31. <i>Mimulus moschatus</i>
51. Leaves compound or deeply lobed	52
Leaves simple and apparently entire	58
52. Leaves palmately compound or lobed	53
Leaves pinnatifidly compound or lobed	55
53. Plant with short erect stems, achenes in an oblong head	
Plant with creeping stolons, achenes in a more or less globular head	7. <i>Ranunculus sceleratus</i> 54
54. Leaf stalks up to 4 in. long; achenes no more than 10	
Leaf stalks 5 in. or more long; achenes 20 and more	9. <i>Ranunculus rivularis</i> 10. <i>Ranunculus macropus</i>
55. Leaves 3-pinnate, submerged leaves with hairlike segments	25. <i>Oenanthe aquatica</i>
Leaves 1-pinnate, no hairlike leaves	56
56. Leaves pinnatifid, inflorescence a composite head of yellow flowers	28. <i>Cotula coronopifolia</i>
Leaves compound, flowers white	57
57. Leaves serrate, flowers in umbels	24. <i>Apium nodiflorum</i>
Leaves entire or sinuate edged, fruit in a long raceme	14. <i>Rorippa</i> spp.
58. Leaves straplike, with parallel veins	66
Leaves not straplike	59
59. Leaves with tubular sheaths (ochrea) that enclose the stem	60
Leaves without tubular sheath	62
60. Flower heads short, dense, stout, about ¼ in. wide	
Inflorescence interrupted, long, slender	17. <i>Polygonum persicaria</i> 61
61. Inflorescence drooping, flowers greenish white, tepals with yellow glands	16. <i>Polygonum hydropiper</i>
Inflorescences upright, single or in pairs at end of branch, flowers pinkish, tepals without glands	15. <i>Polygonum decipiens</i>
62. Leaves arising from a short stout rootstock, flowers in a large compound panicle	39. <i>Alisma plantago-aquatica</i>
Leaves arising from long upright stems	63
63. Plant with appressed hairs, flowers small, blue	
Plant without hairs or hairs not appressed, flowers yellow or golden	29. <i>Myosotis caespitosa</i> 64

64. Inflorescence a composite head 28. *Cotula coronopifolia*
Flowers solitary 65
65. Secondary veins many arising along the length of the midrib
at a wide angle 19. *Jussiaea* sp.
Principal secondary veins 2, arising near the base of the
midrib and running more or less parallel to it
8. *Ranunculus flammula*
66. Leaves septate, rhizomes filamentous 26. *Lilaeopsis* sp.
Leaves not septate, rhizomes if present $\frac{1}{3}$ in. or more thick 67
67. Leaves without midrib 51. *Typha muelleri*
Leaves with distinct midrib 68
68. Leaves without ligule at junction of blade and sheath 69
Leaves with ligule or ring of hairs at junction of blade and
sheath 71
69. Flower stalks round in cross-section, leaves in 2 ranks;
rhizomes over 1 in. thick 52. *Iris pseudacorus*
Flower stalks and stems triangular in cross-section; rhizomes
about $\frac{1}{3}$ in. thick, black tubers usually present 70
70. Plant 5-8 ft tall, style arms 3 59. *Scirpus perviridis*
Plant $1\frac{1}{2}$ -3 ft tall, style arms 2 60. *Scirpus caldwelii*
71. Plants of tussock form; filament attached to base of anther;
nut enclosed in a flask-shaped sac or utricle 72
Plants not a tussock; filament attached to side of anther;
fruit enclosed by scales 73
72. Utricles shining and polished, nerves obscure 63. *Carex secta*
Utricles dull, conspicuously nerved 64. *Carex virgata*
73. Leaves 5 ft or more long, sheaths stout 73. *Zizania latifolia*
Leaves 2 ft or less long, sheaths not stout 74
74. Ligule a ring of hairs 72. *Spartina townsendii*
Ligule not a ring of hairs 75
75. Plant more or less hairy, especially near the junction of blade
and sheath 70. *Paspalum distichum*
Plant not hairy 76
76. Leaf sheaths with margins united, youngest leaf of shoot
folded flat along midrib 77
Leaf sheaths with margins free, youngest leaf of shoot rolled 79
77. Plants stout and tall, up to 6 ft or more; leaves 1-2 ft long,
up to $\frac{3}{4}$ in. broad 65. *Glyceria maxima*
Plants slender, not more than 3 ft high, leaves 2-12 in. long,
usually not more than $\frac{1}{3}$ in. broad 78
78. Lemmas (outer scales of florets) up to 6-7.5 mm long, entire,
anthers 2-3 mm long 66. *Glyceria fluitans*
Lemmas 4-5 mm long, 3-lobed or toothed at tip, anthers not
more than 1 mm long 67. *Glyceria declinata*
79. Stout plant $2\frac{1}{2}$ ft tall or more, spreading by extensive
rhizomes 71. *Phalaris arundinacea*
Lax plants up to $1\frac{1}{2}$ ft long, kneed or more or less prostrate
at the base 80
80. Awn conspicuous and protruding; anthers purple
68. *Alopecurus geniculatus*
Awn concealed or almost so; anthers orange or golden-yellow
69. *Alopecurus aequalis*

LIST OF SPECIES

CHAROPHYTA

CHARACEAE

Submerged plants with cylindrical stems and branchlets, each joint of the stem consisting of a single cell; branchlets in whorls. The oogonium (fructification) is a small body consisting of five cylindrical cells twisted spirally, surmounted by a cap or crown, and enclosing the oospore which is black or brown when ripe. About 15 species recorded for New Zealand, but few are troublesome.

Chara

Branchlets unforked, crown cells in oogonia five.

1. *Chara australis* R.Br. Stems up to 15 in. high, bright green, smooth, shining, brittle at the nodes; whorls of 3-8 smooth branchlets about 1 in. long.

Nitella

Branchlets forked, crown cells in oogonia ten.

2. *Nitella hookeri* A. Braun. Branchlets forked 1-3 times, ultimate branches with 2-3 cells, the end cells being much narrower than the first.

In dense, dark green masses in rivers and streams.

