Key to Chlorophyceae - the green seaweeds

1 Found growing inside other plants or within the shells or outer coverings of animals 2
Found growing attached to the surface of a variety of substrata including rocks, shells or seaweeds, occasionally loose-lying on sand and mud 17

2 Growing in between the cells of other seaweeds 3
Growing inside the inhabited or empty shells of molluscs, barnacles or serpulids 10

3 Plant a single cell, sometimes connected to other cells by non-cellular tubes 4
Plant a creeping network of cellular filaments 6

4 Cells very irregular in shape, containing a mosaic of numerous plastids; cells often bear colourless hairs and are interconnected by colourless tubes .....Blastophysa rhizopus
Cells spherical - ovoid, only irregular in shape if several crammed together; each contains a single dense plastid. Hairs absent; cells never joined together by tubes 5

5 Cells 6-100 um across depending on species, unstalked, found amongst the cells of various plants especially Dilsea, Polysiphonia, Rhodingia and Zostera ..... Chlorochytrium spp.
Cells 60-90 um long x 20-30 um wide, deep green but on a transparent stalk 35-55 um long x only 3-4 um wide, upright amidst the filaments of Petrocelis Codiolum petrocelidis

6 Bristle-like hairs borne on at least some of the cells, vegetative filaments 4-40 um wide 7
Bristle-like hairs completely absent, filaments only 3-8 um wide Entocladia viridis

7 Colourless hair continuous with a pigmented cell at its base; vegetative filaments 12-15(-40) um in diameter 8
Colourless hair cut off from the pigmented cell at its base; vegetative filaments only 4-10 um in diameter 9

8 Hairs swollen at base, ± straight; frequently in clusters of 3-5; cells of vegetative filaments only 12-16 um wide; in and on various seaweeds especially Chorda ..... Bolbocoleon piliferum
Hairs not swollen at base, often slightly corkscrewed, borne singly or in 2's(3's); cells of vegetative filaments 12-40 um across, in various seaweeds Phaeophila dendroides

9 Erect Branches, if present, often single-celled, hairs arise from tips of erect branches if present or from distinct bumps on the creeping filaments; (1-) several pyrenoids per cell, one often larger than the rest; inside various algae, but especially Chorda ..... Acrochaete repens

Erect branches never present; hairs arise from normal vegetative cells, not on bumps; 2-3 pyrenoids per cell, all of similar size; in various algae ..... Ectochaete leptochaete

10 Inhabiting the outer membranous 'skin' (periostracum) covering the shell of Littorina littoralis. Branched filaments of cigar-shaped cells ..... Tellamia intricata

Inhabiting the calcareous part of the shell of a variety of animals (can only be examined by dissolving away the shell); thallus of various forms but cells not cigar-shaped 11

11 Plant a single green cell up to 250 um long x 150 um wide, often with a short colourless tail of more elaborate rhizoids at one end or on the side ..... Codiolum spp.

Plant filamentous or tubular or a cluster of cells 12

12 Thallus a ± gelatinous cluster of cells, each cell 5-10 µm across, sometimes with short filaments protruding from the edge Aphanothece halophysalis deusta (a blue-green alga)

Thallus long, filaments or tubes, 1-25 um in diameter 13

13 Plant a network of branched tubes 1-4 um wide, with no cross walls, but with irregular swollen vesicles 20-50 um across at intervals ..... Ostreobium queketii

Plant filamentous, branched or unbranched, divided into cells by obvious or faint cross walls; often very irregular in width (1-25 um), but not vastly swollen at intervals 14

14 Filaments only 1-2 um wide, rarely branched, forming tangled masses ..... Schizothrix calcicola (a blue-green alga)

Filaments 4-25 um wide, branched, forming a ramifying network 15

15 Bristle-like hairs usually present on at least some cells; cells very irregular in shape, 13-25 um wide ..... Phaeophila dendroides

Bristle-like hairs lacking; cells uniformly cylindrical, only 4-13 um wide 16

16 Plastid ± completely filling the cell, cross walls thin and fairly inconspicuous, cross walls often absent from the bases of branches; usually found on upper shore especially in shells of living Littorina ..... Entocladia perforans

Plastid rarely filling the cell, cross walls conspicuous up to 30um thick, usually present at the bases of branches; found subtidally and in estuaries or in cast-up dead shells ..... Eugomontia sacculata

17 Plants microscopic, single cells or filamentous strings of cells or non-cellular tubes, only discernable to unaided eye if filaments are united into tiny discs or cushions 18

