Key to Red, Green and Brown Seaweed

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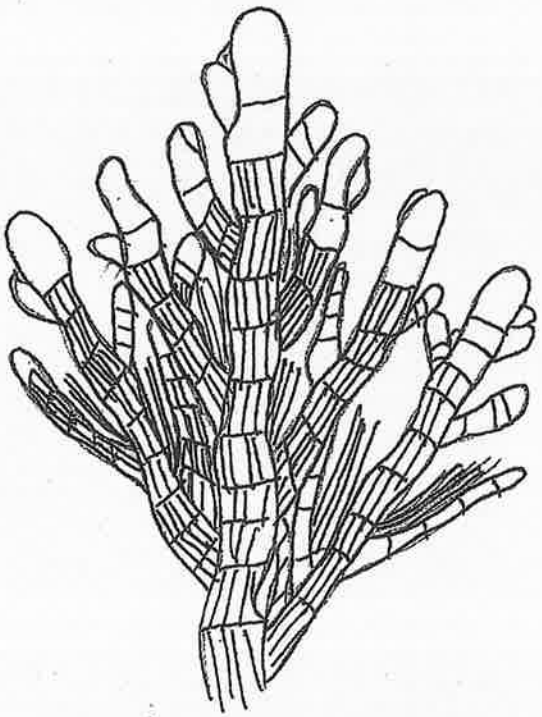

KEY TO THE DIVISIONS OF ALGAE

1. Cells with grass-green plastids; iodine test for starch (turns black) positive..... .....**Chlorophyta***
1. Cells with brown or red plastids; iodine test for starch negative.....2
2. Cells with olive to dark-brown plastids; boiling water test results in no colour change.....**Phaeophyta**
2. Cells with red plastids; boiling water test results in green colouration..... .....**Rhodophyta**

(Xanthophyceae, but included in this section for convenience)
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*Vaucheria has green plastids but does not respond to the iodine test.

Prasinophyceae (Prasinophyta) has also been included
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KEY TO THE GREEN ALGAE

1 Plant microscopic (less than 1-2mm size or diameter) often an epiphyte, endophyte, epizoite, endozoite, rock or shell boring species.....**Section A**
1 Plant macroscopic (more than 2mm in size).....2
2(1) Plant siphonous.....**Section B**
2(1) Plant not siphonous but of cell or cell-like structures.....3
3(2) Plant filamentous.....**Section C**
3(2) Plant hollow (cylindrical) or flattened (blade-like) .....**Section D**

SECTION A

1 Plant unicellular.....2
1 Plant multicellular, siphonous or saccate.....9
2(1) Cells on branched gelatinous stalk.....**Prasinocladus lubricus** (Plate 1)
2(1) Cells not on branched gelatinous stalk.....3
3(2) Cells in chains; on mud in saltmarshes.....**Stichococcus bacillaris** (Plate 1)
3(2) Cells not in chains; not in saltmarshes.....4
4(3) Cells in clusters of two, four or eight; band-forming at high tide level, particularly in estuaries.....**Pseudendoclonium submarinum** (Plate 5)
4(3) Cells not so.....5
5(4) Cells endophytic in *Petrocelis*....."**Codiolum petrocelidis" life-history stage**
5(4) Cells not endophytic in *Petrocelis*.....6
6(5) Plant with thickened cell wall, forming distinct rhizoidal processes; epilithic or shell-boring....."**Codiolum" stages, Eugomontia and Gomontia** (Plate 1)
6(5) Plants without thickened cell wall; attachment processes if present very small; endophytic or epiphytic.....7
7(6) Cells large more than 30µm diameter; endophytic.....**Chlorochytrium** (Plate 1)
7(6) Cells less than 30µm diameter; epiphytic.....8
8(7) Cells globular, epiphytic on *Rhizoclonium*.....**Sykidion dyeri** (Plate 1)
8(7) Cells elongate, epiphytic on *Pilayella*.....**Characium marinum** (Plate 1)
9(1) Plant siphonous or saccate.....10
9(1) Plant multicellular.....11

10(8) Plant a saccate, bladder-like structure, bladders linked by colourless rhizoid-like thread; hairs present; epiphytic and endophytic.....**Blastophysa rhizopus** (Plate 2)

10(8) Plant siphonous, filamentous, much branched, with irregular swollen vesicles; shell-boring.....**Ostroebium queketii** (Plate 2)

11(8) Plant regularly or irregularly discoidal; may develop into a pustule.....12

11(8) Plant basically filamentous; filaments may aggregate to form a pustule or sheet.....15

12(10) Irregular shaped disc or pustule without bifurcate cells at margin.....13

12(10) A regular shaped disc of radiating filaments with bifurcate cells at margin...14

13(11) Disc monostromatic, except when fertile; hairs not reported; one pyrenoid per cell.....**Syncoryne reinkei** (Plate 2)

13(11) Disc or pustule polystromatic; produces coarse hairs in large numbers from globular cells in the central part of the thallus; one to five pyrenoids per cell.....**Ochlochaete hystrix** (Plate 4)

14(12) Discs monostromatic only at margin, central region polystromatic; disc diameter to 2mm.....**Ulvella lens** (Plate 5)

14(12) Disc monostromatic throughout except when fertile; disc diameter to 250um .....**Pringsheimiella scutata** (Plate 5)

15(11) Filaments often alternately or oppositely branched; hairs absent; grows in the periostracum of *Littorina obtusata* .....**Tellamia intricata** (Plate 2)

15(11) Filaments irregularly branched; hairs may or may not be present; not in the periostracum of *Littorina*.....16

16(15) Plant shell-boring; produces long thin hairs.....17

16(15) Plant not shell-boring; may or may not produce hairs.....19

17(16) Plastids usually lobed; hairs present.....18

17(16) Plastids usually reticulate; hairs absent.....**Eugomontia sacculata**

18(17) Cells of a filament 13-25um across; hairs twisted.....**Phaeophila dendroides** (Plate 4)

18(17) Cells of a filament 3-12um across; hairs not twisted.....**Phaeophila tenuis** (Plate 2)

19(16) Hairs have characteristic basal swellings; cell-wall separates swollen hair base from the cell below; plants epiphytic not epizoic.....20

19(16) Hairs may or may not be present, if present then not as above; plants endophytic and epiphytic, epizoic or epilithic.....22

20(19) One pyrenoid per cell; on various algae **Acrochaete viridis**, on brown algae.....**Acrochaete wittrockii** (Plate 3)

20(19) More than one pyrenoid per cell.....21

21(20) Filaments 4.5-10µm across; two (to six) pyrenoids per cell; chloroplast slightly lobed; on various algae.....**Acrochaete leptochaete** (Plate 3)

21(20) Filaments 10-25µm across; three (to six) pyrenoids per cell; chloroplast reticulate; grows among paraphyses of *Chorda* and surface cells of *Fucus*.....**Acrochaete repens** (Plate 3)

22(21) Plant on or in Bryozoans and hydroids; do not produce hairs.....23

22(21) Plants on other substrates; may or may not produce hairs 25

23(22) Endozoic in *Alcyonidium*; filaments to 3.5µm across, x6-12 as long as broad; filaments aggregate to form a pustule or layer.....**Epicladia phillipsii** (Plate 3)

23(22) Not in *Alcyonidium*; filaments more than 3.5µm diameter and cells less than x6-12 as long as broad; filaments aggregate to a pustule or layer.....24

24(23) Endozoic in *Dynamena*; filaments 4.5µm across, cells x2-4 as long as broad; central cells 2-3µm diameter.....**Pseudendoclonium dynamenae** (Plate 5)

24(23) In/on *Flustra* and *Securiflustra*; filament to 5µm across, cells x2-4 as long as broad; central cells 10-15µm diameter.....**Epicladia flustrae** (Plate 3)

25(22) Does not produce hairs; one pyrenoid per cell; grows on various substrates (*Zostera*, *Fucus*, wood and rock).....26

25(22) Produces characteristic hairs; hairs a part of a small cell containing a ~~chloro~~plast; three to twelve pyrenoids per cell; epi/endophytic in the decaying parts of various algae (especially *Dumontia*).....**Bolbocoleon piliferum** (Plate 4)

26(25) Filamentous; endophytic in the epidermal cells of loose-lying leaves of *Zostera marina*.....**Epicladia perforans** (Plate 3)

26(25) Filaments aggregate into sheets or pustules; not on *Zostera*.....27

27(26) Plant pustular, epiphytic.....28

27(26) Plant sheet-forming, on wood and stone.....**Pseudendoclonium submarinum** (Plate 5)

28(27) Pustules 250µm thick; cells 10-12µm diameter; epiphytic on *Laminaria* stipes .....**Pseudopringsheimia confluens** (Plate 5)

28(27) Pustules 75µm thick; cells 5-7µm diameter; epiphytic on *Fucus*.....**Pseud~~opringsheimia~~ fucicola** (Plate 5)

SECTION B

1 Plants pea-sized, non-cellular balloons.....2

1 Plants of filaments lacking cross walls.....3

2(1) Plastids discoid with no pyrenoids.....**"Halicystis ovalis" life-history stage of Derbesia marina** (Plate 6)

2(1) Plastids spindle-shaped with one or two pyrenoids.....

.....**"Halicystis parvula" life-history stage of Derbesia tenuissima** (Plate 6)

3(1) Delicate filamentous plants.....4

3(1) Coarse spongy plants, cylindrical, globular or prostrate, comprising a mass of aggregated filaments.....8

4(3) Plants apically regularly branched, branches arising from a distinct main axis...

4(3) Plants a mass of irregularly branched filaments.....6

5(4) Ultimate branches distichously arranged, plant feather-like..... .....**Bryopsis plumosa** (Plate 6)

5(4) Ultimate branches spirally arranged.....**Bryopsis hypnoides** (Plate 6)

6(5) Plants stain black with iodine.....7

6(6) Plants do not stain black with iodine.....**Vaucheria** spp. (Plate 6)

7(6) Plastids discoid, lacking pyrenoids.....**Derbesia marina** (Plate 6)

7(6) Plastids spindle-shaped with one or more pyrenoids..... .....**Derbesia tenuissima** (Plate 6)

8(3) Plant prostrate forming a velvety layer.....**Codium adhaerens** (Plate 7)

8(3) Plant globular, or erect and terete.....9

9(8) Plant erect, terete and dichotomous or irregularly branched.....10

9(8) Plant a hollow ball.....**Codium bursa** (Plate 7)

10(9) Tips of filaments (utricles) with a distinct point (mucron).....11

10(9) Tips of filaments rounded (without mucrons).....12

11(10) Fronds terete throughout; utricles with a small mucron less than 150µm long.... .....**Codium fragile** ssp. **atlanticum** (Plate 7)

11(10) Fronds flattened below dichotomies; utricles with a long pointed mucron to 680µm long.....**Codium fragile** ssp. **tomentosoides** (Plate 7)

12(10) Frond dichotomously branched; utricles broad and rounded, hairs/hair scars on constriction below utricle.....**Codium tomentosum** (Plate 7)

12(10) Frond irregularly branched, hairs/hair scars just below the broad rim of the utricle.....**Codium vermilara** (Plate 7)

SECTION C

1 Filaments unbranched or only with short lateral, or basal rhizoidal out-growths.....2

1 Filaments profusely branched.....16

2(1) Plastids stellate, axile; growing in the splash zone often in bird-roosts..... .....**Rosenvingiella polyrhiza** (Plate 10)

2(1) Plastids reticulate or band-shaped, parietal; not in the spray zone or bird-roosts.....3

3(2) Plastids band-shaped.....4

3(2) Plastids reticulate.....8

4(3) Plants with smooth-surfaced cell walls uncontaminated by microparticles and organisms.....5

4(3) Plants with rough-surfaced cell walls contaminated by microparticles and organisms.....6

5(4) Diameter of cells (10)-15-64-(85)µm; filament wall of constant thickness, filament tightly curled in reproductive state.....**Ulothrix speciosa** (Plate 8)

5(4) Diameter of cells (8)-10-25-(29)µm; filament wall of variable thickness; filament not tightly curled when reproductive.....**Ulothrix palusalsa**

6(4) Growth habit a complex of basal and erect systems, filaments often coalescent; filament diameter (4)-15-33-(44)µm; cell walls thick; marine species on hard substrate.....**Ulothrix flacca** (Plate 8)

6(4) Growth habit an upright single filament, not coalescent; filament diameter (4)-8-16-(26)µ, brackish species in saltmarshes.....7

7(6) Filament diameter (4)-10-15-(26)µm wide; secondary basal rhizoids frequently present; not on soil in saltmarshes.....**Ulothrix implexa** (Plate 8)

7(6) Filament diameter (5)-8-12-(13)µm; secondary rhizoids absent; on soil in saltmarshes.....**Ulothrix subflaccida** (Plate 8)

8(3) Rhizoidal outgrowths present along filament; forms felty mats..... .....**Rhizoclonium riparium** (Plate 9)

8(3) Rhizoidal outgrowths absent along filaments; does not form felty mats.....9

9(8) Coarse filaments, if attached then by basal cell; filament does not adhere to substrate; cell walls thick.....10

9(8) Fine, soft filaments, if attached then by rhizoidal downgrowths from basal cell or cell above; adheres firmly to a substrate (sometimes shiny in appearance); cell walls thin.....13

10(9) Plant cotton-wool like; filaments soft, 40-80µm diameter; often unattached entwining other algae, forming large skeins..... .....**Chaetomorpha capillaris** (Plate 9)

10(9) Plant not cotton-wool like; filaments stiff, over 100µm diameter; attached solitary filaments or entwining.....11

11(10) Plant a single bristle-like filament, 210-1050µm diameter, dark green in colour.....**Chaetomorpha melagonium** (Plate 9)

11(10) Plants rarely solitary, often entangled, 120-585µm diameter, light green in colour.....12

12(11) Plant attached, on rocky shore.....**Chaetomorpha aerea**

12(11) Plant loose-lying in saltmarshes and estuaries.**Chaetomorpha linum** (Plate 9)

13(9) Plants attached by a single rhizoid from the basal cell; filament diameter 15-50µm.....**Urospora neglecta** (Plate 8)

13(9) Plants attached by several rhizoids arising from the basal and neighbouring cells; filament ~~diameters usually larger~~, over 50µm diameter.....14

14(13) Cells distinctly barrel-shaped, more than 150µm diameter.....**Urospora wormskioldii** (Plate 8)

14(13) Cells cylindrical, less than 150µm diameter.....15

15(14) Cells in mature filaments square or longer than broad.....**Urospora bangioides** (Plate 8)