MUSCI MOSSES

AMBLYSTEGIACEAE

3. *Drepanocladus fontinaliopsis* var. *flaccidus* Allison. A soft slender, flaccid, moss up to 4 in. long. Leaves arranged indistinctly in 3 rows; stem leaves distant, appressed to stem, branch leaves crowded, erect and spreading, lanceolate to linear, gradually narrowed to a sharp apex, up to 3.5 mm long, toothed on upper margin, without any nerve.

Auckland Province, in drains and shallow water of river.

HEPATICAEE LIVERWORTS

RICCIACEAE

4. *Ricciocarpus* sp. Plant a flat, floating, forked, stemlike body, about ¼ in. long, furrowed on top, with delicate, purple scales and usually green rhizoids hanging beneath.

In still waters rich in inorganic matter.

SALVINIALES

AZOLLACEAE

5. *Azolla rubra* R.Br. Waterfern. Plant ⅓ to 1 in. long, branched; floating; leaves ovate and densely overlapping, blue-green in shade and early in season, red in the open later in the season. Often in dense masses.

On still, fertile waters.

SALVINIACEAE

- *6. *Salvinia natans* (L.) All. Floating leaves green, flat on water on either side of stem, with scattered hairs.

Still water, Auckland

DICOTYLEDONES

RANUNCULACEAE

Ranunculus

Leaf blades palmately lobed or cut, rarely entire and lanceolate, linear, leaves alternate. Petals yellow or white, regular, stamens many; nutlets (achenes) many, in clusters, beaked.

*7. *Ranunculus sceleratus* L. Fibrous rooted; stem upright, hollow. *Leaves shining*, deeply lobed, lobes again lobed or divided. Flowers pale yellow; fruit heads oblong, many fruited (70-100).

Common on mud at edges of slow and still waters.

*8. *Ranunculus flammula* L. Slender, usually rooting at lower nodes, leaves entire or almost so, varying from stalked and ovate (lower leaves) to lanceolate and linear-lanceolate and sessile; veins parallel. Flowers yellow; achenes 20-50 in a globose head.

In swamps and wet places. Abundant in the Waikato and Hauraki; in scattered localities throughout.

9. *Ranunculus rivularis* Banks & Sol. ex DC. Waoriki. A branched, creeping and rooting herb with stems sometimes floating. Leaf blades divided to the base into 3-5 deeply toothed segments; leaves varying in shape and size, $\frac{1}{4}$ - $1\frac{1}{4}$ in. across, stalks $\frac{3}{4}$ -6 in. long. Flowers yellow; achenes up to ten in a globose head.

Common in swamps and wet places.

10. *Ranunculus macropus* Hook. A little branched, creeping and rooting herb with hollow stems, often floating. Leaf blades divided to the base into 3 or 5 deeply cut segments; leaves varying in shape and size, $\frac{3}{4}$ -3 in. across; leaf stalks 6-18 in. long. Flowers yellow or petals greenish and shorter than the sepals; achenes 20 and more in a globose head.

In slow streams, ponds, and swamps. Sometimes the flowers and fruits are completely submerged in water.

*11. *Ranunculus fluitans* Lam. Water Buttercup. A large herb with creeping rhizomes, and leafy submerged stems up to 10 ft long. Leaves dark green, 2-3 times divided into fine thread-like segments, up to $4\frac{1}{2}$ in. long. Flowers white.

In ponds, lakes and streams. Widespread from Auckland south.

CERATOPHYLLACEAE

*12. *Ceratophyllum demersum* L. Hornwort. A stiff, rather brittle, densely leafy plant, with twice-forked leaves in whorls on a long slender stem; leaf segments linear and irregularly toothed. Flowers and fruit inconspicuous. Plant without roots, floating submerged, or end of stem caught in the mud.

In ponds and backwaters of rivers. Found in recent years near Napier and in the Waikato River. As this is grown in aquaria and readily breaks up into small pieces which can multiply it may well spread further.

NYMPHACEAE

*13. *Nymphaea alba* L. Waterlily. Plant with floating leaves arising from stout rhizome; leaves almost circular, 4-12 in. diam., with a deep, narrow notch. Flowers with 20-25 white petals.

Still waters. Mostly found cultivated for ornament, but occasionally a nuisance.

CRUCIFERAE

*14. *Rorippa microphylla* (Boenn.) Hyland. Watercress. (Synonym: *Nasturtium microphyllum* (Boenn.) Rchb.) Herb with hollow stems up to 6 ft or more long, rooting below. Leaves bright green, turning brown in autumn, up to 10 in. long, with 5-9 leaflets. Flowers white. Inflorescence up to 2 ft long in fruit; pods slender, $\frac{2}{3}$ -1 $\frac{1}{4}$ in. long, curved, seeds in one row.

Common in slow streams and shallow waters; sometimes completely submerged in faster waters but then not flowering.

**R. nasturtium-aquaticum* (L.) Hayek (Synonym: *Nasturtium officinale* R. Br.) is very like the above species, but the leaves remain green in winter and the pods are $\frac{1}{2}$ - $\frac{3}{4}$ in. long with seeds clearly in two rows. Scattered in both islands, but more frequent in the North Island.

POLYGONACEAE

Leaves usually alternate with sheathing stipules (ochreae). Perianth segments 3-6, sepaloid or petaloid, persistent. Fruit hard, 3-sided or lens-shaped.

15. *Polygonum decipiens* R. Br. Slender, little branched, lax herb up to 2 $\frac{1}{2}$ ft tall, without glands, prostrate and rooting at the base. Leaves willow-shaped, usually with a dark marking, sometimes reddish. Flower spikes 1 or 2 at end of the branches, very slender, flowers pink (sometimes whitish). Fruit lens-shaped (sometimes bluntly triangular), dark brown, more or less shining. Plant pungent to taste.

Common in swamps and slow waters in the North Island; in the north of the South Island.

*16. *Polygonum hydropiper* L. Willow Weed, Water Pepper. An erect herb, stems reddish, leaves without markings, edges wavy. Inflorescence slender, drooping, leafy, interrupted. Flowers white or greenish; *tepals covered with yellow glands*. Fruit biconvex or bluntly 3-angled, dark brown, *dull*. Plant burning to taste.