Plants macroscopic, of various forms but individuals usually visible to the naked eye on close scruting or, if unicellular or composed of very fine filaments then present in easily seen masses 51

18 Growing on rock, pebbles, empty shells, mud or other non-living substrata 19

Growing on other plants or animals 29

19 Plant composed of tiny tubes with no cross walls or of single cells, isolated or on the ends of empty tubes or stalks, occasionally 4 or 5 cells can partially join end to end to form a short filament which very readily fragments into separate cells 20

Plant obviously made up of numerous cells of various forms, tiny cushions or sheets, erect membranes or filaments of firmly adhering cells 24

20 Thallus non-cellular, tiny tangles of thin tubes with no cross walls but ending in sausage-shaped swellings (utricles) juvenile Codium spp.

Thallus a single cell or several isolated cells on the ends of colourless tubes or loosely aggregated into very short chains 21

21 Cells stalked, usually on rock or other hard substrata on the shore 22

Cells not on stalks, usually on mud in salt marshes ..... Stichococcus bacillaris

22 End cell 30-100 µm wide x 135 µm - 1.5 mm long, stalk unbranched 23

End cell only 7-11 µm wide x 13-20 µm long, stalk much branched ..... Prasinocladus marinus

23 Thallus tapers gradually from apex to base, stalk 8-14 um wide expands smoothly almost imperceptibly into the cell which may widen to 30-60(-70) um at its distal tip ..... Codium pusillum

Thallus expands abruptly from a stalk 15-40 um wide to a distal cell 50-100 um wide Codiolum gregarium

24 Thallus an erect, usually unbranched filament or ribbon 25

Thallus of creeping usually much branched filaments ± united into prostrate discs, cushions or sheets 26

25 Frond a single row of cells 65

Frond of 2 - several rows of cells lying side by side, sometimes also more than 1 cell layer thick and constricted at intervals Rosenvingiella polyrhiza

26 Disc or crust only 1 layer of cells thick 27

Disc of cushion several cells layers thick, at least in centre 28

27 Thallus a crust, sometimes extensive; composed of irregularly radiating filaments although filamentous nature only apparent at periphery; cells 6-12 um in diameter; plastid with 1 pyrenoid; usually intertidal ..... Pseudendoclonium marinum

Thallus a disc, rarely exceeding 5 mm in diameter; obviously composed of radiating filaments; cells up to 15-25 um across; plastid lacking pyrenoids; usually subtidal ..... Ulvella lens

28 Prostrate often gelatinous cushion formed of fused creeping filaments producing closely packed erect filaments up to 15(-25) cells long; often with long hairs growing from the end cells of the epright filaments ..... Pilinia rimosa

Prostrate disc of fused radiating overlapping filaments; hairs absent ..... Ulvella lens

29 Growing on animals 30

Growing on other seaweeds 32

30 Found on Polyzoa, hydroids and soft corals, especially Alcyonidium, Flustra and Membranipora ..... Epicladia flustrae

Found on mollusc shells, especially Littorina 31

31 Thallus a ± regular disc formed of fused radiating filaments; often several cells thick in the centre ..... Pseudulvella applanata

Thallus irregular in shape; often a central plate of fused cells with irregular filaments at the margin; usually only 1 layer of cells thick even in the centre ..... Entocladia perforans

32 Bristle-like hairs on at least some of the cells 33

Bristle-like hairs completely absent 41

33 Plant usually several minute ovoid-irregular bladders 50-120 µm across, packed with numerous green plastids, bladders often interconnected by non-cellular colourless tubes only 8-15 um in diameter, found on various seaweeds but especially on Enteromorpha and Dumontia ..... Blastophysa rhizopus

Plant filamentous with obvious cross walls, each cell with a single green plastid, filaments often irregular in width but never exceeding 40 µm in diameter usually 3-15 um; never distended into larger vesicles 34

34 Colourless hair continuous with a pigmented cell at its base; filaments 10-15(-40) um wide, hairs usually abundant and obvious 35

Colourless hair cut off from the pigmented cells~~xtxxitxxwxxmxxfxixxxmxtx~~ of the filament by a basal cell wall; filaments only 3-10 µm wide; hairs may be sparse - abundant 39

35 Base of hair swollen and pigmented 36

Base of hair colourless and not swollen 38

36 Hairs arising from almost every cell on the upper side of the plant, except at the very edge of of the plant; plastid with only one pyrenoid, on various algae and Zostera, in the subtidal and intertidal; and on flowering plants on salt marshes 37