15(14) Cells in mature filaments mostly shorter than broad.....**Urospora penicilliformis** (Plate 8)

16(1) Apical cells prominent and dark in colour; rhizoidal branches may be present from base to apex.....17

16(1) Apical cells not prominent or dark in colour, rhizoids produced basally only.....20

17(16) Plants to 20mm long; cells 20-30µm diameter, uninucleate.....**Spongomorpha aeruginosa** (Plate 16)

17(16) Plants ~~longer~~ to 100mm; cells greater than 70µm diameter, multinucleate.....18

18(17) Filaments entwined to form rope-like growths, bound by hooked lateral branchlets.....**Spongomorpha arcta** (Plate 16)

18(17) Filaments not entwined to rope-like growths, no hooked lateral branchlets..19

19(18) Cells 150-200µm diameter; branching secund; plant dark green.....**Spongomorpha sonderi** ~~(Plate 16)~~

19(18) Cells 70-100µm diameter; branches arise on all sides; light green.....**Spongomorpha centralis** ~~(Plate 16)~~

20(19) Thallus minute (1-3mm high), dark green, attached to the substrate by a basal disc with irregular processes from the cell wall.....**Cladophora pygmaea** (Plate 15)

20(19) Thallus of erect tufts more than 3mm high, attachment cell not disc-shaped.....21

21(20) Plant with long clavaeform basal cell (2-36mm long); basal and lower cells longer than the apical cells.....22
21(20) Basal cells not long or clavaeform.....23
22(21) Rhizoids with annular thickenings emerge from each cell immediately above the basal cell; colourless cubical crystals in the cells; dark green,turns brown on drying.....**Cladophora prolifera** (Plate 15)
22(21) Basal cells without rhizoids; stoloniferous outgrowths sometimes formed at the extreme base of the basal cell; colourless tertrahedral crystals in the cells; does not turn brown on drying.....**Cladophora pellucida** (Plate 15)
23(21) Plants with adventitious rhizoids distally, terminating in a crampon.....
.....**Cladophora coelothrix** (Plate 15)
23(21) Plants without adventitious rhizoids distally.....24
24(23) Plants unattached; lacking rhizoids; entwining *Zostera* often in skeins.....~~25~~
.....25
24(23) Plants attached by rhizoids; not entangling *Zostera*.....26
25(24) Every cell (except the apical cell) carries one or several branches; main axes straight, terminating in a hook; apical cells 120-175(-265)µm diameter; plant turns brown on drying.....**Cladophora retroflexa** (Plate 15)
25(24) A large number of intercalary cells without branches; main axis curved, not terminating in a hook; apical cells 40-65µm diameter; plant stays green on drying.....**Cladophora battersii** (Plate 16)
26(24) Cell walls of branches (2.5)-5-10µm thick, lamellate; colourless cubical crystals in the cells; six branches arise from a single axial cell.....
.....**Cladophora rupestris** (Plate 16)
26(24) Cell walls thin, not lamellate; crystals absent; always less than six branches from a single axial cell.....27
27(26) Apical cells 90-165(-195)µm diameter.....28
27(26) Apical cells smaller.....29
28(27) Main filaments terminating in bunches of curved branches, with ramuli in acropetal order; apical cells cylindrical; main filaments 140-330µm diameter; plant 160mm high.....**Cladophora lehmanniana**
28(27) Main filaments not terminating in bunches of curved branches; apical cells more or less attenuate; main filaments 240-400µm diameter; plants to 350mm high.....**Cladophora hutchinsiae** (Plate 15)
29(27) Branches in uniiaterai rows on the upper and iower part of the thaiius.....30
29(27) No rows of branches on the lower part of the thallus.....31

30(29) Apical cells cylindrical, attenuate but not pointed; apical cell diameter 18-24µm in pale green plants, 50-70µm in dark green plants; main axis filaments 55-170µm.....**Cladophora sericea** (Plate 15)

30(29) Apical cells rounded; apical cell diameter 10-16µm in pale-green plants, 323-41µm in dark green plants; main axis filaments 22-90µm .....**Cladophora albida** (Plate 15)

31(29) Main filaments carry bunches of often terminal ramuli; branching strictly acropetal.....32

31(29) Branches absent or rare and irregular, not clustered; apices distinct.....34

32(31) Two (sometimes three) branches per articulation; diameter of lower filaments two or three times as large as the apical cells; apical cells 35-40µm diameter in pale (insolated) plants, 80-110µm in darker (shaded) plants.....**Cladophora laetevirens** (Plate 16)

32(31) Three to four (sometimes five) branches per articulation; diameter of lower filaments three to six times as large as the apical cells; apical cells narrow, 14-25µm diameter in pale plants, 30-90µm in darker plants.....33

33(32) Apical cells tapered, sometimes conical, 20-25µm diameter in pale plants, 55-90µm in darker plants.....**Cladophora vagabunda**

33(32) Apical cells rounded (sometimes slightly tapered), 14-20µm in pale plants, 35-55µm in darker plants.....**Cladophora dalmatica**

34(31) Apical cells 16-20µm diameter; branches if present, paired, short; forms floating masses.....**Cladophora globulina**

34(31) Apical cells 20-40µm diameter; main filaments with branches of varying length; plants detatched growing on or among *Zostera*..**Cladophora liniformis**

SECTION D

1 Plants filamentous or finely filiform.....2

1 Plants tubular or flattened.....6

2(1) Thalli of two cells rows.....3

2(1) Thalli with more than two cell rows.....4

3(2) Lateral rhizoidal branches present; plastids stellate with a single pyrenoid; cells shorter than wide (6 x 18µm) in uniseriate parts of plant becoming smaller and more square in biseriate parts; spray-zone levels..... .....**Rosenvingiella polyrhiza** (Plate 10)

3(2) Lateral rhizoidal branches absent; plastids parietal with two or three pyrenoids; cells paired, longer than broad (25 x 18µm); middle to upper shore levels.....**Percursaria percursa** (Plate 10)

4(2) Cells round, 4-8µm diameter; plastids stellate; tubular filament arises from a disc; upper shore to spray-zone levels.....**Blidingia minima** (Plate 13)

4(2) Cells rectangular, wider than 8µm; ~~chloro~~plast parietal; tubular filament does not arise from a disc; middle shore levels.....5

5(4) Filaments of four cells; cells 130µm long, 11µm wide; a single pyrenoid per cell; tube cavity 12µm diameter.....**Enteromorpha torta** (Plate 13)

5(4) Filaments of six to twelve cells; cells 220µm long, 17µm wide; many two to eight) pyrenoids per cell; tube cavity 8µm diameter..... .....**Enteromorpha ralfsii** (Plate 13)

6(1) Plant tubular, at least basally.....7

6(1) Plant a flattened blade.....15

7(6) Cells small, 4-8µm diameter; plastid stellate; thalli arise from a basal disc; high tide level and spray-zone.....8

7(6) Cells larger than 8µm diameter; plastid not stellate (parietal or hooded); below high tide level.....9

8(7) Inner cell walls thickened (seen in transverse section)..... .....**Blidingia chadefaudii** (Plate 13)

8(7) Inner cell walls not thickened.....**Blidingia minima** (Plate 13)

9(7) Plants golden-brown in colour; cells in distinct groups of two or four enclosed in a thick mucilaginous sheath and organised in longitudinal rows; in fresh, mildly brackish often polluted waters.....**Capsosiphon fulvescens** (Plate 10)

9(7) Plants green in colour; cells not grouped or separated by mucilaginous sheets; not restricted to fresh or brackish waters.....10

10(9) Cells irregularly arranged in middle and basal regions of thallus; plastid hooded (at apical part of cell); plant often extremely distended and saccate.....**Enteromorpha intestinalis** (Plate 14)

10(9) Cells regularly aranged in middle and basal regions of thallus; plastid not hooded - often parietal; plant not saccate.....11

11(10) Plastids ~~mainly~~ with a single pyrenoid.....12

11(10) Plastids ~~mainly~~ with more than one pyrenoid.....13

12(11) Diameter of thallus more or less the same from base to apex; thallus tubular and much branched (branches uniseriate to four cells in section)..... .....**Enteromorpha prolifera** (Plate 15)

12(11) Diameter of thallus increases from base to apex; thallus flattened, layers separate at margins and base; unbranched.....**Enteromorpha linza** (Plate 12)

13(11) Plant producing spine-like branches (often alternately long and short); cells not in transverse rows.....**Enteromorpha ramulosa** (Plate 15)

13(11) Plants branched, not spiny but feathery; cells in transverse rows.....14

14(13) Cells with two to four pyrenoids; cells lower in the frond measure 30 x 15µm, higher in the frond 12 - 18 x 10µm.....**Enteromorpha flexuosa** (Plate 13)

14(13) Cells with four to ten pyrenoids; cells measure 35-45µm diameter lower in the frond, 25 x 15µm higher in the frond (larger than in *E. flexuosa*)..... .....**Enteromorpha clathrata** (Plate 15)

15(6) Cells small to 5µm diameter, in groups of two to four, separated by mucilage; plastid stellate; at spray-zone levels.....**Prasiola stipitata** (Plate 11)

15(6) Cells larger than 5µm diameter; not in groups bound by mucilage; plastid parietal; middle to low shore levels.....16

16(15) Fronds monostromatic forming a silky and soft membrane.....17

16(15) Fronds distromatic forming a tougher, thicker sheet.....19

17(16) Frond dull-green, turning dark brown to black on drying; cells unordered, each cell with six to eight pyrenoids.....**Ulvaria obscura** (Plate 11)

17(16) Fronds light green, remaining green on drying; cells in rows or groups, each cell with a single pyrenoid.....18

18(17) Young plants saccate, splitting open when mature; lack club-shaped basal rhizoidal cells; cells with several pyrenoids....**Monostroma grevillei** (Plate 11)

18(17) Young plants sheet like; with basal club-shaped rhizoidal cells; cells mostly with a single pyrenoid.....**Monostroma (Ulvaria) oxysperma** (Plate 11)

19(16) Margin of frond near basal region with microscopic teeth; cells in middle regions in longitudinal rows, each cell with two to four pyrenoids; frond in middle region 70µm thick.....**Ulva rigida** (Plate 12)

19(16) Margin of frond near basal region without microscopic teeth; cells in middle regions not in rows, each cell with one or two pyrenoids per cell; frond in middle regions less than 70µm thick.....20

20(19) Cells in apical and middle regions rounded; cells in surface view 24 x 18µm; frond 40-60µm thick; olive-green in colour.....**Ulva olivascens** (Plate 12)

20(19) Cells in apical and middle regions not rounded; cells in surface view 18 x 13.5µm; frond 60-70µm thick; light to dark green in colour..... .....**Ulva lactuca** (Plate 12)

KEY TO THE BROWN ALGAE

1	Thallus a microscopic disc, spot, tuft or stain	**Section A**
1	Thallus much larger (macroscopic)	2
2(1)	Thallus thread like filamentous (or finely filiform)	3
2(1)	Thallus not filamentous or finely filiform	5
3(2)	Filaments mainly uniseriate, longitudinal cell divisions occasionally present	**Section B**
3(2)	Filaments with longitudinal cell divisions (parenchymatous), parts may be uniseriate	4
4(3)	Filaments with prominent apical cell; turns black on treatment with bleach	**Section C**
4(3)	Filaments without prominent apical cell; do not turn black with bleach	**Section D**
5(2)	Thallus a crust, disc, cushion or small knob of tissue	6
5(2)	Thallus not a crust, disc, cushion or small knob of tissue	7
6(2)	Thallus a crust, disc or cushion	**Section E**
6(2)	Thallus a small knob of tissue from which a tuft of filaments arises	**Section F**
7(5)	Thallus with prominent apical cell; at least in part filiform or filamentous; turns black on treatment with bleach	**Section C**
7(5)	Apical cell not prominent	8
8(7)	Thallus cylindrical, sometimes very narrowly so	9
8(7)	Thallus not cylindrical	11
9(8)	Thallus mucilaginous, wormlike, soft to touch; constituent filaments separate	**Section G**
9(8)	Thallus not mucilaginous, wormlike or soft to touch; filaments do not separate under pressure	10
10(9)	Plants bear receptacles/conceptacles and quite often bladders	**Section L**
10(9)	Plants lack receptacles/conceptacles and bladders	**Section H**
11(8)	Thallus obviously saccate or tubular	**Section I**
11(8)	Thallus not saccate or tubular, but flattened, at least in part	11
12(11)	Thallus with distinct midrib	**Section K**
12(11)	Thallus without midrib	13
13(12)	Thallus membranous, ribbon-like; often delicate	**Section J**
13(12)	Thallus cartilaginous and robust	**Section L**

KEY TO SECTION A

1	Main vegetative system erect; prostrate system indistinct; endophytic in *Brongniartella*.....**Streblonema intestinum** (Plate 1)
1	Main vegetative system prostrate or erect and prostrate.....2
2(1)	Prostrate filaments free.....3
2(1)	Prostrate filaments laterally fused.....22
3(2)	Main vegetative system prostrate.....4
3(2)	Main vegetative system erect and prostrate.....5
4(3)	One or two plastids per cell; rhizoids present; filaments do not aggregate into pseudodiscs; plurilocular sporangia multiseriate; in bryozoans.....**Endodictyon infestans** (Plate 2)
4(3)	Two or three plastids per cell; rhizoids absent; filaments aggregate into pseudodiscs; plurilocular sporangia uniseriate; in or on various algae.....**Mikrosyphar spp.** (Plate 2)
5(3)	Erect system less or equal to prostrate system.....6
5(3)	Erect system greater than prostrate system.....19
6(5)	Thallus macroscopic but very small.....7
6(5)	Thallus microscopic.....9
7(6)	Erect system of unbranched assimilatory filaments only; forming small pustules on *Cystoseira*.....**Herponema valiantei**
7(6)	Erect system of branched filaments.....8
8(7)	Erect assimilatory filaments sparsely branched; pseudohairs present; rhizoids present; plurilocular sporangia multiseriate; forming velvety patches on *Himanthalia*.....**Herponema velutinum**
8(7)	Erect assimilatory filaments branched; true hairs present; rhizoids absent; plurilocular sporangia uniseriate; endophytic in *Stilophora*.....**Streblonema stilophorae**
9(6)	Prostrate system a pseudodisc; periclinal cell divisions in the prostrate system.....**Phaeostroma pustulosum**
9(6)	Prostrate system of free filaments; periclinal cell divisions absent.....10
10(9)	One plastid per cell.....11
10(9)	Several plastids per cell.....15
11(10)	Erect system of colourless hairs only .....**Streblonema effusum** (Plate 1)
11(10)	Erect system of assimilatory filaments.....12