In shallow waters and damp places, *e.g.*, on river shingle. Grows in zone above *P. decipiens* when both present.

*17. *Polygonum persicaria* L. Willow Weed, Lady's Thumb. A branched herb, with leaves often blotched, and short, dense inflorescence (up to 1 $\frac{1}{4}$ in. long by $\frac{1}{2}$ in.) of pinkish flowers, without glands, and with *black shining fruit*, is common in waste places, including near water, but can scarcely be classed as a water plant in New Zealand.

ONAGRACEAE

*18. *Ludwigia palustris* L. A lax herb with stems 2 to 24 in. long, often reddish. Leaves in pairs, each pair at right-angles to the next, with a short stalk, blunt, entire. Flowers small, borne singly in leaf axils, without petals. Fruit $\frac{1}{4}$ in. long, 4-angled.

In still and slow waters in the North Island; it has been found in Marlborough. Sometimes completely submerged in deeper water, but not then flowering.

*19. *Jussiaea* sp. Water Primrose. Stems creeping, rooting at the nodes and floating. Leaves alternate, stalked, about 1 in. long, elliptic, blunt, shining. Flowers yellow, about 3¼ in. across, borne singly in leaf axils, on slender stalks; fruit about 1 in. long, narrow.

On swampy ground and at the edge of still waters. In the Waikato north of Hamilton and in a few other localities in the Auckland Province.

HALORAGACEAE

20. *Myriophyllum propinquum* A. Cunn. A herb with slender rhizomes and slender leafy shoots from 2 in. to 8 ft tall. Leaves in whorls (4-5 for submerged leaves, 3 or 2 for linear leaves), varied in shape, the lower finely, sometimes extremely finely, pinnatisectly divided, about 1 in. long gradually changing with segments becoming shorter until the above-water leaves are entire and linear. Flowers small, seated singly in axils of upper leaves. Female flowers without sepals or petals, stigmas with very long hairs; male flowers with pale petals. Fruit pale and rough.

One of the most widely spread water plants in New Zealand, growing in lakes, ponds, streams, and swamps. It varies greatly in form. When deeply submerged and permanently it has finely divided leaves, in soft mud subject to inundation leaves may be divided or only entire leaves occur.

21. *Myriophyllum elatinoides* Gaud. A herb with slender rhizomes and slender, sometimes wiry, leafy stems, 2 in. to 8 ft tall. Leaves in whorls (usually 4, sometimes 3 or 2), lower pinnatisect in fine segments, ⅛ to 1 in. long, changing usually abruptly to short, ovate to oblong leaves ⅓ to ¼ in. long, toothed or entire, often red. Flowers seated singly in axils of upper leaves, hermaphrodite, petals pale. Fruit brownish red, smooth.

Widespread, occurring from sea level to 4,000 ft in pools, lakes, and slow streams. In cold high-country waters the plant is dark green and the whorls of leaves are crowded, stiffish, and overlapping so that it is recognizable when totally submerged. In lowland waters it is not always distinguishable from *M. propinquum* when entirely submerged.

22. *Myriophyllum robustum* Hook. f. Robust herb with rhizomes and leafy stems up to 5 ft tall, ¼ in. in diam. Leaves in whorls of 4 or 5, 1¼ to 1¾ in. long, all pinnately divided, those above water with shorter and slightly broader segments, light green. Flowers seated in axils of upper leaves, hermaphrodite. Fruit pale, smooth, or sometimes with a few tubercles.

Widespread but not particularly common in the North Island; on the west coast of the South Island. In swamps and lagoons, apparently where there is a good deal of organic matter.

CALLITRICHACEAE

*23. *Callitriche stagnalis* Scop. Water Starwort. Plant slender, up to 3 ft tall in water, or creeping and forming a turf on mud. Leaves light green, variable, spathulate or obovate, average about ⅓ in. long; forming a rosette on the surface of the water, submerged ones up to 1 in., rather narrow; with 3, 5, or 7 veins, the secondary ones looped. Flowers minute, male ones consisting of a single stamen with a long filament, female a 4-lobed ovary with 2 long styles, seated singly or a male and female together in axils of upper leaves. Fruit minute, round, pale, with broad wings.

Common and widespread in fertile waters.

C. petriei Mason, is a smaller, more delicate, but similar plant, up to 8 in. tall, with leaves with only 2 looped secondary veins, sometimes with free side veins, occasionally with under-water leaves linear and one-nerved.

Male and female flowers on different plants. Fruit grey-brown, broader than long, not keeled or winged. It is widespread and not uncommon, found more often on wet mud than submerged, and is not troublesome.

**C. hamulata* Ktze. is an amphibious plant with long, 1-nerved, linear underwater leaves, deeply 2-toothed and widened at the tip; rosette leaves spatulate, and dark brown; round fruit with a narrow whitish wing. It has been found twice in Marlborough.

UMBELLIFERAE

Flowers usually in an umbel, with sepals 5 or 0, petals 5; fruit dry, of 2 nutlets, often crowned by calyx lobes, and often separating when ripe.

*24. *Apium nodiflorum* (L.) Lag. Fool's Watercress. Stems slender or stout, finely furrowed, rooting at the base, up to 6 ft long. Leaves pinnate, bright green, up to 27 in. long; leaflets toothed, without stalks. Umbels opposite leaves; flowers white. Fruit about 2 mm long and as broad, with sharp ridges.

In slow waters and shallow ponds in scattered localities in the North Island. Possibly spreading.

*25. *Oenanthe aquatica* (L.) Poir. Horsebane. A stout erect herb with creeping stems, up to 5 ft tall, with hollow stems and fibrous roots. Leaves all pinnately divided (3 times), submerged ones with hairlike segments, aerial with deeply lobed more or less ovate, acute segments. Umbels opposite the leaves; fruit longer than broad with 5 rounded ribs.

Wet places in Marlborough.

26. *Lilaeopsis* spp. Plants with slender creeping rhizomes, rooting at nodes, and producing more or less cylindrical or rather flattened, hollow, septate leaves, 1 to 15 in. long. Umbels few flowered. Fruit small 1¼ to 2½ mm, with 3 to 6 ribs on each half.