Hairs usually abundant, often arising in clusters, but not from every cell; plastid with (1-)5-10 pyrenoids, on various algae but especially Chorda in the subtidal ..... Bolbocoleon piliferum

37 Plant a tiny irregular disc of only 1 layer of fused radiating filaments although occasionally a filament comes to lie on top of the others making locally a tissue 2 cells thick; cells 10-30 µm wide ..... Ochlochaete histrix

Plant a tiny disc or hemispherical cushion; at least 2 layers of cells thick except at the edges, cells 12-16 um wide .... Chaetobolus gibbus

38 Hairs long and straight, arising from almost every cell, plastid with only 1 pyrenoid ..... Ochlochaete hystrix

Hairs long and often undulate or slightly corkscrewed, may be abundant but not arising from anything like every cell; plastid with several pyrenoids ..... Phaeophila dendroides

39 Erect branches if present, often single-celled, hairs sometimes with a transparent basal collar, arise from tips of erect branches or from distinct bumps on the creeping filaments; on various algae especially Chorda ..... Acrochaete repens

Erect branches never present; hairs never with a basal collar, arise from normal vegetative cells not on bumps; on various algae 40

40 Plastid with 1 pyrenoid ..... Ectochaete wittrockii

Plastid with 2-3 pyrenoids ..... Ectochaete leptochaete

41 Plant a single cell stalked or sitting directly on the host plant 42

Plant filamentous, filaments radiating to form a disc or cushion, or ramifying to form a network 43

42 Cell spherical or pear shaped, usually as wide as or wider than tall; tapering toward the base, where it is attached to the host directly or sometimes by an almost imperceptible stalk ..... Sykidion dyeri

Cell ovoid, oval or elongate, usually much longer than wide, tapering basally to a distinct stalk ..... Characium marinum

43 Thallus of usually branched creeping filaments adpressed or fused to form prostrate discs or sheets 44

Thallus of branched creeping filaments which ramify as a network over the host, rarely forming discs or sheets 50

44 Creeping filaments branch only in one plane to form a thallus only 1 cell thick throughout 45

Creeping filaments also branch in a second plane to give rise to erect filaments at least in the older central part of the thallus 47

45 Pyrenoids 1(-4) present in each cell 46

Pyrenoids lacking ..... Ulvella lens

46 Thallus a minute disc rarely exceeding 200 µm in diameter, fairly obviously composed of fused radiating filaments .... Pringsheimiella scutata

Thallus irregular in shape, may reach many mm across; cells arranged randomly; filamentous nature only apparent at margins of thallus ..... Pseudendoclonium marinum

47 Pyrenoids absent ..... Ulvella lens
Pyrenoids present, 1 per cell 48

48 Rhizoids produced in the central region of the thallus attaching it to the substratum 49
Rhizoids lacking ..... Pseudulvella applanata

49 Erect filaments loosely aggregated, not fused; usually intertidal; on various algae but especially Fucus ..... Pseudopringsheimia fucicola
Erect filaments fused into vertical rows; usually subtidal; on various algae but especially Laminaria ..... Pseudopringsheimia confluens

50 Each cell with a single pyrenoid ..... Ectochaete wittrockii
Each cell with 2-3 pyrenoids ..... Ectochaete leptochaete

51 Plant not multicellular; either a single cell, or a tiny noncellular balloon, or if larger, constructed of tubes lacking cross walls 52
Plants obviously cellular when viewed under a microscope; filamentous or if forming tubes or sheets, surface clearly a mosaic of cells 63

52 Individual plants large enough for their shape to be clearly evident to the unaided eye 53
~~Xxxxx~~ Individual plants too small to be clearly seen without the aid of a handlens or microscope, but collectively forming obvious velvety patches on rock or mud 61

53 Thallus coarse, sturdy, spongy, ± opaque, at least at the base; a pinch of tissue examined microscopically reveals densely packed non-cellular tubes ending in sausage-shaped swellings (utricles) 54
Thallus delicate, flimsy, ± transparent; if tubular, obviously so on external examination and tubes do not end in swollen utricles 59

54 Plant an unbranched crust, cushion or sphere or an encrusting mass of tiny 'finger tips' 55
Plant an erect, much branched miniature of thin green 'fingers' 57

55 Thallus a hollow ball 20-100(-200) mm tall, surface smooth ..... Codium bursa
Thallus rarely more than 15 mm tall, never hollow 56

56 Plant an irregularly shaped prostrate velvety crust or cushion with an uneven, folded surface; on lower shore ..... Codium adhaerens
Plant a mass of smooth 'finger-tips' crowded together; on upper shore .. 'amphibium' stage of Codium spp.