12(11) Erect system of assimilatory filaments only, hairs absent; endophytic in *Ascophyllum*.....**Streblonema breve** (Plate 1) 7

12(11) Erect system of hairs and filaments; not endophytic in *Ascophyllum*.....14

13(12) Erect assimilatory filaments unbranched; plurilocular sporangia uniseriate or biseriate; sublittoral; endophytic in *Ceramium* and other algae.....
.....**Streblonema parasiticum** (Plate 1) 7

13(12) Erect assimilatory filaments branched; plurilocular sporangia uniseriate; intertidal; endophytic in *Mesogloia*.....**Streblonema tenuissimum** (Plate 1) 7

14(10) Erect system of colourless hairs only; many plastids per cell; plurilocular sporangia unbranched; endophytic in *Chordaria*.....
.....**Dichosporangium chordariae** (Plate 3) 19

14(10) Erect system of hairs and filaments; one or two plastids per cell; plurilocular sporangia branched; endophytic in *Eudesme*, *Mesogloia* and *Helminthocladia*..
.....**Streblonema fasciculatum** (Plate 1) 7

15(14) Hairs as pseudohairs; epiphytic on Dictyotaceae.....
.....**Herponema solitarium** (Plate 1) 9

15(14) Hairs as true hairs; on other algae.....16

16(15) Rhizoids present.....17

16(15) Rhizoids absent.....18

17(16) Erect assimilatory filaments branched; plurilocular sporangia multiseriate; in *Dudresnaya*.....**Streblonemoid microthallus of Litosiphon pusillus**

17(16) Erect assimilatory filaments unbranched or branched; plurilocular sporangia uni- or biseriate; in *Chylocladia*.....**Streblonema zanardinii** (Plate 2) 18

18(16) Plurilocular sporangia uni- or biseriate; endophytic in *Mesogloia* and *Liebmannia*.....**Streblonema sphaericum** (Plate 2) 18

18(16) Plurilocular sporangia multiseriate; in *Chorda*.....**Phaeostroma pustulosum**

19(3) One plastid per cell; plurilocular sporangia, if present, uniseriate.....20

19(3) Several plastids per cell; plurilocular sporangia multiseriate.....21

20(19) One linear plastid per cell; erect system of assimilatory filaments; plurilocular sporangia uniseriate perpendicular to main axis, unilocular sporangia unknown; lower intertidal on *Laminaria*.....**Laminariocolax tomentosoides**

20(19) One discoid plastid per cell; erect sytem of assimilatory filaments and very long hairs; plurilocular sporangia unknown, unilocular sporangia terminal; splash-zone, epilithic.....**Pleurocladia lacustris** (Plate 3) 21

21(19) Thallus 3mm long; plurilocular sporangia elongate; epiphytic on *Padina* high .....**Feldmannia padinae** (Plate 1) 23

21(19) Thallus 2mm long; plurilocular sporangia ovoid; epiphytic on *Taonia*.....
.....**Kuetzingiella battersii** (Plate 23)

22(19) Erect filaments usually branched....23
22(19) Erect filaments usually unbranched....31
23(22) Single plastid per cell....24
23(22) More than one plastid per cell....30
24(23) Plants epilithic or epizoic....25
24(23) Plants epiphytic....27
25(24) Plurilocular sporangia unknown in Britain; unilocular sporangia occur low on paraphyses....**"Microspongium gelatinosum" life-history stage** (Plate 19)
25(24) Plurilocular sporangia present; unilocular sporangia on erect filaments....26
26(25) Plurilocular sporangia branched like a "cocks-comb; terminal on erect filaments....**Protectocarpus speciosus** (Plate 19)
26(25) Plurilocular sporangia unbranched; usually on lateral branches....**Compsonema minutum** (Plate 19)
27(24) Plurilocular sporangia uniseriate....**Microspongium globosum** (Plate 19)
27(24) Plurilocular sporangia bi- or multiseriate....28
28(27) Unilocular sporangia present on erect filaments....**Protectocarpus speciosus** (Plate 19)
28(27) Unilocular sporangia unknown....29
29(28) Basal layer of cells distromatic....**Hecatonema maculans** (Plate 20)
29(28) Basal layer of cells monostromatic....**Compsonema microspongium** (Plate 19)
30(23) Plant usually globular spots; plurilocular sporangia uniseriate....**Microspongium globosum** (Plate 19)
30(23) Plant usually tiny tufts of filaments; plurilocular sporangia bi- or multiseriate....**Hecatonema maculans** (Plate 20)
31(19) Basal layer of cells distromatic....32
31(19) Basal layer of cells monostromatic....35
32(31) Ascocysts present....**Chilionema foecundum** (Plate 20)
32(31) Ascocysts absent....33
33(32) Plants tiny tufts of filaments; cells with a single plastid; unilocular sporangia present (plurilocular sporangia unknown); epilithic....**"Compsonema saxicolum" life history stage** (Plate 19)
33(32) Plants tiny discs or spots; cells with two or three (rarely one) plastids; plurilocular sporangia present (unilocular sporangia unknown); epiphytic....34
34(33) Plurilocular sporangia to 65µm long; hairs common; epiphytic on *Palmaria*....**Chilionema ocellatum** (Plate 20) MICRO
34(33) Plurilocular sporangia to 90µm long; hairs uncommon; epiphytic on other algae....**Chilionema reptans** (Plate 20) MICRO

35(31) Plant endophytic (usually with protruding filaments), not a compact disc but loose and irregular....36
35(31) Plant not endophytic but epilithic and epiphytic, usually a compact disc or spot....38
36(35) Erect filaments usually unbranched; endophytic in *Laminaria* and *Dumontia*....37
36(35) Erect filaments usually branched; endophytic in *Mesogloia* and *Sauvageaugloia*.... **Strepsithalia buffhamiana** (Plate 5) 21
37(36) Ascocysts present; plurilocular sporangia uniseriate; unilocular sporangia present; endophytic in *Laminaria*.... **Gononema aecidioides** (Plate 5) 21
37(36) Ascocysts absent; plurilocular sporangia biseriate; unilocular sporangia unknown; epi-/endophytic on *Dumontia*.... **Ulonema rhizophorum** (Plate 4) # 20
38(35) Plant epilithic....39
38(35) Plant epiphytic....40
39(38) Apical cells ascocyst-like; plant 1-2mm; erect seven to twelve cells long; plurilocular sporangia present (unilocular sporangia unknown).... **Myrionema liechtensternii** (Plate 4) 20
39(38) Apical cells not ascocyst-like; plants usually more than 2mm diameter; erect filaments to twenty-five cells long; unilocular sporangia present (plurilocular sporangia unknown).... **"Microspongium gelatinosum" life-history stage** (Plate 5) 19
40(38) Ascocysts present....41
40(38) Ascocysts absent....43
41(40) Ascocysts narrowly linear (11µm wide, 45-125µm long); plurilocular sporangia uniseriate; unilocular sporangia present.... **Myrionema magnusii** (Plate 5) 21
41(40) Ascocysts conical (wider than 11µm, to 50µm long); plurilocular sporangia bi- or multiseriate; unilocular sporangia absent....42
42(41) Plastids multilobed; hairs frequent.... **Chilionema foecundum** (Plate 4) 20
42(41) Plastids platelike; hairs not infrequent.... **Chilionema hispanicum** (Plate 4) 20
43(40) Erect filaments with short lateral protuberences.... **Myrionema papillosum** (Plate 5) 21
43(40) Erect filaments without lateral protuberences....44
44(43) Plurilocular sporangia bi- or multiseriate....45
44(43) Plurilocular sporangia uniseriate....47
45(44) Erect filaments three to seven (nine) cells long, 4-9µm wide; plurilocular sporangia (uni- and) biseriate.... **Myrionema strangulans** (Plate 5) 21
45(44) Erect filaments 10-17cells long, 8-13µm wide; plurilocular sporangia bi- and multiseriate....46

46(45) Plurilocular sporangia to 65um long; hairs common; epiphytic on *Palmaria*.....
.....**Chilionema ocellatum** (Plate 4) 20

46(45) Plurilocular sporangia to 90um long; hairs uncommon; epiphytic on other algae.....**Chilionema reptans** (Plate 4) 20

47(44) Downgrowing rhizoidal filaments present; epiphytic on *Dumontia*.....
.....**Ulonema rhizophorum** (Plate 4) 20

47(44) Downgrowing rhizoidal filaments absent; epiphytic on *Laminaria*, *Enteromorpha* or *Ulva*.....48

48(47) Erect filaments clavate, more than 5um wide; plurilocular sporangia to 50um long; unilocular sporangia present; usually on *Enteromorpha* and *Ulva*.....
.....**Myrionema strangulans** (Plate 5) 21

48(47) Erect filaments linear, less than 5um wide; plurilocular sporangia to 125um long; unilocular sporangia absent; on *Laminaria*.....
.....**Myrionema corunnae** (Plate 5) 21

KEY TO SECTION B

1 Erect system greater than prostrate system.....2

1 Erect system less than or equal to prostrate system.....26

2(1) Occasional longitudinal cell divisions present.....27

2(1) Longitudinal cell divisions absent.....3

3(2) Thallus less than 10mm.....4

3(2) Thallus more 10mm.....11

4(3) Erect system as assimilatory filaments only; one linear plastid per cell.....
.....**Laminariocolax tomentosoides** (Plate 6) 22

4(3) Erect system as hairs or pseudohairs and assimilatory filaments; more than three discoid plastids per cell.....5

5(4) Plurilocular sporangia uniseriate resembling a "cocks comb"; epilithic, in caves and crevices.....**Pilinia rimosa** (Plate 6) 25

5(4) Plurilocular sporangia multiseriate not resembling a "cocks comb"; epiphytic or endophytic; not in caves.....6

6(5) Plurilocular sporangia ovoid.....7

6(5) Plurilocular sporangia elongate.....9

7(6) Branching sparse.....8

7(6) Branching abundant.....**Feldmannia globifera** (Plate 7) 23

8(7) Endophytic in *Codium* .....**Feldmannia simplex** (Plate 7) 23

8(7) Epiphytic on *Taonia* and *Dictyota*.....**Kuetzingiella battersii** (Plate 7) 23

9(6) Epiphytic on *Padina*; very small to 3mm long....**Feldmannia padinae** (Plate 7) 23
9(6) On other algae; larger than 3mm....10
10(9) Branching opposite; unilocular sporangia absent....
....**Feldmannia caespitula** (Plate 7) 23
10(9) Branching not opposite; uniocular sporangia present....
....**Feldmannia irregularis** (Plate 7) 23
11(3) Plastids linear....12
11(3) Plastids discoid....14
12(11) Filaments interwoven cord-like; right angle branches present....
....**Spongonema tomentosum** (Plate 6) 22
12(11) Filaments not interwoven; right angle branches absent....13
13(12) Filament branching pseudodichotomous or alternate; plurilocular sporangia more than 125µm long, with a terminal hair....**Ectocarpus siliculosus** (Plate 6) 22
13(12) Filament branching opposite; plurilocular sporangia less than 125µm long without a terminal hair....**Ectocarpus fasciculatus** (Plate 6) 22
14(11) Erect system of assimilatory filaments only; hairs absent; right angle branches present; monosporangia present....**Acinetospora crinita** (Plate 6) 25
14(11) Erect system filaments and sometimes of hairs or pseudohairs; right angle branching absent; monosporangia absent....15
15(14) Filaments terminate in true hairs....16
15(14) True hairs absent; pseudohairs present....17
16(15) Branching alternate or secund; plurilocular sporangia multiseriate....
....**Sorocarpus micromorus** (Plate 9) 25
16(15) Branching irregular, pseudodichotomous or alternate; plurilocular sporangia, mulberry-like....**Sorocarpus reinboldii** (Plate 9) 25
17(15) Unilocular and plurilocular sporangia intercalary..**Pilayella littoralis** (Plate 6) 22
17(15) Sporangia not intercalary....18
18(17) Branching sparse....19
18(17) Branching abundant....20
19(18) Branching irregular....**Kuetzingiella holmesii** (Plate 7) 23
19(18) Branching pseudodichotomous or alternate....**Giffordia fenestrata** (Plate 8) 24
20(18) Banching regular; plurilocular sporangia sessile....21
20(18) Branching irregular; plurilocular sporangia pedicellate...**Feldmannia globifera** (Plate 28)
21(20) Main branching opposite (often irregularly so)....22
21(20) Main branching not opposite....23

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22(21) Lateral branchlets secund; corticating filaments present; plurilocular sporangia ovoid, scattered.....**Giffordia granulosa** (Plate 8) 24
22(21) Lateral branchlets not secund; corticating filaments absent; plurilocular sporangia elongate, in pairs.....**Giffordia ovata** (Plate 8) 24
23(21) Branching pseudodichotomous or alternate.....**Giffordia mitchellae** (Plate 8) 24
23(21) Branching secund.....24
24(23) Plurilocular sporangia ovoid, scattered.....**Giffordia secunda** (Plate 8) 24
24(23) Plurilocular sporangia not ovoid, in sori.....25
25(24) Main axis with corticating filaments; plurilocular sporangia conical.....
.....**Giffordia hincksiae** (Plate 8) 24
25(24) Main axis without corticating filaments; plurilocular sporangia elongate .....
.....**Giffordia sandriana** (Plate 8) 24
26(1) Sparsely branched; forming a felt on *Himanthalia*.....
.....**Herponema velutinum** (Plate 9) 25
26(1) Unbranched; forming tufts on *Cystoseira*.....**Herponema valiantei** (Plate 9) 25
27(2) Bicellular (one to three) propagules present.....
.....**Choristocarpus tenellus** (Plate 9) 25
27(2) Bicellular propagules absent.....28
28(27) Thallus creeping; plurilocular sporangia uniseriate, clustered in sori on distal parts of the few upright filaments.....
.....**Myriotrichia clavaeformis ("M. repens" form)** (Plate 30)
28(27) Thallus upright; plurilocular sporangia multiseriate.....29
29(28) Filament unbranched; epiphytic on *Laminaria*.....**Pogotrichum filiforme** (Plate 30)
29(28) Filament branched.....30
30(29) Sporangia immersed in filament and developed from the cortical layer; epiphytic on *Palmaria*.....**Stictyosiphon griffithsianus** (Plate 17) 29
30(29) Sporangia, pedicellate or intercalary; not on *Palmaria*.....31
31(30) Branching regularly pinnate; monosporangia (in short chains of 2-3 loculi) and gametangia intercalary.....**Tilopteris mertensii** (Plate 22) 29
31(30) Branching irregularly opposite.....32
32(31) Monosporangia sessile or pedicellate, gametangia intercalary; ultimate branching secund.....**Haplospora globosa** (Plate 15) 29
32(31) Plant not as above.....33
33(32) Unilocular sporangia paired, sessile on filaments; often among *Callithamnion hookeri* and *Plumaria*.....**Isthmoplea sphaerophora** (Plate 17) 29
33(32) Intercalary unilocular (in chains) and plurilocular sporangia .....
.....**Pilayella littoralis** (Plate 6) 22