On wet soft ground at the edges of lakes and slow waters. Three species have been described for New Zealand, but they are difficult to distinguish unless in ripe fruit. Plants may form swards in shallow water but usually flower and fruit only above water in well lit positions.

COMPOSITAE

*27. *Bidens frondosa* L. Tiger Weed, Seccombe Weed. An upright annual up to 3 ft tall, with opposite, pinnate, toothed leaves. Heads solitary, with 5 to 8 long, fringed, leafy outer bracts as well as yellow inner ones; flowers yellow. Fruit flattened, dark brown, with 2 barbed awns.

In swamps and shallow water and damp places in various places in the North Island; also in a few places in the north of the South Island. The clinging fruit make this a troublesome weed.

28. *Cotula coronopifolia* L. Soldier's Button. A fleshy herb with lower branches creeping and rooting, then ascending, up to 12 in. tall. Leaves narrow, entire, especially on small plants, or more usually irregularly pinnatifid. Heads on slender stalks, bright yellow, ¾ in. across, buttonlike.

Wet places, sometimes in shallow water, usually near the coast.

BORAGINACEAE

*29. *Myosotis caespitosa* K. F. Schultz. Water Forgetmenot. An annual or biennial, simple or branched plant about 15 in. tall with alternate, entire leaves and with appressed hairs on upper surface of leaves, often on the lower surface and the stems. Flowers light blue, not more than 1/6 in. across. Fruit of 4 dark brown shining nutlets.

Common in wet places and at the edges of streams.

SCROPHULARIACEAE

*30. *Mimulus guttatus* DC. Monkey Musk. A perennial, creeping below, stems upright, up to 2 ft tall. Leaves opposite, toothed, lower stalked, ovate to oblong, upper more rounded, without stalks. Flowers singly on stalks in upper leaf axils, corolla bright yellow often with reddish spots, 1 in. or more long, markedly 2-lipped. Fruit blunt.

Lining streams and drains and in wet places. Abundant in much of the Wellington Province and most of the eastern parts of the South Island; less common, rare, or absent elsewhere (absent north of Auckland).

*31. *Mimulus moschatus* Doug. Musk. A low-growing, spreading, hairy perennial. Leaves opposite, shortly stalked. Corolla yellow, not blotched, up to 3/4 in. long. Fruit pointed.

Wet soils and shallow water along streams, in swamps and on seepages. Rather scattered distribution from Auckland Isthmus south, abundant in places.

*32. *Veronica anagallis-aquatica* L. A herb up to 1 ft tall, shortly creeping and rooting at base. Leaves opposite, without stalk, widest near the base, clasping the stem. Flowers usually more than 30 on raceme, pale blue.

Edges of ponds, streams, on wet mud. Occasional in the North Island and common on the east side of the South Island.

*33. *Veronica americana* (Raf.) Schwein. Similar to *V. anagallis-aquatica*, but leaves definitely stalked and flowers usually fewer than 25, lilac.

Found in both North and South Islands, but not as commonly as *V. anagallis-aquatica*.

**V. scutellata* L. with leaves with nearly parallel sides, each inflorescence from alternate leaf axils, and fruit strongly 2-lobed, is found occasionally.

LABIATAE

*34. *Mentha piperita* L. Plant with creeping rhizomes, up to 2½ ft tall, stems erect, square, reddish or purplish. Leaves stalked, sharply toothed, glandular dotted, strongly scented, with few or no hairs.

var. *piperita*. Peppermint. Leaves lanceolate, peppermint scented; inflorescence a more or less oblong spike.

var. *citrata* (Ehrh.) Briq. Leaves ovate, lemon-scented; inflorescence a head consisting of 1 to 3 whorls, often with 1 or 2 lower whorls well separated.

In wet and swampy places, sides of ditches, etc. Widespread.

**Mentha spicata* L. Spearmint, the common garden mint, with leaves quite green, without stalks or hairs, and flowers in long spikes of 20 or so whorls is not uncommon on waste land, often in damp places.

MONOCOTYLEDONES

HYDROCHARITACEAE

*35. *Ottelia ovalifolia* Rich. Without appreciable stem, early leaves submerged, long and ribbon-like, later leaves with ovate to oblong blades up to 6½ in. long floating at the end of long stalks, 7-nerved. Flowers almost 1½ in. across, with short green sepals, and extremely fragile white petals with orange base; 6 orange stamens.

In fertile ponds and slow waters in the North Island, common in many districts and still spreading.

*36. *Elodea canadensis* Michx. (Synonym: *Anacharis canadensis* (Michx.) Planch.) Oxygen Weed, Black Weed, Yankee Weed. Submerged herb with long, slender, branched, brittle stems arising from creeping stems. Leaves ¼ to about ½ in. long, narrow, pellucid, in whorls of three. Female flowers on long white stalk (in fact the perianth tube) up to 8 in. long, floating on the surface of the water, small. (Only plants with female flowers found in New Zealand.)

In ponds, lakes, streams, and rivers from Auckland south, though not known in Taranaki and rare on the west coast of the South Island.

In cold water the leaves become very crowded.

*37. *Lagarosiphon major* (Ridley) Moss. Oxygen Weed. Similar in habit to *Elodea canadensis*, but often a stouter plant. Leaves not in whorls, 1¼ in. long, stiff, strongly recurved. Only female flowers known in New Zealand.

Occasional in the middle Waikato, a great nuisance in Rotorua and Rotoiti, in the Kaituna River (Bay of Plenty); in Lake Ratapiko (central Taranaki); in the Hutt Valley; in Blenheim.

*38. *Egeria densa* Planch. Oxygen Weed. Similar in habit to the above 2 species but with very dark green leaves, leaves in whorls of 4 to 6, ¾ to 1¼ in. long. Flowers conspicuous, white, about ⅜ in. across. Only male flowers known in New Zealand.

Abundant in the Waikato district from Ngaruawahia down; and in other scattered localities in the North Island.