57 Utricles with a definite nipple or spike on the tip ..... Codium fragile
Utricles smooth tipped, usually rounded but even if pointed lacking a terminal nipple 58

58 Thallus ± cylindrical but noticeably flattened where it branches; branching repeated regular forkings; hair scars situated well below the tip of the utricle or if high up, at a constriction so that the utricle expands above them ..... Codium tomentosum
Thallus ± cylindrical throughout; branching regular or irregular forkings often plus irregularly produced later offshoots; hair scars usually situated high on the shoulders of the utricle never at a constriction, so that the utricle tapers immediately above them Codium vermilara

59 Plant a tiny undivided balloon only 5-10(-15) mm tall .... Halicystis ovalis
Plant a ± erect branched tuft of tubes 10-100 mm tall 60

60 Thallus usually sparsely branched, tubes only 30-70 um wide, reproductive organs if present conspicuous ± spherical bodies held on the branches by short stalks ..... Derbesia marina
Thallus usually a beautiful much branched feather of tubes, main axis 300-500 um wide, reproduction organs merely branches modified internally ..... Bryopsis plumosa

61 Plant an erect unbranched colourless stalk with a single green cell on top, usually on rocky shores 62
Plant a creeping mass of much branched tubes, usually on mud or sand on salt marshes or in estuaries ..... Vaucheria sp.

62 Thallus tapers gradually from apex to base, stalk 8-14 µm wide expands smoothly almost imperceptibly into the cell which may widen to 30-60(-70) um at its distal end ..... Codiolum pusillum
Thallus expands abruptly from a stalk 15-40 um wide to a distal cell 54-100 um wide ..... Codiolum gregarium

63 Plants clearly filamentous, composed of a single row of cells end to end, sometimes 2 cell rows wide, branched or unbranched 64
Plants usually expanded into sacs, tubes or membranes composed of a mass of cells; if thread-like 3 or more cell rows wide 107

64 Filaments always a single row of cells, branched or unbranched 65
Filaments wholly or in part 2 cells wide, unbranched or sparsely branched 105

65 Thallus unbranched except for basal attachment rhizoids 66
Thallus sparsely to profusely branched 79

66 Individual filaments visible to the unaided eye, broadest part 30 µm or more wide 67
Individual filaments too fine to be clearly discerned without a handlens, broadest part less than 30 µm wide 74

67 Filament tapering towards the base where it is attached to the substratum by the basal cell or by rhizoids; cells cylindrical, barrel-shaped or almost spherical, side walls often constricted between cells 68
Filament more or less constant width along its entire length; unattached, forming entangled masses, cells cylindrical, side walls not constricted between the cells 72

68 Plants usually firm or even stiff; rough to the touch, not slimy; attached by a basal cell or by a rhizoid which arises from what appears to be a single, large (up to 1 mm or more long) basal cell 69
Plants usually soft and limp, often somewhat slimy to the touch; attached by several rhizoids each emerging from one of the small (only 50-60 um long) basal cells 70

69 Colour dark green with a bluish sheen, tough, looks beaded even to the naked eye, terminal cells usually 260-800(-1060) um wide, cells immediately above large basal cell are 8-14 x as long as broad (cells in rest of filament mostly 2-3 x); typically found as single filaments or in small groups on clean rock.. Chaetomorpha melagonium
Colour dull green at base, often fading towards the tip; somewhat fragile; looks segmented rather than beaded to the naked eye; terminal cells usually 120-350(-585) um wide; cells immediately above large basal cell only 1-4 x as long as broad (mostly 1-2 x elsewhere), typically found in dense clusters on sandy rock ..... Chaetomorpha linum

70 Widest cells only 30-150 um across, attachment rhizoids usually emerge from each of the 4-6 lowermost cells 71
Widest cells 100-3009-1200) um wide, rhizoids are produced from each of the 12-15(-20) lowermost cells ..... Urospora wormskjoldii

71 Colour a brilliant yellowish green; filaments curled and coiled around each other; cells always much shorter than broad ... Urospora speciosa
Colour green or if yellowish faded rather than bright; even if in tangled skeins the individual filaments more or less straight; cells shorter than broad to 2(-4) x longer than broad Urospora penicilliformis