SECTION C

1 Lateral branchlets in whorls.....**Cladostephus spongiosus** (Plate 10)
1 Lateral branchlets not in whorls.....2
2(1) Branch initials arise terminally, straddling the cross-walls between two articulations; sporangia axillary.....3
2(1) Branch initials arise laterally, not straddling a cross wall; sporangia not axillary.....4
3(2) Fronds olive-brown, feathery, branched in one plane.....**Halopteris filicina** (Plate 12)
3(2) Fronds dark brown, densely tufted (in summer; relatively bare in winter) resembling series of inverted shaving brushes...**Halopteris scoparia** (Plate 12)
4(2) Propagules present.....5
4(2) Propagules absent.....9
5(4) Propagules with long arms.....6
5(4) Propagules with very short or no arm.....8
6(5) Propagules with arms constricted at base, terminal hair usually present.....**Sphacelaria cirrosa** (Plate 11)
6(5) Propagules with arms not constricted, no terminal hair.....7
7(6) Main filaments usually more than 50µm wide.....**Sphacelaria fusca** (Plate 11)
7(6) Main filaments usually less than 50µm wide.....**Sphacelaria rigidula**
8(5) Branching regularly pinnate.....**Sphacelaria plumula** (Plate 12)
8(5) Branching scarce, irregular.....**Sphacelaria tribuloides** (Plate 12)
9(4) Secondary transverse cell divisions numerous.....10
9(4) Secondary transverse cell divisions rare or absent.....16
10(9) Branching pinnate.....11
10(9) Branching not pinnate.....13
11(10) Branching strictly pinnate; cortex usually thick, of lightly coalescent rhizoids in lower parts of main axes.....12
11(10) Branching irregularly pinnate; cortex absent or of loosely appressed rhizoids; rare, Shetland Isles.....**Sphacelaria arctica** (Plate 12)

12(11) Corticating rhizoids rising from most peripheral cells of main filaments; zoidangia on special small laterals arising from cortex.....
.....**Sphacelaria plumosa** (Plate 11)

12(11) Corticating rhizoids rising from the few peripheral cells in the plane of branching of the erect filaments; zoidangia on specialised laterals arising from the lateral branchlets terminal and subterminal parts of erect filaments.....
.....**Sphacelaria plumigera** (Plate 12)

13(12) Medullary cells present in main filaments; pericysts absent; zoidangia usually in racemes.....**Sphacelaria racemosa** (Plate 10)

13(12) Medullary cells absent; pericysts present; zoidangia solitary or paired.....14

14(13) Main filaments usually more than 300µm wide; pericysts conspicuous
.....**Sphacelaria radicans** (Plate 10)

14(13) Main filaments usually less than 300µm wide; pericysts usually inconspicuous 15

15(14) Almost all cells of main filaments with secondary transverse divisions; multi-layered basal crust present; zoidangia large and conspicuous; subtidal.....
.....**Sphacelaria caespitula** (Plate 11)

15(14) Many cells without secondary transverse divisions; attached by creeping stolons or thin basal disc; zoidangia small, inconspicuous; mainly upper intertidal.....**Sphacelaria nana** (Plate 10)

16(15) Branching pinnate.....17

16(15) Branching not pinnate.....19

17(16) Branching strictly pinnate; main filaments more than 750µm wide; subtidal.....**Sphacelaria plumula** (Plate 11)

17(16) Branching irregularly pinnate or bipinnate; main filaments less than 750µm wide; intertidal in pools or shallow subtidal.....18

18(17) Branching irregularly pinnate; epiphytic or epilithic; zoidangia infrequent; corticating rhizoids few, loose.....**Sphacelaria cirrosa** (Plate 11)

18(17) Branching bipinnate; base endophytic in *Halidrys* or in *Cystoseira* spp.; zoidangia generally abundant; corticating rhizoids frequent.....
.....**Sphacelaria fusca** ecad **bipinnata** (Plate 11)

19(16) Main filaments less than 300µm wide.....20

19(16) Main filaments more than 300µm wide.....22

20(19) Plants forming soft felted mats, attached by stolons or thin basal discs; zoidangia solitary; usually in upper tidal zone.....**Sphacelaria nana** (Plate 10)

20(19) Plants forming rigid, dense cushions, mats or bushes, attached by stolons or small discs; zoidangia solitary or secund; intertidal in pools or subtidal.....21

21(20) Few to several lateral branches transformed into rhizoids; branching scarce to rich.....**Sphacelaria rigidula**

21(20) No laterals transformed into rhizoids; branching absent to scarce .....**Sphacelaria tribuloides** (Plate 11) 24 chocks

22(21) Laterals usually determinate; widespread.....**Sphacelaria cirrosa** (Plate 11) 27 chocks

22(21) Laterals indeterminate; rare.....**Sphacelaria fusca** (Plate 11) 28 chocks

KEY TO SECTION D

1 Main filaments clearly branched.....10
1 Main filaments unbranched.....2
2(1) Filament arising from a mass of rhizoids.....3
2(1) Filament not arising from rhizoids.....4
3(2) Filament parenchymatous; does not terminate in a hair; plurilocular sporangia formed on the superficial cells of the thallus ....**Petalonia filiformis** (Plate 13) 29
3(2) Filament monosiphonous towards the base; with a terminal hair; plurilocular sporangia pedicellate on short laterals or sessile..... .....**Giraudia sphacelarioides** (Plate 13) 29
4(2) Main filament bearing short lateral filaments.....5
4(2) Short lateral filaments absent.....7
5(4) Laterals of equal length, often branched, densely distributed over the main filament; plurilocular sporangia uni- or biseriate..... .....**Leblondiella densa** (Plate 13) 29
5(4) Lateral filaments variable in length, unbranched, restricted to upper parts of main filament; plurilocular sporangia multiseriate.....6

6(5) Plurilocular sporangia distributed singly; uppermost lateral filaments longest .....**Myriotrichia clavaeformis** (Plate 14) 30
6(5) Plurilocular sporangia clustered; lateral filaments equal in length..... .....**"Myriotrichia filiformis" form of Myriotrichia clavaeformis** (Plate 14) 30
7(4) Filaments almost entirely monosiphonous.....8
7(4) Filaments in part polysiphonous (parenchymatous).....9
8(7) True hairs present; thallus creeping; plurilocular sporangia uniseriate clustered in sori; epiphytic on varous algae ....**Myriotrichia clavaeformis "Myriotrichia repens" form** (Plate 14) 30
8(7) True hairs absent; thallus upright; plurilocular sporangia multiseriate developed from epidermal cells; epiphytic on *Laminaria*..... .....**Pogotrichum filiforme** (Plate 14) 30
9(7) Small tufts, filaments to 12.5mm long, on *Alaria*..... .....**Litosiphon laminariae** (Plate 14) 30
9(7) Dense tufts covering host, filaments to 120mm long, on *Chorda*..... .....**Litosiphon pusillus** (Plate 30) – no descr

10(1) Main branching irregularly opposite; ultimate branching secund.....
.....**Haplospora globosa** (Plate 29) endophytic ; low Palmaria
10(1) Main branching opposite; ultimate branching not secund.....11
11(10) Sporangia partly immersed in filament and developed from cortical layer :.....
.....**Stictyosiphon griffithsianus** (Plate ~~19~~) 29
11(10) Sporangia not as above.....12 ; not on Palmaria
12(11) Sporangia (monosporangia) intercalary in monosiphonous parts of the frond in short chains of two or three loculi; lower intertidal and subtidal.....
.....**Tilopteris mertensii** (Plate ~~13~~) 29
12(11) Sporangia (uniocular) in opposite pairs, sessile on monosiphonous and parenchymatous parts of the filament; mainly intertidal.....
.....**Isthmoplea sphaeropora** (Plate ~~13~~) 29

KEY TO SECTION E

1 Thallus a membranous sheet attached by rhizoids.....2
1 Thallus not a membranous sheet.....3
2(1) Thallus membranous, leathery when older; margin bears a fringe of hairs.....
.....**Zanardinia prototypus** (Plate ~~16~~) 32
2(1) Thallus delicate; margin without hairs .....
.....**"Aglaozonia multifida" life-history stage of Cutleria multifida** (Plate ~~16~~) 32
3(1) Thallus a gelatinous blob or cushion.....4
3(1) Thallus a brown crust.....8
4(2) Outermost layer of thallus composed of unbranched assimilatory filaments....5
4(2) Outermost layer of thallus composed of branched assimilatory filaments.....7
5(4) Cells of assimilatory filaments linear minute (2-5µm).....**Microcoryne ocellata** (Plate 33) Mic
5(4) Cells of assimilatory filaments wider apically (filament club shaped); plant larger cushion.....6
6(5) Assimilatory filaments short, two to four cells; internal tissue of large stellate colourless cells; epilithic and epiphytic on varous algae.....
.....**Leathesia difformis** (Plate ~~24~~) 40
6(5) Assimilatory filaments long, ten to seventeen cells; internal tissue of cylindrical cells; epiphytic on *Chondrus* .....**Corynophloea crispa** (Plate ~~16~~) 32

7(4) Plant a gelatinous cushion (5-20mm diameter); epilithic or epiphytic on *Ralfsia*.....**Petrospongium berkeleyi** (Plate 16)

7(4) Plant a small tuft or cushion (3mm diameter); partly endophytic in *Gracilaria*.....**Cylindrocarpus microscopicus** (Plate 16)

8(3) Erect filaments loosely coalesced, easily separable under pressure.....9

8(3) Erect filaments coalescent, do not separate easily under pressure.....11

9(8) Crust pulvinate; ascocysts absent; plurilocular sporangia unknown.....
.....**"Microspongium gelatinosum" life-history stage Scytosiphon lomentaria** (Plate 19)

9(8) Crust thin, ascocyst or ascocyst-like cells present; plurilocular sporangia present.....10

10(9) Erect filaments of up to twenty cells; plurilocular sporangia uniseriate (rarely bi- or triseriate); plastid without pyrenoid.....
.....**Petroderma maculiforme** (Plate 15)

10(9) Erect filaments of two to seven cells; plurilocular sporangia multiseriate; plastid with a pyrenoid.....**Symphyocarpus strangulans** (Plate 15)

11(8) Several plastids per cell.....12

11(8) One plastid per cell.....14

12(11) Crust parenchymatous, up to 40mm thick .....**Sphacelaria mirabilis** (Plate 15)

12(11) Crust pseudoparenchymatous, clearly of erect filaments.....13

13(12) Erect filaments rarely more than ten cells long.....
.....**Pseudolithoderma extensum** (Plate 15)

13(12) Erect filaments more than twenty cells long.....
.....**Pseudolithoderma roscoffensis** (Plate 15)

14(11) Erect filaments six or seven cells long, seldom more than ten; paraphyses absent, sporangia terminal.....**Sorapion simulans** (Plate 15)

14(11) Erect filaments more than ten cells; paraphyses present; sporangia terminal on filaments at base of paraphyses.....15

15(14) Paraphyses cylindrical.....**Stragularia spongiocarpa** (Plate 15)

15(14) Paraphyses clavate.....16

16(15) Large coriaceous growths with a definite margin; paraphyses of six to twelve cells .....**Ralfsia verrucosa** (Plate 15)

16(15) Discoid growths 10-20mm diameter; margin indefinite merging with substrate; paraphyses of three to five cells.....**Stragularia clavata** (Plate 15)

KEY TO SECTION F

1 Erect filaments of two morphologically distinct types; prominent assimilatory filaments, small paraphyses at their bases....2
1 Erect filaments of one morphological type only....5
2(1) Paraphyses well developed....3
2(1) Paraphyses poorly developed; epiphytic on *Arthrocladia*, sometimes on *Scytosiphon* and *Spermatochnus*....**Elachista stellaris** (Plate 11)
3(2) Assimilatory filaments less than 100µm wide....4
3(2) Assimilatory filaments more than 100µm wide; on *Cystoseira* and *Halidrys*.... **Elachista flaccida** (Plate 11)
4(3) Unilocular sporangia pedicellate; forming tufts on *Himanthalia*.... **Elachista scutulata** (Plate 11)
4(3) Unilocular sporangia sessile or on pedicells; distinct tufts on *Fucus*.... **Elachista fucicola** (Plate 11)
5(4) Hairs present....7
5(4) Hairs absent....6
6(5) Plurilocular sporangia intercalary; a band of loculi surrounding the cells assimilatory filaments; unilocular sporangia absent.... **Halothrix lumbricalis** (Plate 11)
6(5) Plurilocular sporangia intercalary, uni- or multiseriate; unilocular sporangia present....**Leptonematella fasciculata** (Plate 11)
7(6) Plant a very small gelatinous tuft or cushion; plurilocular sporangia multiseriate, unilocular sporangia absent....**Microcoryne ocellata** (Plate 11)
7(6) Very small tufts; plurilocular sporangia, if present, uniseriate; unilocular sporangia present....**Myriactula spp.** (Plate 11)
Epiphytic on:
Fucus....**Myriactula clandestina**
Himanthalia....**Myriactula areschougii**
Chorda....**Myriactula chordae**
Scytosiphon....**Myriactula haydeni**
Halidrys and *Cystoseira*....**Myriactula rivulariae**
Dictyota....**Myriactula stellulata**

KEY TO SECTION G

KEY TO SECTION G

1 Frond uniaxial....2
1 Frond multiaxial....4
2(1) Apical cell of assimilatory filaments 20-35µm diameter; frond cartilaginous; unilocular and plurilocular sporangia present...**Liebmannia leveillei** (Plate 1/5) 34 Le Micro
2(1) Apical cell of assimilatory filaments 15-20µm diameter; frond very gelatinous; plurilocular sporangia unknown....3 Micro
3(2) Frond slender, equal in width throughout; pale yellow brown; surface woolly....**Mesogloia lanosa** (Plate 1/8) 34
3(2) Frond thick, unequally distended; brown in colour; surface smooth....**Mesogloia vermiculata** (Plate 1/8) 34
4(1) Frond richly branched....5
4(1) Frond sparsely branched....7
5(4) Assimilatory filaments not sharply differentiated from central axis....**Eudesme virescens** (Plate 1/8) 34
5(4) Assimilatory filaments sharply differentiated from central axis....6
6(5) Frond rarely more than 1mm diameter; assimilatory filaments 6-8 cells long; middle to low intertidal levels....**Sauvageugloia griffithsiana** (Plate 1/8) 34
6(5) Frond 1-3mm diameter; assimilatory filaments 18-30 cells long; inhabiting upper and mid shore levels....**Sauvageaugloia chordariaeformis** (Plate 1/8) 34
7(4) Frond 120-200mm long, 2mm diameter; brown; assimilatory filaments much branched....**Cladosiphon contortus** (Plate 1/8) 34
7(4) Frond 60-100mm long; 0.5mm diameter; yellow; assimilatory filaments simple or rarely branched....**Cladosiphon zosterae** (Plate 1/8) 34