ALISMATACEAE

*39. *Alisma plantago-aquatica* L. Waterplantain. Stem upright, short, stout, up to 3½ ft, arising from stout corms. Leaves upright, with long stalks and 3 to 9-nerved blades up to 8 in. long. Inflorescence a large, much branched and whorled panicle. Flowers numerous, pale lilac or pinkish. Fruitlets flat, pale, in a small head.

In muddy ponds, ditches, swamps, and slow flowing waters. From Kaitaia to Balclutha district, abundant in places but absent in others. Still spreading.

APONOGETONACEAE

*40. *Aponogeton distachyus* L.f. Leaves arising from a tuber, submerged leaves linear, floating leaves on long stalks, more or less oblong, up to 12 in. long, usually more than 3 times as long as broad, 7-nerved. Flowers borne on a 2-forked spike, each with one white tepal, fragrant.

In still and slow waters in the North Island; occasional in the South Island.

Sometimes called "Water lily" and "Water hyacinth" but these names are not only incorrect but misleading.

POTAMOGETONACEAE

Potamogeton

Plants with slender rhizomes and slender leafy stems, entirely submerged or with floating leaves; flowers and fruits in spikes, with 4 sepals, 4 stamens, and 4 free carpels; the stones of the fruit with an operculum or lid which is pushed aside by the germinating embryo.

41. *Potamogeton pectinatus* L. Always entirely submerged, rhizomes with small *underground tubers*, plant up to 6 ft tall, with very narrowly ribbon-like leaves, up to 5½ in. long, often brownish. Flowers in an interrupted spike. Fruit brownish, rounded, with a short beak.

In hard and brackish waters. From Auckland Isthmus south, in scattered localities, usually near the coast. Easily overlooked in turbid waters. When not fertile easy to confuse with *Ruppia spiralis*; see No. 45, also p. 248.

42. *Potamogeton ochreatus* Raoul. Entirely submerged, up to 2 ft tall, reddish, bronze, or dark green. Leaves without stalks, with parallel sides, each with 20 or more veins parallel to the edges, usually 1½ to 2½ in. long (sometimes 4 in.), about ¼ in. wide, *ligules with many veins which survive as long soft bristles when softer parts decay*.

*43. *Potamogeton crispus* L. Entirely submerged, stems up to 6 ft, more or less 4-angled. Leaves without stalks, up to 1½ in. long and ¼ in. broad, rounded and blunt, with about 5 parallel veins, usually *very wavy when mature, toothed*, translucent, sometimes reddish. Fruit flattened, with a curved beak as big as the rest of the fruit, dark olive.

Abundant in lakes, ponds, rivers, and streams in many parts of the North Island south of the Auckland Isthmus. Near Blenheim.

44. *Potamogeton cheesemanii* A. Bennett. Stems up to 6 to 7 ft tall. Underwater leaves thin and translucent, 2 to 4 in. long with short stalks, usually with 5 longitudinal veins and distant cross veins, usually tapered at both ends, sometimes slightly wavy. Floating leaves on long stalks, blades usually not more than 2 in. long, more or less elliptic-oblong, blunt, leathery, with not more than 13 longitudinal veins. Flowers in a dense spike up to ¾ in. long, standing above the water, but curving under water when in fruit. Fruit keeled on the back.

Common throughout in ponds, lakes, still and slow waters where there is some silt on the bottom.

A rather variable plant, with reddish, small few-veined floating leaves in poor conditions. It can grow in very wet mud as a short plant with the floating type of leaf forming a rosette on the mud.

Potamogeton suboblongus Hagstr. differs from *P. cheesemanii* in having up to 21 veins in floating leaves, sometimes a fold at the leaf base, and small, rounded, red fruits. It is found in swamps and sometimes in still pools.

RUPPIACEAE

45. *Ruppia spiralis* L. Horse's Mane Weed. An entirely submerged plant up to 8 ft tall with slender creeping rhizomes. Leaves 3 to 9 in. long, narrow ribbon-like, dark green, usually on slender ascending stems, but in shallow or fast water mostly from the rhizomes. Flowers on long slender white stalks which rise singly in the axils of the leaves, floating on the surface when the stamens ripen;

2 flowers without tepals on each stalk. After fertilization the stalk coils spirally, sometimes becomes red, and draws the fruit below the surface. Fruitlets on long stiff stalks, green; stone black with an operculum or lid.

Common in brackish water, in pools, drains, estuaries and lagoons, often forming dense beds. Sometimes in fresh waters.

When not fertile easily confused with *Potamogeton pectinatus*, see No. 41; also p. 248.

ZANNICHELLIACEAE

46. *Zannichellia palustris* L. A submerged herb with threadlike rhizomes and leafy stems up to 18 in. or more tall. Leaves opposite, usually 1½ to 2½ in. long (sometimes 4 in.). Fruit up to 4, in leaf axils, more or less oblong, slightly curved and flattened, with a beak. Usually in brackish water, from the Auckland Isthmus south.

PONTEDERIACEAE

*47. *Eichhornia crassipes* L. Water Hyacinth. Plants floating or sometimes rooting in mud, up to 12 in. tall, with branched roots; leaves in rosettes. Leaf stalks often inflated. Flowers blue and lilac in showy spikes.

An attractive plant but a most troublesome weed which has become naturalized in some districts in the North Island. Eradicated from some localities.

LEMNACEAE

Plants minute, floating, consisting of fronds without definite leaf or stem, either occurring linked in small groups or singly. Flowers much reduced, seldom seen in New Zealand.

48. *Lemna* sp. Duckweed. A bright green, rather flat plant, pale green beneath, with one root to each frond; fronds about 2 to 3.5 mm long. Daughter fronds growing from a pocket at the side of one end of the parent frond.

Abundant in still, fertile waters throughout.

49. *Spirodela oligorrhiza* Kurz. Similar to *Lemna* sp., but fronds thicker, up to 3 to 4 mm long purple below, and with 3 or more roots to a frond.

In fertile waters from the Waikato River south to South Canterbury.

50. *Wolffia arrhiza* (L.) Wimm. Watermeal. Size about that of a pinhead, green on top, keeled-shaped below and colourless. Daughter fronds arising from the end of the parent.