72 Plastids a network of strands festooned around the cell, cells 11-33(-60) µm wide; cell walls may be fairly thick but not obviously layered ..... Rhizoclonium riparium
Plastid a dense granular mass filling the cell; cells 30-300(-700) um wide; walls thick and in obvious layers 73

73 Cells 30-80(-150) um wide; plant resembles very fine curly wool; most commonly found in rock pools, floating or entangled amongst Corallina ..... Chaetomorpha capillaris
Cells 200-300(700) um wide; plant resembles an untidy tangle of very fine fishing line, most commonly found as dense strata on mud banks, salt-marshes or in brackish pools ..... Chaetomorpha linum

74 Plastid looks like a broad, usually incomplete, wedding ring seen in side view, with only 1(-3) pyrenoids; cells sometimes shorter than broad 75
Plastid occasionally band shaped but more often filling cell with a granular mass or a network of strands; always with more than 3 pyrenoids; cells usually 1-3(-6) x as long as broad, rarely shorter 77

75 Most cells square - 2x longer than broad, only occasionally shorter than broad; cell walls usually thin and inconspicuous; generally inhabits estuaries and other brackish areas Ulothrix subflaccida
Most cells square - much shorter than broad; sometimes resemble a pile of pennies, walls usually fairly thick and conspicuous; generally inhabits fully marine situations 76

76 Each plastid with 1(-3) pyrenoids, cells (10-)18-25(-30) µm wide, fertile cells often swelling to 50-80 µm, filament attached to the substratum by a basal cell and sometimes also by rhizoids produced by adjacent cells ..... Ulothrix flacca
Each plastid with only 1 pyrenoid, never more, cells 8-16(-22) um wide, no wider when fertile; filament attached solely by the basal cell, not producing rhizoids ..... Ulothrix pseudoflacca

77 Filaments tapering towards the base where they are attached to the substratum by rhizoids; cell walls thick and in obvious layers Urospora penicilliformis
Filaments of ± constant width along entire length; unattached in entangled masses; walls may be fairly thick but not in obvious layers 78

78 Cells (6-)12-19(-26) µm wide ..... Rhizoclonium implexum
Cells (11-)20-33(-60) µm wide ..... Rhizoclonium riparium

79 Branches very similar to parent filament in cell shape and pigmentation, usually only slightly thinner; many cells long and themselves further branched 80
Branches very distinct from parent filaments, often much thinner, rhizoidal or spine-like, or colourless or all four; usually only a few cells long and unbranched 102

80 Plant less than 2 mm tall, attached to the substratum by a disc formed from the lower wall of the basal cell, rhizoids absent ..... Cladophora pygmaea
Plants usually 10mm or more tall, either completely unattached or fixed by rhizoidal cells emerging from at least the basal cells 81

81 Rhizoids almost invariably absent; plants found entangled around other algae or free-living, the intermeshed filaments forming spongy balls up to 30 mm in diameter 82
Rhizoids present whether plant attached or not [look carefully at base of plant]; plants usually forming erect tufts or creeping mats, only occasionally forming free-living balls 83

82 Apical cells 120-265 µm wide; widest cells in main filaments 170 µm or more wide, 6-12 diameters long; plant dark green when fresh turning brown when dried ..... Cladophora retroflexa
Apical cells only 40-75 µm wide; widest cells in main filaments only 90-150 µm wide, 2-5 diameters long; plant dark green whether fresh or dried ..... Cladophora battersii

83 Rhizoids can emerge from almost any cell from base of plant to apex 84
Rhizoids formed only from cells at or very near to the base of the plant 87

84 Ultimate branches 30-200 µm wide; plant bright green to dark green 85
Ultimate branches only 15-25(-30) µm wide, plant usually pale green ..... Spongomorpha aeruginosa

85 Plant an attached tuft, usually 50-100 mm tall, bound by rhizoids into matted hanks; some apical cells ± cylindrical and rounded, others tapering to a sharp, spine-like point; sometimes also short hook-like branchlets present ..... Acrosiphonia arcta
Plant attached or ~~[illegible]~~ free-living, forming creeping entangled cushions or mats, rarely more than 40 mm tall, larger if in free-living globular tufts; apical cells all ± similar, usually cylindrical and blunt-ended, if tapering not spine-like; hooked branches rare 86