KEY TO SECTION H

1 Thallus unbranched....2
1 Thallus branched....5
2(1) Thallus 10m long (usually one or two metres); unilocular sporangia merged between paraphyses; epilithic....5
2(1) Thallus less than 80mm long; unilocular sporangia, if present, in the outer cortical layers of the thallus; epiphytic....3

3(2) Plant covered in uniseriate lateral branchlets (eight cells long). Plurilocular sporangia uni- or biseriate; unilocular sporangia unknown, epiphytic on *Sauvageaugloia*.....**Buffhamia speciosa** (Plate 23)

3(2) Plant not covered in uniseriate lateral branchlets; plurilocular sporangia unknown on macrothallus; unilocular sporangia sunk in the outer cortical layers of the thallus; epiphytic on *Scytosiphon* and *Cystoclonium*.....
.....**Dictyosiphon eckmanii** (Plate 24)

4(2) Paraphyses club shaped; plant covered with colourless hairs.....
.....**Chorda filum** (Plate 19)

4(2) Paraphyses linear; plant covered with with brown hairs.....
.....**Chorda tomentosa** (Plate 19)

5(1) Thallus alternately branched.....**Desmarestia aculeata** (Plate 22)

5(1) Thallus branching not alternate.....6

6(5) Thallus branching opposite.....7

6(5) Thallus branching not opposite.....9

7(6) Plant parenchymatous; often hollow; unilocular sporangia in sori often encircling thallus in rings.....**Striaria attenuata** (Plate 21)

7(6) Plant pseudoparenchymatous; obvious main axial filament covered with dense cortication; sporangia not encircling thallus.....8

8(7) Thallus about 1mm diameter, usually more than 150mm long; in summer covered with delicated green hairs, not whorled; unilocular sporangia sunk in thallus.....**Desmarestia viridis** (Plate 22)

8(7) Thallus more than 1mm diameter, less than 150mm long; bearing whorls of monosiphonous ramuli on which develop chains of unilocular sporangia.....
.....**Arthrocladia villosa** (Plate 22)

9(8) Thallus dichotomously branched.....10

9(8) Thallus irregularly or alternately branched.....12

10(9) Thallus uniaxial.....11

10(9) Thallus multiaxial; assimilatory filaments and sporangia scattered, surrounded by open cortex giving plant a warty appearance.**Stilophora rhizodes** (Plate 21)

11(10) Assimilatory filaments present only at frond apices or absent; sporangia (unilocular) often show a whorled arrangement.....
.....**Spermatochnus paradoxus** (Plate 21)

11(10) Assimilatory filaments clothing entire frond; sporangia (unilocular) irregularly distributed over frond surface.....**Stilopsis lejolisii** (Plate 23)

12(9) Plant alternately branched.....**Chordaria flagelliformis** (Plate 19)

12(9) Plant irregularly branched.....13

13(12) Thallus pseudoparenchymatous and formed by lateral fusion of axes, branches or both; essentially filamentous nature or thallus evident.....14
13(12) Thallus parenchymatous and formed by repeated cell division within areas, branches or both; separate filaments lacking.....21
14(13) Thallus uniaxial.....15
14(13) Thallus multiaxial.....19
15(14) Assimilatory filaments present only at frond apices or absent.....
.....**Spermatochnus paradoxus** (Plate 27) 37
15(14) Assimilatory filaments clothing entire frond.....16
16(15) Assimilatory filaments more than six cells.....17
16(15) Assimilatory filaments less than six cells.....18
17(16) Assimilatory filaments four to eight cells long; axes profusely branched; plurilocular sporangia unknown.....**Acrothrix gracilis** (Plate 23) 39
17(16) Assimilatory filaments more than twelve cells long; axes sparsely branched; plurilocular sporangia intercalary; known from southern Britain.....
.....**Myriocladia tomentosa** (Plate 24) 39
18(16) Assimilatory filaments two or three cells long, lacking a prominent apical cell
.....**Stilopsis lejolisii** (Plate 24) 39
18(16) Assimilatory filaments five cells long; terminating in a large globular cell.....
.....**Sphaerotrichia divaricata** (Plate 24) 39
19(14) Assimilatory filaments clothing axes from apex to base.....
.....**Chordaria flagelliformis** (Plate 19) 35
19(14) Assimilatory filaments absent or only at frond apices.....20
20(19) Assimilatory filaments present only on the distal parts of branches; frond apices lacking a tuft of hairs; sporangia not terminal on branchlets. Colourless hairs, paraphyses and sporangia scattered, surrounded by open cortex giving plant a warty appearance.....**Stilophora rhizodes** (Plate 21) 37
20(19) Assimilatory filaments absent; frond apices with a prominent tuft of hairs; sporangia, surrounded by a whorl of monosiphonous branchlets, terminal on lateral branches.....**Sporochnus pedunculatus** (Plate 21) 37
21(13) Branches lacking a terminal pseudohair but terminating with a small apical cell; cortical cells small and rounded, irregularly placed; plurilocular sporangia absent on macrothallus, unilocular sporangia submerged below epidermal cells.....22
21(13) Branches terminating in a pseudohair; cortical cells rectangular and irregularly placed; plurilocular sporangia developed from epidermal cells; unilocular sporangia unkown.....23

38
39

22(21) Branches not basally attenuate; thallus 0.5mm - 1mm wide, fine plant; not gelatinous and slippery.....**Dictyosiphon foeniculaceus** (Plate 28) 36

22(21) Branches attenuate at base; thallus 1-3mm wide, coarse plant, gelatinous and slippery.....**Dictyosiphon chordaria** (Plate 29) 36

23(21) Thallus 75-150mm long; fine plant, pale brown colour; central cells in longitudinal section longer than wide. Plurilocular sporangia absent on monosiphonous parts (in nature).....**Stictyosiphon tortilis** (Plate 30) 36

23(21) Thallus 100-600mm long; coarse plant, dark brown; central cells in longitudinal as wide as long; plurilocular sporangia present on monosiphonous parts of the frond.....**Stictyosiphon soriferus** (Plate 30) 36

KEY TO SECTION I

1 Thallus elongated and tubular.....2

1 Thallus round.....6

2(1) Thallus constricted at intervals; one plastid per cell; small surface cells transformed into sporangia which are not localised into sori; unilocular sporangia unknown on macrothallus .....**Scytosiphon lomentaria** (Plate 24) 0 40

2(1) Thallus not constricted; several plastids per cell; unilocular and plurilocular sporangia occur in small sori dotted over the thallus.....3

3(2) Thallus at least in part flattened.....**Asperococcus compressus** (Plate 24) 0 40 trs

3(2) Thallus tubular.....4

4(3) Thallus with large discoid base; less than 10mm long.....**Asperococcus scaber** (Plate 24) 0 40

4(3) Thallus without large discoid base; more than 10mm long.....5

5(4) Thallus cylindrical; 2.5 - 10mm diameter; tapering to the base.....**Asperococcus fistulosus** (Plate 24) 0 40

5(4) Thallus inflated; more than 10mm diameter; narrowing abruptly at the base.....**Asperococcus turneri** (Plate 24) 0 40

6(2) Thallus irregularly lobed, sub-spherical; gelatinous; internal tissue of colourless filaments; assimilatory filaments separate under pressure.....**Leathesia difformis** (Plate 24) 0 40

6(2) Thallus balloon-like; membranous; internal tissue of large round cells assimilatory cells do not separate under pressure....**Colpomenia peregrina** (Plate 24) 0 40

KEY TO SECTION J

1 Frond branched or divided....2
1 Frond unbranched....6
2(1) Frond with prominent apical cell; hairs lacking....3
2(1) Frond wihtout prominent apical cell, but with line of small apical cells, hairs present....4
3(2) Thallus two cell layers thick at base; yellow-brown; on all coasts....**Dictyota dichotoma** (Plate 25) 41
3(2) Thallus three cell layers thick at base; pale yellow-brown; confined to south-west coasts....**Dilophus spiralis** (Plate 25) 41
4(2) Frond dichotomously divided; dotted with sori of plurilocular sporangia....**Cutleria multifida** (Plate 25) 41
4(2) Frond divided, but not dichotomously; tetrasporangia and gametangia associated with hairs and organised in rows....5
5(4) Frond fan-shaped, less than 100mm long; with chalky deposit....**Padina pavonica** (Plate 26) 41
5(4) Frond ligulate, more than 100mm long; without chalky deposit....**Taonia atomaria** (Plate 26) 41
6(1) Attachment organ a root-like holdfast....7
6(1) Attachment organ rhizoids or a small disc....8
7(6) Stipe with a small swelling; cryptostomata present....**Young Saccorhiza** (Plate 42)
7(6) Stipe without a small swelling; cryptostomata absent....**Young Laminaria spp.** (Plate 42)
8(6) One plastid per cell....9
8(6) Many plastids per cell....10
9(8) Frond less than 2mm wide....**Petalonia zosterifolia** (Plate 26) 42
9(8) Frond more than 10mm wide....**Petalonia fascia** (Plate 26) 42
10(8) Thallus less than 10mm wide....11
10(8) Thallus more than 10mm wide....13
11(10) Sporangia associated with hairs and paraphyses; medulla of more than two layers large rounded cells....**Asperococcus compressus** (Plate 26) 40
11(10) Sporangia not associated with hairs and paraphyses; hairs scattered; medulla of two layers of rectangular (longitudinally elongated) cells....12
12(11) Epiphytic on *Zostera, Chorda* and other plants....**"Desmotrichum undulatum" form of Punctaria tenuissima**
12(11) On small stones and shells; pale brown (hyaline)....**Punctaria tenuissima** (Plate 26) 42

13(10) Plant pale brown in colour.....14
13(10) Plant dark brown in colour.....15
14(13) Plant 20mm wide; sporangia associated with paraphyses and multicellular hairs; medulla of large colourless cells.....**Asperococcus compressus** (Plate 24) 40
14(13) Plant 20-75mm wide; sporangia not associated with paraphyses and hairs; medulla of two layers of rectangular cells.....**Punctaria latifolia** (Plate 26) 42
15(13) Margin of frond very wavy; frond to 240mm wide; narrows abruptly to a stipe; known only from the Scilly Isles.....**Punctaria crispata** (Plate 26) 42
15(13) Margin of frond slightly undulating; frond to 50mm wide; tapers gradually to a stipe; widespread.....**Punctaria latifolia** (Plate 26) 42

KEY TO SECTION K

1 Frond undivided; bearing a cluster of lateral outgrowths (sporophylls) from the stipe; attached by a large root-like holdfast.....**Alaria esculenta** (Plate 41) 43
1 Frond divided; sporophylls absent; not attached by a root-like holdfast.....2
2(1) Branching opposite.....3
2(1) Branching dichotomous.....4
3(2) Lateral branches narrow and ligulate.....**Desmarestia ligulata** (Plate 41) 43
3(2) Lateral branches wide and foliaceous.....**Desmarestia ~~dresnayi~~** (Plate 41) ligulata var. firma
4(2) Frond narrow (3mm or less).....5
4(2) Frond more than 3mm wide.....6
5(4) Sublittoral species from southwest Britain; tall plants to 300mm long; unilocular sporangia in terminal conical protuberences.....**Carpomitra costata** (Plate 41) 43
5(4) Saltmarsh species mainly from northern Britain, forms mossy carpets; plants less than 40mm high; reproduces vegetatively.....**Fucus muscoides**
6(4) Frond papery/membranous; tetrasporangia present in sori over frond, gametangia in small sori over the frond.....**Dictyopteris membrancacea** (Plate 41) 43
6(4) Frond leathery; tetrasporangia absent; gametangia in receptacles near the apical parts of the frond.....7
7(6) Frond with toothed margin.....**Fucus serratus** (Plate 28) 44
7(6) Frond margin entire.....8
8(7) Frond with paired vesicles in the thallus.....**Fucus vesiculosus** (Plate 28) 44
8(7) Frond without paired vesicles in the thallus.....9

9(8) Receptacles terminal.....10
9(8) Receptacles not terminal; apex of frond continues to grow beyond receptacles.....12
10(9) Frond thin, often decayed to midrib; receptacles pointed; growing in areas of freshwater run-off.....**Fucus ceranoides** (Plate 7~~8~~) 44
10(9) Frond tougher, such less decayed to midrib; receptacles not pointed; grows in estuaries but not in freshwater.....11
11(10) Frond twisted; receptacles with a sterile rim.....**Fucus spiralis** (Plate 7~~8~~) 44
11(10) Frond not twisted; receptacles without a sterile rim.....**Fucus vesiculosus f. linearis**
12(9) Plants small, less than 100mm; growing in wave-exposed situations.....13
12(9) Plants large, more than 100mm; growing in sheltered situations.....**Fucus evanescens** (Plate 7~~8~~) 44
13(12) Frond with stiff midrib, forming drooping plants on rocks.....**Fucus distichus** ssp. **anceps** (Plate 7~~8~~) 44 ? bold.
13(12) Frond less rigid; grows in upper littoral pools.....**Fucus distichus ssp. distichus** (Plate 7~~8~~) 44

KEY TO SECTION L

1 Vegetative frond button (conical) shaped; receptacles, if present, strap-shaped.....**Himanthalia elongata** (Plate 7~~9~~) 45
1 Frond not as above.....2
2(1) Frond small, about 100mm long.....3
2(1) Frond longer than 100mm.....4
3(2) Plants attached by holdfast to rocks near high tide level; frond inrolled (channelled); receptacles present.....**Pelvetia canaliculata** (Plate 7~~7~~) 47 (1)
3(2) Plants form dense mossy carpets in saltmarshes; thallus not inrolled; vegetative growth only.....**Fucus muscoides**
4(2) Frond regularly dichotomously branched; holdfast creeping, root-like; known only from southwest Britain.....**Bifurcaria bifurcata** (Plate 7~~4~~) 47
4(2) Frond not regularly dichotomously branched.....~~6~~ 5
5(4) Frond with air bladders.....~~7~~ 6
5(4) Frond without air bladders.....14
6(5) Holdfast absent; plant unattached, very irregularly branched, forms extensive carpets.....**Ascophyllum nodosum var. ~~mackaii~~** Scorpioides
6(5) Holdfast present; plant attached; regularly branched does not form carpets...7