In still, fertile waters from the Waikato River to near Dunedin. Sometimes a nuisance in drinking troughs.

The three lemnids may grow intermingled.

TYPHACEAE

51. *Typha muelleri* Rohrb. Raupo. A plant up to 8 ft tall, with stout, spreading rhizomes. Leaves long, linear, upright, without midrib. Flowers borne in tight cylindrical spikes on a long stem, lower section dark brown, female; upper section (sometimes 2 or 3) pale brown, male. Fruit wind borne on silky hairs.

Abundant throughout in swamps, lakes, seepages, etc. Its rhizomes can gradually extend over still water in a floating mat.

IRIDACEAE

*52. *Iris pseudacorus* L. Yellow Flag. Rhizome stout, leaves flat, long, swordlike, upright, up to 2½ ft long, with a distinct midrib. Flowers yellow, large and showy, 3 to 4 in. across. Fruit 2 in. long, splitting into 3, with brown seeds.

Occasional in wet places.

JUNCACEAE

Plants sedge-like or grass-like, but flowers regular, with 3 sepals, 3 petals, 3 to 6 stamens, and fruit splitting into 3, with numerous minute seeds. Sepals and petals stiff and scale-like, and individual flowers insignificant.

*53. *Juncus articulatus* L. Plant with a slender, horizontal, rooted, more or less tufted rhizome; stems up to 2½ ft long, slender, lax, with lower parts more or less prostrate. Leaves slightly compressed, cylindrical, curved, septate. Inflorescence much forked; branches at an acute angle. Flowers dark brown, tepals acute.

Common in shallow water and wet places.

*54. *Juncus bulbosus* L. A small, tufted plant with slender stems, swollen at the base; sometimes erect, or stems rooting at the nodes, or floating. Leaves threadlike. Inflorescence simple, or little and irregularly branched, leafy. Flowers bright brown.

A very variable plant, found in the south of the North Island and in the South Island, particularly on the west coast. When entirely submerged it produces a multitude of long fine threadlike leaves. *Juncus bulbosus* var. *bulbosus* has 3 stamens; **J. bulbosus* var. *kochii* with 6 stamens, also occurs.

CYPERACEAE

Plants grassy or rushlike in appearance. Leaf sheaths closed. Flowers in the axils of overlapping scales; pistils 1 with 2 to 3 stigmas; stamens 1 to 3 with filaments attached to the base of the anthers. Fruit a lens-shaped or 3-angled nutlet.

Eleocharis

Leaves reduced to sheaths at the base of the stems. Spikelets single, terminating the stems. Nut crowned by the persistent base of the style.

55. *Eleocharis sphacelata* R. Br. Rhizome thick and creeping. Stems stout about ½ in. in diam., bright green, hollow and septate, up to 3 ft tall. Up to six long bristles around pistil.

Common in acid waters. Absent from the east coast of South Island.

56. *Eleocharis acuta* R.Br. Plants with rhizomes. Stems often crowded, up to ⅛ in. in diam., up to 20 in. tall. Sheath with a dark, thickened, horizontal rim, and a minute erect projection (much reduced leaf blade). Bristles round pistil 4 to 8.

Abundant in wet places throughout. Varies much in size.

Eleocharis gracilis R. Br., which is similar to *E. acuta* is usually a smaller and more slender plant with papery oblique-mouthed sheaths and is found in wet places.

Scirpus

Stems round or triangular. Spikelets usually several or many, with a leaf or leaves at the base of the spikelet cluster or the branches; if there is only one upright leaf the inflorescence may appear to be on the side of the stem.

57. *Scirpus inundatus* Poir. A small tufted plant up to 12 in. tall. Leaves reduced to short broad sheaths at the base of the stem, or rarely 1 or 2 short leaves. Heads of 2 to 15 crowded spikelets, sometimes proliferating and sending out long or short branches which bear smaller heads of spikelets. Stamen 1, styles 3. Nut sharply 3-angled, white and smooth, minute.

On wet soil and in pools throughout. Occasionally in pools it grows several feet long with heads repeatedly proliferating.

Scirpus prolifer Rottb. is a similar but larger, stouter plant with 3 stamens. Abundant in North Auckland, the south of the Wellington Province, and on the West Coast, South Island.

Scirpus sulcatus Thours var. *distigmatus* Clarke in Cheesem. is also similar but larger, with 1 stamen but only 2 styles and a shining lens-shaped nut, and is scattered throughout as far south as Timaru.

58. *Scirpus lacustris* L. A dark or grey-green plant up to 10 ft tall, with creeping rhizomes, leafless, or with rudimentary leaves, stems round. Inflorescence an irregular umbel, with numerous spikelets about $\frac{1}{3}$ in. long.

In lakes, slow streams and heads of estuaries south to latitude 44°S.

59. *Scirpus caldwellii* V. J. Cook. Plant up to 3 ft tall, with creeping rhizomes and black tubers. Stems triangular, leaves grasslike, in 3 ranks. Inflorescence a head of 3 to 5 spikelets, often with one or more rays with 2 to 3 spikelets. Stamens 3, styles 2. Nut shining, lens-shaped and obovate, yellow-brown, about $\frac{1}{8}$ in. long, surrounded by 6 bristles no longer than half the nut.

In fresh and brackish swamps, usually coastal. From Dargaville southwards to Westport and Dunedin.

60. *Scirpus perviridis* V. J. Cook. Similar to *S. caldwellii* but always taller, up to 6 ft. Inflorescence an irregular umbel with 6 to 9 unequal rays $\frac{3}{4}$ to 3 in. long with 1 to 5 spikelets. Styles always 3. Nut narrow, 3-angled, dark, bristles as long as nut.

Fresh water lowland swamps in the North Island.

Scirpus medianus V. J. Cook, which is intermediate in size between *S. caldwellii* and *S. perviridis*, and has both 2- and 3-styled flowers and both 2- and 3-angled nuts, is found in the North Island and a few places in the South Island.

Cladium

Plants with creeping rhizomes covered with overlapping scales. Spikelets few-flowered, without flowers in lower scales.