86 Thallus grass green to dark green when fresh, turning brownish when dried; apical cells (55-)80-215 µm wide; found in marine or brackish conditions ..... Cladophora coelothrix

Thallus dark green whether fresh or dried; apical cells only 30-70 µm wide; a freshwater species occasionally found in brackish conditions ..... Cladophora aegagropila

87 Apical cells less than 40 µm wide 88

Apical cells 40 µm or more wide 93

88 Thickest main filaments less than 90 µm wide 89

Thickest main filaments 90 µm or more wide 94

89 Thallus usually very sparsely branched; filaments only fork 2 or 3 times, branches simple or with a scattering of short lateral branchlets; plant only 20-40(-90) mm tall; never seen attached; swollen fertile cells not produced; found characteristically in brackish waters ..... Cladophora liniformis

Thallus usually much branched; filaments fork numerous times and often bear abundant lateral branches; plant usually 50-150 mm or more tall; attached or free-living; fertile cells swollen, barrel shaped, in rows like a string of beads; found in marine or brackish waters 90

90 Ultimate branches often clearly arranged acropetally i.e. becoming progressively younger and shorter towards the tip of the plant; branches usually markedly thinner than the parent filament from which they arise ..... Cladophora oblitterata

Ultimate branches rarely arranged as above, usually a mixture of old and young branches in no obvious sequence; branches only slightly thinner than parent filament 91

91 Apical cells 3.5-15(-32) diameters long; plant free-living in brackish water, not found in fully marine conditions .... Cladophora fracta

Apical cells 1.5-8(-19) diameters long; plant attached or free-living in marine or brackish conditions 92

92 Base of branches usually adpressed to the filament from which they arise; apical cells (15-)18-40 µm or more wide, tapering to a point at the tip..... Cladophora sericea

Base of branches rarely adpressed to parent filament; apical cells 8-35(-40) µm wide, ± cylindrical and rounded at the tip Cladophora albida

93 Apical cells 40-90(-110) µm wide; plants found in marine or brackish water conditions 94

Apical cells ~~(x)~~ (90-)105-160 µm or more wide, even on the thinnest plants some apical cells exceeding 110 µm wide; plants marine, not found in brackish situations 100

94 Lowermost cells of main filaments very elongate, 16-36 diameters long 95

Lowermost cells of main filaments usually 1.5-10(-15) diameters long, very rarely more 96

95 Main filaments 250-600 µm wide; much branched, virtually every cell producing 1-5 branches, basal cells club-shaped, plant invariably attached, on the shore or in the subtidal zone, not in brackish water ..... Cladophora pseudopellucida

Main filaments only 100-275 µm wide; much or sparsely branched, sometimes giving rise to characteristic long simple Chaetomorpha-like filaments; basal cells ± cylindrical; in estuaries and brackish water, not found in fully marine conditions ..... Cladophora glomerata

96 Plants usually profusely branched dense tufts, coarse to the touch, a characteristic deep dull green colour; branches invariably stiff and straight, cell walls even in ultimate branches 2.5-5(-10) µm thick and obviously layered .... Cladophora rupestris

Plants sparsely to much branched, tufts or tangles, soft and limp or firm, but not coarse to the touch, pale to dark green; branches straight or curved, cell walls usually less than 2.5 µm thick but occasionally up to 5 µm or more; if layered, not obviously so 97

97 Ultimate branches often clearly arranged acropetally i.e. becoming progressively younger and shorter towards the tip of the plant, base of branches rarely adpressed to filament from which they arise; apical cells pointed or blunt 98

Ultimate branches usually a mixture of old and young branchlets in no obvious sequence; base of branches almost always adpressed to parent filament, especially in lower regions of plant; apical cells tapering to a point ..... Cladophora sericea

98 Thinnest apical cells usually 20 µm wide or less; branches markedly thinner than filaments from which they arise, sometimes in distinct whorls ..... Cladophora oblitterata

Thinnest apical cells always more than 20 µm wide; branches only slightly thinner than parent filament, sometimes several branches arise from the same cell but clustered, not in a whorl 99

99 Apical cells 1.5-5 diameters long; branching sparse to abundant, sometimes giving rise to characteristic long simple Chaetomorpha-like filaments; plant attached or free-living in estuaries and brackish water, never found in fully marine conditions ..... Cladophora glomerata

Apical cells (2-)4-11(-19) diameters long; usually much branched, never producing long unbranched filaments; plant invariably attached in marine conditions ..... Cladophora laetivirens