7(6) Thallus flattened, branched (irregularly dichotomous) but not bushy; air bladders at intervals along frond; globular receptacles on short branchlets .....**Ascophyllum nodosum** (Plate 41) 47

7(6) Thallus cylindrical or with flattened leafy appendages, much branched (irregularly pinnate), bushy; air bladders pod-like or cylindrical; receptacles small and elongated.....7

8(7) Bladders and receptacles pod-like (siliquose).....**Halidrys siliquosa** (Plate 42) 47

8(7) Bladders and receptacles spherical.....9

9(8) Receptacles and bladders intercalary on main axis.....10

9(8) Receptacles and bladders on lateral branchlets..... .....**Sargassum muticum** (Plate 39) 46

10(9) Axis flattend, apex surrounded by incurved young lateral branchlets..... .....**Cystoseira baccata** (Plate 38) 47

10(9) Axis radial.....11

11(10) Axis bearing zones of lateral branches with zones of swellings at their bases (tophules).....**Cystoseira nodicaulis** (Plate 36) 46

11(10) Axis lacking tophules.....12

12(11) Plants solitary; apical region of axis and young laterals covered with whorls of bifid appendages giving an *Equisetum* like appearance; strongly irridescent when submerged.....**Cystoseira tamariscifolia** (Plate 37) 46

12(11) Plants caespitose; apical region of axis smooth or covered with tubercles; not irridescent.....13

13(12) Lateral branches of young plants flattened and foliose; occasional flattened lateral branches in older plants; known only from southwest Britain..... .....**Cystoseira foeniculacea** (Plate 35) 46

13(12) Lateral branches of young plants radial and filiform; never foliose; no flattened lateral branches in adult plants; known only from the Channel Isles..... .....**Cystoseira humilis** (Plate 40) 46

14(6) Plant unattached, forms dense carpets.....**Ascophyllum nodosum var. mackaii**

14(6) Plant attached with distinct holdfast, does not form carpets.....15

15(14) Thallus narrow, much branched and bushy.....**Desmarestia aculeata** (Plate 32) 38

15(14) Thallus broad, divided, not bushy.....16

16(15) Frond with flattened stipe with frilled wings; base irregularly bulbous and warty; cryptostomata and hairs present.....**Saccorhiza polyschides** (Plate 29) 45

16(15) Frond, stipe oval or cylindrical; no frilled wings to stipe; cryptostomata and hairs absent.....17

9

17(16) Frond margin wavy, centre area undulating, blade undivided.....18
17(16) Frond margin not wavy, centre parts flat, blade divided.....19
18(17) Stipe solid; widespread species.....**Laminaria saccharina** (Plate 29) 45
18(17) Stipe hollow; Shetland only.....**Laminaria longicruris** (Plate 29) 45
19(17) Stipe smooth, without epiphytes.....20
19(17) Stipe rough with many epiphytes.....**Laminaria hyperborea** (Plate 29) 45
20(19) Stipe flexuous, no yellow coloration at base of frond.....
.....**Laminaria digitata** (Plate 29) 45
20(19) Stipe stiff and brittle; yellow coloration at base of frond.....
.....**Laminaria ochroleuca** (Plate 29) 45

(44)

KEY TO THE RED ALGAE

1	Plant unicellular	*Porphyridium purpureum* (Plate 85)
1	Plant multicellular	2
2(1)	Encrusted with lime (effervesces with weak acid)	**Section A**
2(1)	Not encrusted with lime (except possibly on underside in *Peyssonnelia*)	3
3(2)	Colourless or brownish-grey parasite, partly embedded in host	**Section B**
3(2)	Not a parasite	4
4(3)	Spreading over substrate, without erect fronds (crustose)	**Section C**
4(3)	At least some erect fronds formed	5
5(4)	Frond flattened (opposite surfaces parallel) at least in part	6
5(4)	Frond cylindrical or compressed but not flattened	7
6(5)	Frond without differentiated medulla and/or cortex, at least in part delicate and membranous, one cell thick at least marginally	**Section D**
6(5)	Frond cartiliaginous to membranous, with differentiated medulla and/or cortex, always more than one cell thick	**Section E**
7(5)	Monosiphonous, not corticated	8
7(5)	Polysiphonous, or if monosiphonous corticated at least in part	9
8(7)	Frond less than 10mm long	**Section F**
8(7)	Frond usually more than 10mm long	**Section G**
9(8)	Frond visibly monosiphonous (without sectioning or squashing)	**Section H**
9(8)	Frond not obviously monosiphonous	10
10(9)	Frond mainly polysiphonous or multiseriate, ecorticate at least distally	**Section I**
10(9)	Frond corticate thoughout	11
11(10)	Frond hollow, at least in part	**Section J**
11(10)	Frond solid throughout	12
12(11)	Frond gelatinous, readily squashed	**Section K**
12(11)	Frond not gelatinous, not readily squashed	13
13(12)	Axis compressed, at least in part	**Section L**
13(12)	Axis cylindrical throughout	**Section M**

SECTION A

1	Thallus with erect jointed fronds (sometimes little developed) 2	
1	Thallus without erect jointed fronds 5	
2(1)	Frond with featherlike or irregular branching, from a branched crustose base 3	
2(1)	Frond with forked branching, from branched rootlike base 4	
3(2)	Branching regularly featherlike; at least some of cystocarpic conceptacles often 'horned' ..... **Corallina elongata** (Plate 15)	65
3(2)	Branching often irregular; cystocarpic conceptacles rarely 'horned' ..... **Corallina officinalis** (Plate 15)	65
4(2)	Fronds small (to 50mm), with slender terete articulations; epiphytic (often on *Cladostephus*) ..... **Jania rubens** (Plate 15)	65
4(2)	Fronds larger (to 100mm), with stout compressed articulations; on rock or larger algae (especially *Cystoseira* spp.) ..... **Haliptilon squamatum** (Plate 15)	65
5(1)	Plant a minute endophytic parasite in *Jania* and *Haliptilon*; only conceptacles protruding ..... **Choreonema thuretii** (Plate 5B)	55
5(1)	Plant not a parasite 6	
6(5)	Growing on plants or animals (hydroids and bryozoans) 7	
6(5)	Growing on rock or shells or unattached 16	
7(6)	Thallus of lobed, semicircular fronds with free margins, usually on *Corallina* ..... **Mesophyllum lichenoides** (Plate 16)	
7(6)	Thallus attached to substrate over whole undersurface 8	
8(7)	Crust polystromatic throughout; heavily calcified 9	
8(7)	Crust monostromatic at least marginally; lightly to heavily calcified 10	
9(8)	Colour reddish-violet; crust to 3mm diameter, to 400µm thick, walls between successive layers not very thick; on *Corallina* ..... **Titanoderma corallinae**	
9(8)	Colour pale purple, crust to 2mm diameter, to 700µm thick, walls between successive layers very thick; on *Laminaria* stipes ..... **Dermatolithon crouanii**	
10(8)	Crust monostromatic throughout, except immediately around conceptacles 11	
10(8)	Crust polystromatic except for narrow monostromatic margins 15	
11(12)	Trichocytes frequent 12	
11(12)	Trichocytes rare or absent ..... **Melobesia membranacea** (Plate 16A)	67

12(11) Hypothallial cells obliquely inclined towards margin in vertical section; tetrasporangial conceptacles very rare ..... **Dermatolithon litorale**

12(11) Hypothallial cells not obliquely inclined towards margin in vertical section; tetrasporangial conceptacles frequent 13

13(12) Trichocytes markedly larger than ordinary vegetative cells, terminal, frequent ..... **Fosliella farinosa** (Plate 16)

13(12) Trichocytes not markedly larger than ordinary vegetive cells, intercalary, of variable frequency 14

14(13) Conceptacles (other than male) with flat roofs only 1-2 cells thick; on *Zostera* only ..... **Pneophyllum fragile** (Plate 16)

14(13) Conceptacles (other than male) with raised roof several cells thick; on *Zostera* and various algae ..... **Pneophyllum limitata**

15(10) Crusts spreading irregularly, 200-250µm thick; rarely recorded, North Devon ..... **Dermatolithon cystoseirae**

15(10) Crusts orbicular, to 350µm thick; common especially on *Mastocarpus*, widespread ..... **Titanoderma pustulatum** (Plate 67)

16(6) Plants unattached; subtidal; coralloid, often forming extensive deposits (maerl) 17

16(6) Plants attached to solid substrate; intertidal or subtidal; smooth or coralloid 21

17(16) Crust white-speckled, pink to purplish; branches more than 3mm diameter ..... **Lithothamnion glaciale** (Plate 16)

17(16) Crust not white-speckled; branches less than 3 mm diameter 18

18(16) Branches less than 1.5mm thick, pink ..... **Lithothamnion corallioides**

18(16) Branches 2-3mm thick, red to violet 19

19(18) Crust hard and glossy, reddish; rather rarely unattached ..... **Lithothamnion sonderi**

19(18) Crust fragile, rough surfaced, reddish-violet; usually unattached ..... **Phymatolithon calcareum** (Plate 16)

20(16) Thickness less than 1mm 21

20(16) Thickness more than 1mm 29

21(20) Crust leafy, lobed, semicircular with free margins, basally attached ..... **Mesophyllum lichenoides** (Plate 16)

21(20) Crust attached over entire lower surface 22

22(21) Trichocytes present (sometimes rare); crust less than 100µm thick 23

22(21) Trichocysts absent; crust more than 100µm thick 24

23(22) Crust monostromatic except around conceptacles; trichocytes frequent; terminal; intertidal to subtidal .....**Fosliella farinosa** (Plate 64)

23(22) Crust polystromatic throughout; trichocytes frequent to rare, intercalary; subtidal .....**Pneophyllum zonale**

24(22) Crust chalky-surfaced; yellow to pink, typically discoid.....
.....**Lithophyllum orbiculatum**

24(22) Crust smooth or scaly surfaced; colour various; spreading irregularly 25

25(24) Crust smooth; pink; conceptacles to 680µm diameter; deep subtidal, northwest coasts .....**Leptophytum laeve** micro

25(24) Crust smooth or scaly surfaced, pink, orange or violet; shallow subtidal, southwest coasts or widespread 26

26(25) Hypothallium of single layer, crust less than 200µm thick .....27 micro

26(25) Hypothallium of several to many layers, crust more than 300µm thick .....30 ?28 micro

27(26) Crust smooth or lightly scaly; pink-violet to pink-orange; widespread.....
.....**Dermatolithon hapalidiodes**

27(26) Crust markedly scaly, violet to purple-red; southwest coasts only.....28L species ?

? 28(26) Hypothallium half the total thickness; conceptacles rasied; crust lilac, rough but with smooth glossy margin .....**Phymatolithon lenormandii** (Plate 16)

? 28(26) Hypothallium thin, conceptacles sunken with marked rims, crust pink to pink-violet, usually smooth .....**Phymatolithon laevigatum**

29(20) Crust chalky-surfaced; pink lavender to yellowish; conceptacles sunken 30

29(20) Crust smooth (often glossy); pink to violet; conceptacles raised or sunken....31

30(29) Hypothallium many-layered, crust to 400µm thick; margins ridged where crusts meet..... .....**Lithophyllum incrustans** (Plate 16) micro

30(29) Hypothallium one to few-layered, crust to 1.5mm thick; margins not ridged where crusts meet .....**Lithophyllum orbiculatum**

31(29) Crust more than 5mm thick; surface very irregular 32

31(29) Crust less than 5mm thick; surface smooth to rugulose 33

32(31) Margin white-edged, concentrically furrowed; crust bluish-red to blue-violet (often faded and yellowish) .....**Phymatolithon purpureum** (Plate 16)

32(31) Margin neither white-edged nor furrowed; crust bright pink to purplish, minutely white-speckled .....**Lithothamnion glaciale** (Plate 66)

33(31) Crust rugulose, pink to violet; hypothallium on to few-layered, conceptacles sunken; intertidal and subtidal .....**Phymatolithon rugulosum**

33(31) Crust smooth (sometimes with simple branches), pink to reddish; hypothallium one to many-layered, conceptacles partly raised; subtidal only 34

34(33) Hypothallium single-layered; crust bright pink; south and west shores.....
.....**Lithophyllum nitorum**
34(33) Hypothallium multi-layered; crust reddish with scattered faint white rings (conceptacle remains); widespread .....**Lithothamnion sonderi**

SECTION B

Colourless parasites, partly embedded in host; host specific (Plate 5B)

Pinkish branched tufts on *Phyllophora truncata* .....**Ceratocolax hartzii**
Irregularly lobed fronds, to 4mm on *Callophyllis laciniata*.....**Callocolax neglectus**
Tufts of simple or lobed leafy fronds, to 3mm on *Cryptopleura ramosa* .....
.....**Gonimophyllum buffhamii**
Globose brownish-white cushions, to 2mm diameter, on *Gracilaria verrucosa*
.....**Holmesella pachyderma**
Irregular hemispherical cushions, to 2mm diameter on *Polysiphonia lanosa*
.....**Choreocolax polysiphoniae**
Hemispherical cushions, to 3mm diameter, on *Rhodomela confervoides*
.....**Harveyella mirabilis**
Colourless pustules, to 1.5 mm diameter, on *Palmaria palmata*
.....**Halosacciocolax kjellmanii**
White protruding conceptacles on *Haliptilon* and *Jania*
.....**Choreonema thuretii**

SECTION C

1 Forming pink stains in various mollusc shells .....
....."Conchocelis" life-history stage (Plate 1A)
1 Not forming pink stains in mollusc shells.....2
2(1) Discs less than 1mm diameter 3
2(1) Discs or crusts more than 1mm diameter 10
3(2) On or in animals (hydroids or bryozoans) 4
3(2) On or in other plants 5

4(3) Colour purplish red; filaments coalescing into one to several layered disc; cells uniform; reproduction by monospores cut off obliquely from vegetative cells.....**Erythrocladia irregularis**

4(3) Colour pink, a single-layered disc with small cells cut off obliquely superficially from distal ends of prostrate cells; reproduction by bispores only.....**Melobesia van-heurckii**

5(4) Distinct disc formed, monospores obliquely superficial .....**Erythrocladia irregularis**