61. *Cladium articulatum* R. Br. Stems tall, stout, leaves almost as tall; both stems and leaves round and conspicuously septate. Flowers in a large, much branched, drooping, red-brown panicle up to 18 in. long.

In swamps and at the edge of still and slow waters in the North Island south to Waikanae, most abundant north of 38°S.

62. *Cladium glomeratum* R. Br. Plant up to 3 ft tall, stems and leaves round, rushlike, dark-green; leaves few, from the base of the stem. Panicle very narrow, with few, upright branches, 3 to 10 in. long. Nut 3-angled, orange, with a sharp tip.

In swamps and at the edge of still waters.

Cladium junceum R. Br., about 2 ft tall, has leaves consisting of sheaths with rudimentary blades at intervals up the stems, and is found in brackish water, swamps, particularly in the Auckland Province.

Carex

Leaves grasslike, with ligules. Male and female flowers in different spikes or in different parts of the same spike. Nuts enclosed in a flask-shaped 2-toothed sac (utricle).

63. *Carex secta* Boott in Hook.f. Niggerhead. A plant of tussock form with matted rhizomes which often form a trunk up to 5 ft high. Leaves many, long, narrow (up to 1/8 in.), and drooping. Panicles much branched, lax and nodding, 1 to 2 1/2 ft long. Utricles shining.

Common in swamps.

64. *Carex virgata* Sol. ex Hook.f. A plant of tussock form, not forming a trunk. Leaves similar to those of *C. secta*. Panicles long, narrow, branches erect, closely pressed to the main stalk. Utricles dull, many-nerved. Common in swamps, on higher ground than *C. secta*.

**Carex lurida* Wahlenb. is a grassy plant with broad green leaves, flowers in dense spikes, and with thin, much swollen utricles which have long necks and 5 ribs on either side and in which the nut occupies little space. It is abundant in and dominates some wet swamps near Te Puke and is known from one or two other localities.

GRAMINEAE

Stems round in cross-section. Leaves in 2 ranks, each consisting of an open sheath (except in *Glyceria*), a blade, and a ligule at the junction. Flowers in a spikelet which consists of 2 glumes (scales) and 1 or more florets, each consisting of a pistil with 2 stigmas, and 3-6 stamens, the filaments of which are fixed to the side of the anther, and all enclosed by 2 scales (lemma and palea).

Glyceria

Aquatic plants with a creeping rootstock. Leaves flat, sheaths with edges united. Glumes shorter than the lowest spikelet. Lemmas strongly nerved.

*65. *Glyceria maxima* (Hartm.) Holmb. Plant stout, upright, up to 6 ft tall, rhizomes spreading and covering large areas. Leaves 1 to 2 ft long, 3/4 in. broad. Panicles much branched, rather dense, spikelets numerous.

On swampy ground, in ponds, and at the edge of slow waters, on silty soil; in water up to 2 1/2 ft deep. Scattered localities in both islands, particularly abundant in the Waikato and Hauraki.

*66. *Glyceria fluitans* (L.) R. Br. Sweet Grass. Plant up to 3 ft, rather lax, stems sometimes rooting at the base. Leaves 2 to 6 in. long, sometimes floating on the water. Panicles little branched, narrow after flowering, spikelets 20 to 25 or so. Lemmas entire, blunt or slightly pointed; anthers 2 to 3 mm long.

Widespread in still and slow waters.

*67. *Glyceria declinata* Bréb. Similar to *G. fluitans* but up to 2 ft tall. Panicles little branched, rather one-sided. Lemmas 3-toothed or lobed, two teeth of palea (inner scale) projecting beyond it; anthers up to 1 mm long.

Widespread on muddy edges of still and slow waters.

**Glyceria plicata* Fries, which is similar to the above two species, but with open, wide panicles and twice as many spikelets (60 or so) is occasionally found.

Alopecurus

Inflorescence long and narrow, of crowded flat spikelets each with only one scale (lemma) which has a bristle (awn) rising on the back, readily falling in fruit.

68. *Alopecurus geniculatus* L. Marsh Foxtail. Stems creeping and rooting at the nodes then ascending and kneed. Awn from near the base of the lemma and twice as long as it. Anthers 5-6 times as long as broad, whitish and purple.

Widespread in shallow water and on wet ground.

*69. *Alopecurus aequalis* Sobol. Stems ascending from a kneed or prostrate base. Awn attached just below the middle of the lemma, short and almost hidden. Anthers 1½ times as long as broad, orange when ripe.

Less common than *A. geniculatus*: in similar places.

*70. *Paspalum distichum* L. Stems ascending from a creeping and rooting base, up to 2 ft tall. Leaves very hairy near the junction of blade and sheath and elsewhere often with scattered hairs, about 1½ to 4 in. long. Racemes 2, at top of stem, narrow, spikelets all on one side.

Wet ground and shallow water in the North Island, most abundant in the northern half.

*71. *Phalaris arundinacea* L. Reed Canary-grass. Plant robust, up to 6 ft tall, spreading by creeping rhizomes. Leaves 4 to 6 on a stem, 4 to 12 in. long, ¼ to ¾ in. wide, rough, finely pointed. Panicles narrow but spreading in flower, up to 18 in. long, lobed. Spikelets densely crowded, flattened.

Edges of streams, ponds and in damp places. Scattered localities throughout.

*72. *Spartina townsendii* H. & J. Groves. Plant with soft, fleshy, creeping rhizomes; up to 4 ft high. Leaves bright green, stiff and spreading, sheaths overlapping, 6 to 18 in. long, ligule a dense fringe of hairs. Inflorescence of 3 to 6 upright stiff spikes.

Soft coastal mud.

*73. *Zizania latifolia* Turcz. Manchurian Wild Rice. A tall coarse plant up to 9 ft tall, with stout, far spreading rhizomes. Leaves 5 ft and more long, with stout sheaths and midribs, ligules about 1½ in. long. Inflorescence up to 2½ ft long, chestnut brown, mostly spreading below and male, upright above with female flowers.

Abundant along the Northern Wairoa River and in a few other Auckland localities.