100 Plant not obviously stalked, cells, even basal cell, ± cylindrical and uniformly 1-4 diameters long, rarely more, main axis only 240-400 um wide ..... Cladophora hutchinsiae

Plant obviously stalked owing to elongate club-shaped basal cell, 10-20(-60) diameters long, cells of main axis 400-600 um wide 101

101 Rhizoids constricted at intervals, emerging from several cells near to base of plant and creeping down filaments to attach to the substratum; plant dark green when fresh turning brown when dried ..... Cladophora prolifera

Rhizoids ± cylindrical, not constricted, emerging from the basal cell and attaching directly to the substratum; plant pale to dark green whether fresh or dried ..... Cladophora pellucida

102 Branches usually colourless; cells of main filaments 1-3(-8.5) diameters long; plastid with several to numerous pyrenoids 103

Branches usually green; cells of main filaments only 0.25-0.75(-1) diameters long; plastid with 1(-3) pyrenoids 104

103 Cells (6-)12-19(-26) µm wide ..... Rhizoclonium implexum

Cells (11-)20-33(-60) µm wide ..... Rhizoclonium riparium

104 Branches rhizoidal, mostly 1 celled, rarely 2-4 celled, arising predominantly from 1 side of the filament, usually emerging in pairs side by side, occasionally singly or in 3s

Rosenvingiella polyrhiza

Branches often spine-like, usually of several cells rarely unicellular, arising singly on both sides of the filament

Ulothrix consociata

105 Plants unattached; cells 1-2 diameters long, each with 1-32-4 pyrenoids ..... Percursaria percursa

Plants attached by a basal cell and/or rhizoid(s); cells only 0.25-0.75(-1) diameters long, each with only 1 pyrenoid 106

106 Individual filaments may be single or double and are often predominantly single but 2 cells wide in places or vice versa; bases of plants clearly distinct even if growing close together; plastid ± star-shaped but difficult to distinguish; branches if present usually rhizoidal and 1 celled (rarely 2-4 celled), often in pairs ~~xx~~ together on same side of filament ..... Rosenvingiella polyrhiza

Individual filaments either single or double, not both, although often several filaments are closely packed at the base to form an almost fused mass of cells; plastid an incomplete ring seen in side view; branches, if present, often spine-like, of several cells, rarely unicellular, arising singly ... Ulothrix consociata

107 Thallus hollow, although if walls of tube collapse looks flattened; tubular nature easily seen in transverse section or by piercing the wall and inserting a blunt needle into the central cavity; in surface view lateral margins of thallus often appear darker than central area 108

Thallus may be hollow when very young but if so soon splits into a membrane, remaining tubular only at very base if al all; edge of thallus not noticeably darker than elsewhere 118

108 Cells in surface view 4-8(-9) µm across 109

Cells 10-17 µm or more across 110

109 Thallus often less than 1 mm wide, usually ± regular in width throughout length, sometimes somewhat channelled on one side; cells in distinct longitudinal rows at least in youngest parts of the plant ..... Blidingia marginata

Thallus usually 1-5 mm wide, often irregular in width, not channelled; cells ± without order throughout the plant ... Blidingia minima

110 Cells in distinct rows often running spirally around the thallus, can frequently be easily separated if plant is squashed between 2 microscope slides; cells round or oval, often in groups of 4 with a distinct thick round envelope encircling each group of cells ..... Capsosiphon fulvescens

Cells unordered, or if in rows these run longitudinally along the thallus rather than spirally and they are very difficult to separate even under pressure; cells angular or somewhat rounded, if in groups not with conspicuous envelopes around each group 111

111 Thallus sac like or a hollow cone open distally, relatively wide in relation to its length; cells at base of plant elongate longitudinally in both directions; intertidal pools in spring ..... Monostroma grevillei

Thallus a long tube, branched or unbranched, narrow relative to its length, distal end open or intact; cells at very base of plant club-shaped elongated downwards with their tapering 'tails' running towards the base of the plant 112

112 Fronds thread-like less than 100 um wide, of more or less the same diameter from base to apex; composed of 3-8(-12) distinct longitudinal rows of cells 113

Fronds occasionally thread-like but usually obviously tubular or expanded, almost always more than 1 mm wide, increasing in diameter from base to middle; cells irregularly arranged or in numerous rows, main axis more than 12 cells wide 114

113 Plastid usually filling the cell, most cells with 1 pyrenoid a few with up to 3; cavity of tube about 12 um in diameter ..... Enteromorpha torta