5(4) Distinct disc not formed, monospores lateral or terminal 6

6(5) Growing on *Cladophora* spp. comprising four short prostrate filaments (three to five cells long) from a single basal cell; known only from the Orkneys.....**Audouinella scapae**

6(5) Growing in various red and brown algae; filaments more than five cells long, forming a reticulate network, widespread.....7

7(6) In *Himanthalia* reproductive fronds, penetrating deeply; known only from St. Mary's Island, Northumberland .....**Audouinella sanctae-mariae**

7(6) In outer cell walls of various red algae 8

8(7) In *Bonnemaisonia hamifera*; filaments not anastomosing; cells 6-10µm diameter; plastids small, discoid; rare, North Devon .....**Audouinella asparagopsis**

8(7) In various red algae; filaments anastomosing, cells less than 6µm diameter; single parietal plastid 9

9(8) Growing in *Bonnemaisonia* spp. and *Ceramium rubrum*, anastomoses frequent; pyrenoids present .....**Audouinella bonnemaisonii**

9(8) Growing in *Gastroclonium ovatum*, anastomoses occasional, pyrenoids absent .....**Audouinella chylocladiae**

10(2) Growing in cell walls of *Cladophora pellucida*; deep red in colour.....**Schmitziella endophloea**

10(2) Growing on various substrates; colour various 11

11(10) Crustose plants with erect papillae bearing reproductive organs; known only from Galway and France .....**Dermocorynus montagnei (Plate 5)**

11(10) Crustose plants without papillae; widespread 12

12(11) Crusts glossy greenish-purple, to 1mm thick; usually on rock; tetrasporangia cruciate, intercalary 13

12(11) Crusts reddish-purple, mostly less than 1 mm thick; usually on crustose Corallinaceae; tetrasporangia zonate or cruciate, not intercalary 14

13(12) Colour purple to brownish red; tetrasporangia solitary; frequent .....
.....**"Petrocelis cruenta" life-history stage** (Plate 5)

13(12) Colour dark purple; tetrasporangia in a chain of six to twelve cells; rare.....
.....**Petrocelis hennedyi**

14(12) Tetrasporangia zonate 15

14(12) Tetrasporangia cruciate or irregular 20

15(14) Crust rosy red; short erect filaments interspersed with cylindrical 'secretory' cells with highly refractive contents; deep subtidal .....
.....**"Cruoria rosea" life-history stage**

15(14) Crust red, purple or brown; without 'secretory' cells 16

16(15) Tetrasporangia large (to 220µm long), lateral on erect filaments (winter and spring only) .....**"Cruoria pellita" life-history stage**

16(15) Tetrasporangia small (less than 220µm long), terminal on erect filaments or in conceptacles 17

17(16) Tetrasporangial conceptacles present (throughout year), sunken in thallus forming visible pits; crust brownish .....**Hildenbrandia crouanii** (Plate 5)

17(16) Tetrasporangial conceptacles absent; crust blackish red or violet 18

18(17) Tetrasporangia in superficial nemathecia in mucilaginous envelope, not intermixed with unmodified filaments .....
.....**"Porphyrodiscus simulans" life-history stage (Plate 5A)**

18(17) Tetrasporangia in surface layer in patches amongst unmodified filaments 19

19(18) Crust dries fissured; white spots visible with a hand lens; lower intertidal, subtidal.....**"Haematocelis fissurata" life-history stage**

19(18) Crust dries smooth and glossy; white spots absent; intertidal .....
.....**"Haematocelis rubens" life-history stage** (Plate 5A)

20(14) Rhizoids present or absent; tetrasporangia cruciate 21

20(14) Rhizoids absent; tetrasporangia irregularly divided 28

21(20) Rhizoids present, at least lower surface lime-encrusted 22

21(20) Rhizoids absent, no part lime-encrusted 24

22(21) Crust thin, dark red, irregularly wrinkled when dry, to 30mm diameter.....
.....**Peyssonnelia dubyi** (Plate 5)

22(21) Crust thin to thick, red to blackish purple, smooth or warty, to 40mm or more diameter.....23

23(22) Erect filaments curved; lime layer thin, hard; crust blackish purple, thick, smooth .....**Peyssonnelia atropurpurea**

23(22) Erect filaments straight, lime layer thick; crust red, purplish or brownish, thickness variable, warty .....**Peyssonnelia harveyana**

24(21) Tetrasporangia 6-9µm diameter, in short chains; subtidal, rare (Plymouth).....
.....**"Erythrodermis allenii" life-history stage (Plate 54)** 54 micro
24(21) Tetraspornagia 15-42µm diameter, not in chains; intertidal or subtidal.....25 micro
25(24) Branching featherlike, in single horizontal layer; subtidal, rarely recorded.....
.....**"Hymenoclonium serpens" life-history stage** (Plate 49)
25(24) Branching forked, prostrate system bearing erect filaments of one to several cells 26
26(25) Tetrasporangia without paraphyses; a thin crust to 8mm diameter on shells and pottery; rarely recorded, Devon .....
....."**Rhododiscus pulcherrimus" life-history stage** (Plate 54)
26(25) Tetrasporangia with curved paraphyses; thick or thin crust, 3-300mm diameter; on various substrates, intertidal or subtidal 27
27(26) Crusts forming discs or cushions to 3mm diameter; on *Zostera* leaves; rare, southwestern England and western Ireland ...**Rhodophysema georgii** ~~(Plate 5)~~
27(26) Crusts irregular, to 300mm or more diameter; on rocks, shells, algae, common and widespread .....**Rhodophysema elegans** (Plate 53)
28(20) Tetrasporangia in sunken globular conceptacles which form visible pits; crusts rose-red to brownish red; spreading indefinitely; intertidal to subtidal, common.....**Hildenbrandia rubra** (Plate 63)
28(20) Tetrasporangia not in conceptacles; crusts carmine or purple-red, to 150mm diameter; deep subtidal, rare 29
29(28) Crust to 3mm diameter; tetrasporangia 24-30µm x 15-20µm, terminal on shortened erect filaments .....**"Cruoriopsis hauckii" life-history stage** (Plate 54) micro micro
29(28) Crust to 150mm diameter; tetrasporangia 6-9µm x 15-17µm, lateral on erect filaments .....**Plagiospora gracilis** (Plate 54) micro micro

SECTION D

1 Frond with well-marked, repeatedly branched midrib, forming regular veins..2
1 Frond without well-marked midrib, veins absent or irregular .....6 L
2(1) One-layered portion forming narrow continuous bilateral margin to midrib.....
.....**Membranoptera alata** (Plate 78)
2(1) One-layered portions expanded into leafy veined blades 3

3(2) Stipe cylindrical, unwinged below, continued as midrib of leafy blades in plane of branching 4

3(2) Stipe flattened, winged, secondary leafy blades borne directly on midrib at right angles to plane of branching 5

4(3) Blade margin ruffled, entire, blade bright crimson, ovate-lanceolate ....**Delesseria sanguinea** (Plate 24) — 77

4(3) Blade margin flat, lobed, toothed or fringed, blade purple-crimson, often oak-leaf-shaped .....**Phycodrys rubens** (Plate 25) — 77

5(6) Fronds and leaflets pointed, linear-lanceolate, margins without microscopic veins .....**Hypoglossum ~~woodwardii~~** (Plate 26) 77 hypoglossoides

5(6) Fronds and leaflets blunt, ovate, margins with microscopic veins ....**Apoglossum ruscifolium** (Plate 26) — 77

6(1) Macroscopic veins present, at least near base 7

6(1) Macroscopic veins absent 11

7(6) Colour brown-red, iridescent under water; frond much divided and often prostrate, branching forked .....**Cryptopleura ramosa** (Plate 77) 9

7(6) Colour not brownish, not iridescent, frond fan-shaped, not prostrate 8

8(7) Frond much and deeply divided into narrow, ribbon-like segments with pointed apices; rare, Somerset and Devon..... .....**Erythroglossum sandrianum** (Plate 72) 9

8(7) Frond entire to deeply cleft into wedge- or ribbon-shaped segments with rounded apices 9

9(8) Microscopic veins absent .....**Nitophyllum bonnemaisonii** (Plate 76) 78

9(8) Microscopic veins present in younger parts 10

10(9) Colour dark purplish red; tetrasporangia in linear marginal sori..... .....**Polyneura laciniata** (Plate 72) 9 (1)

10(9) Colour rosy to crimson; tetrasporangia in small, oval scattered sori..... .....**Polyneura hilliae** (Plate 72) 9 (1)

11(6) Microscopic veins present 12

11(6) Microscopic veins absent 13

12(11) Colour pale rose; frond with minute marginal adherent processes, apices lobed; subtidal, very rare, southwest coasts..... .....**Radicilingua thysanorhizans** (Plate 76) 78

12(11) Colour deep red; margins toothed and proliferous, apices often hooked; intertidal and subtidal, occasional, widespread ....**Acrosorium uncinatum** (Plate 72) 9 79

11 of 11 doesn't work! Contradicts

13(11) Frond two- or many-layered in older parts, one-layered in younger parts.....14
13(11) Frond uniformly one-layered 18
14(13) Frond distromatic throughout; cells small (18µm diameter), rounded; frond rose-purple-red.....**Porphyra miniata** (Plate 34) 85
14(13) Frond monostromatic in places; cells large (more than 18µm diameter), angular; frond pink to red.....15
15(14) Iridescent under water; marginal processes adherent to substrate; subtidal, very rare, south coasts .....**Drachiella spectabilis** (Plate 78)
15(14) Not iridescent; marginal processes not adherent or absent; mainly subtidal, widespread 16
16(15) Frond colour changing rapidly (but reversibly) to golden-yellow on exposure to freshwater .....**Myriogramme heterocarpum** (Plate 34) 78
16(15) Frond colour not changing reversibly in this way 17
17(16) Blade delicately membranous; tetrasporangial sori often elongate .....**Nitophyllum punctatum** (Plate 27) 9
17(16) Blade relatively robust; tetrasporangial sori small, oval.....**~~Nitophyllum~~ bonnemaisonii** (Plate 26) 78 Myriogramme
18(13) Cells in regular vertical and horizontal rows; subtidal on *Desmarestia aculeata* .....**Porphyropsis coccinea** (Plate 34) 86
18(13) Cells not in regular rows; interdidal and subtidal, on rock or other plants.....19
19(18) Frond irregularly lobed from central holdfast; olive to brown-purple; common .....**Porphyra umbilicalis** (Plate 34) 86
19(18) Frond elongated from basal holdfast; variously coloured 20
20(19) Blade narrowly strap-shaped, purple-brown; upper intertidal rocks, winter and spring .....**Porphyra linearis** (Plate 34) 86
20(19) Blade relatively broad, variously coloured; intertidal and subtidal, not seasonal 21
21(20) Fronds rather tough, amethyst-coloured; subtidal, rare, northern shores.....**Porphyra amethystea**
21(20) Fronds delicate, reddish-brown or purple when fresh; intertidal and shallow subtidal, widespread 22
22(21) Colour red-purple (pink on drying); on larger algae .....**Porphyra leucosticta** (Plate 34) 86
22(21) Colour blackish purple; on rock, sheltered sandy shores ...**Porphyra purpurea**

SECTION E

1	Plant with midrib ..... **Schmitzia hiscockiana** (Plate 9)	59
1	Plant without midrib 2	
2(1)	Fronds with marginal processes 3	
2(1)	Fronds without marginal processes 7	
3(2)	Plant less than 100mm long; commonly bears epiphytic animals..... 4	
3(2)	Plant more than 100mm long; does not bear epiphytic animals..... 5	
4(3)	Stipe long (to 10mm); marginal processes stoloniferous..... **Schottera nicaeensis** (Plate 12)	62
4(3)	Stipe short (1 or 2mm); marginal processes of bladelets or tiny colourless bladelet-like antheridia..... **Phyllophora traillii** (Plate 13)	63
5(3)	Holdfast branched, fronds tough; without distinct axial cell; tetrasporangia present on upright plant 6	
5(3)	Holdfast discoid, fronds squashy; with distinct axial cell; tetrasporangia not on upright plant (on crustose life-history stage) .. **Schmitzia hiscockiana** (Plate 9)	59
6(5)	Blade segment to 5mm wide, with long tendril-like processes, stipe long (to 50mm); mainly intertidal, summer fertile..... **Calliblepharis jubata** (Plate 9)	59
6(5)	Blade to 50mm wide, with short stiff proliferations, stipe short (to 20mm); mainly subtidal, winter fertile ..... **Calliblepharis ciliata** (Plate 9)	59
7(2)	Medulla mainly of large (more than 50µm) isodiametric cells 8	
7(2)	Medulla of narrow (less than 20µm diameter) filamentous cells 27	
8(7)	Mature plant usually less than 40mm high 9	
8(7)	Mature plant usually more than 40mm high 14	
9(7)	Frond repeatedly forked 10	
9(7)	Frond simple, or once or twice forked 11	
10(9)	Colour bright crimson; branching featherlike, ultimate lateral branchlets very short; local, northeast coasts ..... **Callophyllis cristata** (Plate 10)	60
10(9)	Colour pinkish to brownish red; frond membranous, branching forked, frond sometimes fringed with lateral processes to 5mm long; widespread ..... **Rhodophyllis divaricata** (Plate 9)	59
11(9)	Stipe short (1-2mm); plant usually less than 20mm long..... 12	
11(9)	Stipe long (to 10mm); plant more than 20mm long..... 13	

12(11) Cortex of small closely packed cells 2-7µm diameter, subcortical layers not visible; bladelets and antheridia formed on margins.....6
.....**Phyllophora traillii** (Plate 13) 63

12(11) Cortex of larger loosely-packed cells, 18-8µm x 7-11µm, subcortical layers visible; bladelets and antheridia not on margins.....6
.....**Rhodymenia delicatula** (Plate 13) 63

13(11) Plant more than 20mm tall; cortex of larger loosely-packed cells, 6-8µm diameter; subcortical layer not visible.....**Schottera nicaeensis** (Plate 12) 62

13(11) Plant less than 20mm tall; cortex of loosely-packed cells, 14-18µm x 7-11µm, subcortical layer visible.....**Rhodymenia delicatula** (Plate 13) 63

14(8) Branching pinnate; fronds deep purplish-red (drying black); segments narrow with large alternate teeth; northern shores only.....8
.....**Odonthalia dentata** (Plate 31) 83

14(8) Branching forked; frond colour and form various 15

15(14) Frond delicate, usually much divided, often in entangled tufts; tetrasporangia zonate; subtidal .....**Rhodophyllis divaricata** (Plate 9) 59

15(14) Frond often tough, opaque, usually not entangled; tetrasporangia (where known) cruciate; intertidal or subtidal 16