ADDENDUM

Jussiaea sp. has recently been named *Ludwigia peploides* (Kunth) Raven subsp. *montevidensis* (Spreng.) Raven.

VEGETATIVE DIFFERENCES BETWEEN *Ruppia spiralis* AND *Potamogeton pectinatus*

<i>R. spiralis</i>	<i>P. pectinatus</i>
Leaves dark green	Leaves often brownish
Leaf sheaths often broader (sometimes greatly so) towards base, with auricles (small ears) at top	Leaf sheaths uniform in breadth, with a distinct ligule clasping the stem.
No tubers	Small underground tubers often present
Upright stems sometimes zigzag and giving off horizontal branches with hanging roots.	Stems never zigzag and hanging roots never present

PLANTS WITH YELLOW FLOWERS

<i>Bidens frondosa</i>	<i>Mimulus moschatus</i>
<i>Cotula coronopifolia</i>	<i>Ranunculus flammula</i>
<i>Iris pseudacorus</i>	<i>R. macropus</i>
<i>Jussiaea</i> sp.	<i>R. rivularis</i>
<i>Mimulus guttatus</i>	<i>R. sceleratus</i>

PLANTS WITH WHITE FLOWERS

<i>Apium nodiflorum</i>	<i>Polygonum decipiens</i>
<i>Aponogeton distachyus</i>	(usually pinkish)
<i>Egeria densa</i>	<i>P. hydropiper</i>
<i>Elodea canadensis</i>	<i>Ranunculus fluitans</i>
<i>Nymphaea alba</i>	<i>Rorippa microphylla</i>
<i>Oenanthe aquatica</i>	<i>R. nasturtium-aquaticum</i>
<i>Ottelia ovalifolia</i>	<i>Ruppia spiralis</i> (when stamens shedding pollen)

PLANTS WITH BLUE, VIOLET, OR LILAC FLOWERS

<i>Alisma plantago-aquatica</i>	<i>Myosotis caespitosa</i>
(pale lilac)	<i>Veronica americana</i>
<i>Eichhornia crassipes</i>	<i>V. anagallis-aquatica</i>
<i>Mentha</i> spp.	

PLANTS WITH FLOWERS AT THE END OF LONG THREADS

<i>Elodea canadensis</i>	<i>Ruppia spiralis</i>
<i>Lagarosiphon major</i>	

FLOATING PLANTS

<i>Azolla rubra</i>	<i>Ricciocarpus</i> sp.
<i>Ceratophyllum demersum</i>	<i>Salvinia natans</i>
(below surface)	<i>Spirodela oligorrhiza</i>
<i>Eichhornia crassipes</i>	<i>Wolffia arrhiza</i>
<i>Lemna</i> sp.	

PLANTS WHICH ARE OFTEN FOUND IN BRACKISH WATER

Chara australis
Potamogeton pectinatus
Ruppia spiralis
Spartina townsendii
Zannichellia palustris

Also *Lepilaena bilocularis*, the charophyte *Lamprothamnion macro-pogon*, and green algae — e.g., *Enteromorpha* spp. — none of which are dealt with here.

NOTE ON THE PRESERVATION OF WATER PLANTS

If water plants need to be preserved to be sent to an authority for identification they should NEVER be sent in a jar of water or thoroughly wet in a plastic bag unless they have a preservative such as formalin added. In water the absence of air plants rot to an unpleasant mess with very little material left in a condition for identification by the time they have gone through the post.

If plants are drained, the excess water mopped up by a towel, and are then put between thick layers of newspaper and if possible in corrugated cardboard, they will travel very satisfactorily unless there is a great bulk of material. Drying will continue slowly in the post. If conditions permit, it is better of course to press and dry the plants properly in the same manner as any other plant.

GLOSSARY

Inflorescence. The grouping and arrangement of flowers on a floral axis; the flower cluster.

Ligule. A small flap at the junction of a leaf blade and sheath.

Palmate. With parts (veins, lobes, segments) radiating like the fingers of a hand.

Panicle. A branched raceme (q.v.).

Pinnate. With branches coming off as in a feather; hence pinnatisect — cut to the midrib in a pinnate way.

Raceme. A simple inflorescence in which stalked flowers are arranged singly along a central stalk, the order of flowering being from the base to the apex.

Rhizoid. An organ resembling a root.

Rhizome. A more or less horizontal underground stem.

Spike. Similar to a raceme, but the flowers without stalks.

Stolon. A horizontal branch on or above the surface of the ground that roots at the tip.

Tepal. A term used for units of the outer whorls of the flower when they are not clearly differentiated into a typical corolla and calyx.

Umbel. An inflorescence, often flat topped, in which the floret stalks all spring from one point, the order of flowering being from the outside inwards. They may be compound.

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<i>Carex</i> , 63–64	<i>Ottelia</i> , 35
<i>Ceratophyllum</i> , 12	<i>Paspalum</i> , 70
<i>Chara</i> , 1	<i>Phalaris</i> , 71
<i>Cladium</i> , 61–62	<i>Polygonum</i> , 15–17
<i>Cotula</i> , 28	<i>Potamogeton</i> , 41–44
<i>Drepanocladus</i> , 3	<i>Ranunculus</i> , 7–11
<i>Egeria</i> , 38	<i>Ricciocarpus</i> , 4
<i>Eichhornia</i> , 47	<i>Rorippa</i> , 14
<i>Eleocharis</i> , 55–56	<i>Ruppia</i> , 45
<i>Elodea</i> , 36	<i>Salvinia</i> , 6
<i>Glyceria</i> , 65–67	<i>Scirpus</i> , 57–60
<i>Iris</i> , 52	<i>Spartina</i> , 72
<i>Juncus</i> , 53–54	<i>Spirodela</i> , 49
<i>Jussiaea</i> , 19	<i>Typha</i> , 51
<i>Lagarosiphon</i> , 37	<i>Veronica</i> , 32–33
<i>Lemna</i> , 48	<i>Wolffia</i> , 50
<i>Lilaeopsis</i> , 26	<i>Zannichellia</i> , 46
<i>Ludwigia</i> , 18	<i>Zizania</i> , 73