Plastid rarely filling the cell, most cells with more than 1 pyrenoid (usually 2-8); cavity of tube only about 8 µm in diameter ..... Enteromorpha ralfsii

114 Majority of cells at base of frond with 1-4 pyrenoids, cells usually 8-20(-25) um across in surface view 115

Majority of cells at base of frond with more than 5 pyrenoids (usually 8-10), cells usually 25-45(-50) µm across 117

115 Cells at base of frond with 1 (rarely 2-3) pyrenoids 116

Cells at base of frond with 2-4(-7) pyrenoids, rarely 1

Enteromorpha flexuosa

116 Cells more or less irregularly arranged in basal and middle regions of frond, branched or unbranched; cell at base of branch never rhizoidal..... Enteromorpha intestinalis

Cells in basal and middle regions of frond arranged in fairly obvious longitudinal and usually also in transverse rows, usually branched; cells at base of branch clearly rhizoidal ..... Enteromorpha prolifera

117 Plant spiny in appearance and rough to the touch; much branched with both long and short, rigid, spine-like branches ..... Enteromorpha ramulosa

~~Cells in basal and middle regions of frond arranged in fairly obvious longitudinal and usually also in transverse rows, usually branched; cells at base of branch clearly rhizoidal~~

Plant often almost feathery in appearance and soft to the touch; much branched, branches often tapering towards their tips, but neither rigid nor spine-like ..... Enteromorpha clathrata

118 Plant only 1-4 mm long, very irregular in shape, often constricted at intervals into regions only 1-12 cells wide, flattened or somewhat cylindrical, but not hollow ..... Rosenvingiella polyrhiza

Plant at least 5-10 mm tall often considerably larger, shape variable, but even though lacerated never constricted at intervals, always flattened and far more than 12 cells wide except at very base ... 119

119 Thallus 2 layers of cells thick, cells irregularly arranged or in rows but not in groups 120

Thallus only 1 cell layer thick except perhaps at very base, cells usually either in rows or groups of 3-4 123

120 Texture usually limp and silky, a relatively narrow often lanceolate membrane, often with a short but obvious basal stalk; cells in sinuous longitudinal and often also transverse rows; a transverse section of the thallus reveals 2 cell layers firmly stuck together except at the edge of the thallus and in basal stalk, which are hollow ..... Enteromorpha linza

Texture firm and rubbery, a relatively broad shapeless expanded membrane, rarely with more than the most inconspicuous basal stalk; cells without order or in rows; a transverse section of the thallus shows 2 cell layers firmly stuck together throughout plant 121

121 Margin of thallus has numerous microscopic tooth-like projections; cells often in fairly distinct longitudinal and also sometimes transverse rows; most cells with 2 pyrenoids but many with 1 or 3(-8) ..... Ulva rigida

Margin lacking tooth-like projections; cells usually without order although not infrequently in rows in small areas of the thallus; most cells with 1 pyrenoid, only a few with 2-3 122

122 Usually bright green, cells 14-18(-20) um across in surface view ..... Ulva lactuca

Usually yellowish, brownish or dark olive green, cells (15-)18-35 um across ..... Ulva olivascens

123 Plant not more than 13 mm long, cells 2-10 um across, usually grouped in 4s these groups arranged in larger blocks separated by thicker walls, resembles the street plan of a city, basal cells not markedly elongate 124

Plant typically 40-150(-300) mm long, plant often resembling a very flimsy Ulva, cells 14-25(-40) µm across, unordered or in rows or in groups of 2-4, but these groups not obviously arranged in larger blocks; basal cells longitudinally elongated up to 100 µm or more long 125

124 Attached by a basal disc without rhizoids, usually stalked; forms slippery patches on the upper shore ..... Prasiola stipitata

Attached by rhizoids or completely free-living, rarely stalked; in the splash zone or above ..... Prasiola crispa

125 Basal cells usually longitudinally elongate but tapering or drawn out at both ends like a cigar or a spindle ..... Monostroma grevillei

Basal cells club-shaped, each with a colourless threadlike rhizoidal 'tail' pointing downward towards the base of the plant 126

126 Plant usually dark green; usually 2-6 pyrenoids in each cell; cells closely set, walls not very gelatinous ..... Ulvaria obscura

Plant usually pale green; usually 1(-3) pyrenoids per cell, cells often widely separated by gelatinous walls especially if growing at low salinities* ..... Ulvaria oxysperma

*not uncommon in intertidal areas.