16(15) Stipe absent or wedge-shaped, merging into blade.....17

16(15) Stipe cylindrical, often expanding abruptly into blade.....19

17(16) Fronds reddish brown, membranous, very variable in shape, cystocarps unknown; intertidal and shallow subtidal .....**Palmaria palmata** (Plate 8) 58

17(16) Fronds bright red or crimson, thin or thick; cystocarps present; mainly subtidal 18

18(17) Colour bright red; frond thin, deeply divided into strap-shaped segments; cystocarps forming visible 'midrib' to segments, tetrasporangia in scattered sori; subtidal, occasional, southwest coasts 6
.....**Stenogramme interrupta** (Plate 12)

18(17) Colour deep crimson; frond thick, fan-shaped; cystocarps and tetrasporangia marginal or in marginal proliferations; mainly subtidal, common, widespread
.....**Callophyllis laciniata** (Plate 19) 70

19(16) Blade segments strap-shaped 20

19(16) Blade segments fan- or wedge-shaped 22

20(19) Frond simple or once or twice forked, apices often prolonged into long slender process; occasional, southwest coasta.....**Schottera nicaeensis** (Plate 12) 62

20(19) Frond repeatedly forked, apices rounded 21

21(20) Colour bright crimson; frond segments not enlarged at apices, proliferations from blade surfaces, margins crisped, stipe short (rarely to 10 mm); common, widespread ..... **Phyllophora crispa** (Plate 13)

21(20) Colour brownish-red; frond apices often enlarged and pale, no proliferations from blade surfaces, margins not crisped, stipe long; local, south coast..... 6
..... **Gymnogongrus crenulatus** (Plate 12)

22(19) Stipe gradually expanding into a narrow, wedge-shaped blade with marginal and apical proliferations; colour dull brown-red; northern coasts..... 6
..... **Phyllophora truncata** (Plate 13)

22(19) Stipe rapidly expanding into a fan-shaped blade, not marginally proliferous; colour purplish brown or red 23

23(22) Plants brick red, tetrasporangia, not in chains, in cortex; cystocarps with pores 24

23(22) Plants bright red or purplish brown tetrasporangia in chains in elevated sori; cystocarps without pore 26

24(23) Plant with extensive stoloniferous growth; associated with sponges or soft substrate ..... **Rhodymenia holmesii** (Plate 9)

24(23) Plants without extensive basal stoloniferous growth; epiphyte and epilithic (on hard substrates) 25

25(24) Plant sessile; south coasts ..... **Rhodymenia ardissonei** (Plate 9)

25(24) Plant with stipe; widely distributed ..... **Rhodymenia pseudopalmata** (Plate 9)

26(23) Colour bright red; attachment disc to 20mm diameter; tetrasporangia in centre of blade, cystocarps unknown; southwest coasts..... 6
..... **Phyllophora sicula** (Plate 13)

26(23) Colour purplish brown; attachment disc small; tetrasporangia and cystocarps on stipe or lower blade; widespread 6
..... **Phyllophora pseudoceranoides** (Plate 13)

27(7) Blade repeatedly forked not proliferous, apices expanded and fan-shaped, plants tufted, often forming dense stands; colour dark purplish-red or purplish-brown..... 28

27(7) Blade simple, lobed leaflike or irregularly incised, often proliferous plants usually scattered, colour various 29

28(27) Stipe channelled with thickened margins; base often a wide-spreading crust; blade with large (to 10mm long) marginal and superficial papillae; not iridescent underwater ..... **Mastocarpus stellatus** (Plate 14)

28(27) Stipe cylindrical or flattened, not channelled, margins not thickened; basal disc to 20mm diameter; papillae absent; iridescent under water when healthy..
..... **Chondrus crispus** (Plate 64)

29(27) Plants less than 30mm high, stipe to 10 mm long, frond undivided; cystocarps large to 2mm diameter); rare, southwest coasts.....**Meredithia microphylla** (Plate 16) 70

29(27) Plants more than 30mm high, stipe absent or short (2-3 mm), frond simple or divided; cystocarps small (less than 2mm diameter) 30

30(29) Frond gelatinous 31

30(29) Frond membranous to fleshy, but not gelatinous or slippery 34

31(30) Colour brownish or greenish red; cortical cells not in distinct fascicles; local, southern England .....**Grateloupia doryphora** (Plate 6) 56

31(30) Colour pink to rose-red; cortical cells in distinct fascicles 32

32(31) Blade cylindrical or slightly compressed; plants to 25mm long; subtidal (known only from Northumberland) .....**Platoma bairdii**

32(31) Blade flattened, to 140mm long, often marginally proliferous; deep pools to subtidal, western shores 33

33(32) Plant multiaxial; frond irregularly dichotomously branched, not leaf-like; 300-500µm thick; gland cells and hair cells absent....**Platoma marginifera** (Plate 6) micro

33(32) Plant unmarked; frond not dichotomously branched, leaf-like, 2-4mm thick; glands and hair cells present.....**Schmitzia hiscockiana** (Plate 9) 59

34(30) Frond thick (more than 300µm), fleshy but not slippery .....35 micro

34(30) Frond thin (less than 250µm), membranous, slippery .....36 micro

35(34) Fronds dark red, usually entire, with tapered base and no distinct stipe; winter-fertile, perennial, cystocarps fully immersed, tetrasporangia cruciate; common, widespread .....**Dilsea carnosa** (Plate 17) 68

35(34) Fronds-brownish red, frequently split, stipe present; summer annual, cystocarps raising surface, tetrasporangia on a crustose life-history stage; occasional, southern and western shores .....**Schizymenia dubyi** (Plate 6)

36(34) Frond strap-shaped, simple or with strap-shaped segments or proliferations; cystocarps nearly always present (small, scattered), tetrasporangia on a crustose stage; medulla of sparse filaments without stellate cells .....**Halarachnion ligulatum** (Plate 6)

36(34) Frond strap-shaped, ovate or linear lanceolate, simple or with wedge-shaped segments or proliferations; cystocarps scattered or in sori, tetrasporangia scattered; stellate cells present in medulla 37

37(36) Plants soft and elastic, easily squashed; blades linear-lanceolate, erect fronds arise from filaments .....**Halymenia latifolia** (Plate 6)

37(36) Plants tough not easily squashed, blades triangular or ovate/obtuse, irregularly lobed; erect fronds arise from a disc 38

38(37) Blade not thickened at base and margins; cells readily dissociating with dilute hydrochloric acid.....**Kallymenia reniformis** (Plate 19) 70

38(37) Blade thickened at base and margins; cells not readily dissociating with dilute hydrochloric acid.....39

39(38) Marginal proliferations present, midrib absent; very rare, subtidal, Cork Harbour .....**Cryptonemia hibernica** (Plate 8) 69

39(38) Marginal proliferations absent, midrib present in lower parts; known only as a drift specimen from Herm .....**Cryptonemia seminervis**

SECTION F

1 Cells embedded in jelly-like matrix 2

1 Cells not embedded in jelly-like matrix 3

2(1) Cells blue-green, branching irregular; in brackish water ....**Chroodactylon ornatum**

2(2) Cells reddish violet to lilac, branching forked, not in brackish water .....**Stylonema alsidii** (Plate 38) 85

3(1) Plastids numerous; branching opposite; alternate or secund; tetrasporangia tetrahedral; plants with unicellular disc-ended rhizoids 4

3(1) Plastids one or few; branching never opposite; tetrasporangia (if present) cruciate; without unicellular disc-ended rhizoids 5

4(3) Ramuli regularly opposite; tetrasporangia solitary, terminal on ramuli; epiphytic (particularly *Laminaria* stipes) .....**Ptilothamnion pluma** (Plate 24) 76

4(3) Ramuli never opposite; tetrasporangia in groups, lateral; epilithic, very rare .....**Spermothamnion mesocarpum**

5(3) Plant almost entirely within plant or animal host 6

5(3) Plant entirely or mainly superficial on substrate 11

6(5) Within animal host 7

6(5) Within plant host 10

7(6) Prostrate filaments laterally adherent, forming monostromic plate 8

7(6) Prostrate filaments not adhering to form monstromatic plate 9

8(7) Plate cells isodiametric, 10-12 µm diameter, cell walls smooth; endozoic in perisarc of hydroids, intertidal.....**Audouinella infestans**

8(7) Plate cells at least twice as long as wide, cell walls corrugated; endozoic in bryozoans, subtidal.....**Audouinella membranacea** (Plate 1) 48

9(7) Cells regularly cylindrical to barrel-shaped, 6-25um long, 6-13um wide ..... micro micro,
.....**Audouinella endozoica**

9(7) Cells very variably shaped, some curved, twisted, deeply divided or forked .....
.....**Audouinella membranacea** (Plate 1) 48

10(6) In *Gloiosiphonia capillaris*, filaments mainly deep in host; tetrasporangia 18-30um diameter .....**Audouinella brebneri** micro

10(6) In *Heterosiphonia plumosa*, filaments mainly in walls of outer cells of host; monosporangia 6-7um diameter .....**Audouinella endophytica** micro

11(10) Base of plant a single cell (from original spore) only .....12 GS

11(10) Base of plant multicellular, filamentous or pseudoparenchymatous 17

12(11) Axes of five or fewer cells, terminating in hair; on *Sporochnus* and *Carpomitra*.....**Audouinella rosulata**

12(11) Axes of more than five cells, or if not so then without terminal hair 13

2 13(12) On *Alaria*, about 1mm high .....**Audouinella alariae**

2 13(12) On various algae, about 350um high .....14 micro

14(13) Growing on *Porphyra* spp. 15

14(13) Growing on algae other than *Porphyra* spp. 16

15(14) Cell diameter 4-6um; known only from England .....**Audouinella battersiana** micro

15(14) Cell diameter 7-9um; recorded from Ireland (Galway) ..... micro
.....**Audouinella rhipidandra**

16(14) With single axis per basal cell; one plastid per cell ..**Audouinella microscopica**

16(14) With up to six axes per basal cell; one to several plastids per cell .....
.....**Audouinella parvula**

17(11) Plastid a distinct spiral band; epiphytic, subtidal .....**Audouinella efflorescens**

17(11) Plastids not a distinct spiral band; on various substrates, intertidal and subtidal 18

18(17) Prostrate system secondarily developed, growing into host tissue 19

18(17) Prostrate system not penetrating substrate 20

19(18) Original spore recognizable as large swollen basal cell of erect axis, on *Helminthocladia*, *Dudresnaya* and *Dasya* .....**Audouinella corymbifera**

19(18) Original spore not distinct from other cells of erect axis; on Nemalion ..... APY APY Ital
.....**Audouinella nemalionis**

20(19) Erect axes with few or no branches 21

20(19) Erect axes profusely branched 22

21(20) Prostrate system of loosely entangled filaments, not forming disc; on plants .....**Audouinella sparsa**

21(20) Prostrate system of tightly compacted filaments, forming sheet or disc; on plants or animals .....**Audouinella spetsbergensis** (Plate 1) 48

22(20) Cells with several distinct small plastids, no pyrenoids 48
.....**Audouinella purpurea** (Plate 1)
22(20) Cells with single large plastid (sometimes fragmented) 23
23(22) Plastid axile .....**Audouinella secundata** (Plate 1) 48
23(22) Plastid parietal 24
24(23) Cells markedly narrower in upper part of erect axes (4-5um diameter) .....
.....**Audouinella saviana**
24(23) Cells of uniform diameter in upper and lower parts of erect axes.....25
25(24) Plastids with very distinct pyrenoid; plants characteristically fringing *Palmaria* frond .....**Audouinella daviesii** (Plate 1) 48
25(24) Plastid with no obvious pyrenoid .....**Audouinella caespitosa**

SECTION G

1 Filaments unbranched 2
1 Filaments branched 4
2(1) Colour blackish purple; filaments attached by rhizoids, becoming multiseriate; often forming mats, upper interdital rocks, winter and early spring..... trc
.....**Bangia atropurpurea** (Plate 11) 85
2(1) Colour red; filaments attached by expanded basal cell or disc, becoming multiseriate; interdial and subtidal, usually on plants or animals, not markedly seasonal 3
3(2) Uniseriate below, multiseriate above; forming a ribbon one cell thick; rare, southern England .....**Erythrotrichopeltis boryana**
3(2) Uniseriate, or multiseriate with cells radially arranged; common widespread...
.....**Erythrotrichia carnea** (Plate 33) 85
4(1) Branching at least in part opposite or whorled 5
4(1) Branching alternate or forked, never opposite or whorled 18
5(4) Branches or ramuli whorled 6
5(4) Branches or ramuli opposite, in two rows 12
6(7) Ramuli mostly forked 7
6(7) Ramuli simple or irregularly branched 10
7(6) Colour dark or brownish red; whorled ramuli crowded, giving shaggy appearance 8
7(6) Colour rose-red; whorled ramuli widely separated except near apex 9

8(7) Plant robust, dark red, to 250mm long; on rock, widespread..... .....**Halurus equisetifolius** (Plate 23)

8(7) Plant gelatinous, brownish red, to 50mm long; on plants, rare, southern England .....**Crouania attenuata**

9(8) Main branching forked; cells often club-shaped; on plants, rare, intertidal, southern England .....**Griffithsia barbata**

9(8) Main branching opposite or alternate, cells cylindrical; on rock, mostly subtidal, frequent .....**Sphondylothamnion multifidum** (Plate 24)

10(6) Whorled branchlets simple, sometimes forming discoid rhizoids; tetrasporangia sessile, tetrahedral .....**Antithamnionella spirographidis**

10(6) Whorled branchlets themselves branched; tetrasporangia stalked or sessile, cruciate 11

11(10) Ultimate branching featherlike (ramuli in pairs or fours); secretory cells adjoining two or three cells .....**Antithamnion cruciatum**

11(10) Ultimate branching comblike (ramuli on upper sides of branchlets), secretory cells adjoining parental cell only .....**Pterothamnion plumula** (Plate 21)

12(11) Height usually less than 15mm; tetrasporangia usually terminal on ramuli; often forming velvety patches on *Laminaria* stipes..... .....**Ptilothamnion pluma** (Plate 24)

12(11) Height usually more than 20mm; tetrasporangia lateral; in dense tufts on rock or on other plants 13

13(12) Branching regularly opposite or whorled; tetrasporangia always tetrahedral.14

13(12) Branching irregular or irregularly opposite, not whorled; tetrasporangia cruciate, occasionally tetrahedral.....16

14(13) Ramuli secund above; rare, southern England.....**Spermothamnion irregulare**

14(13) Ramuli always opposite.....15

15(14) On muddy rocks, ramuli short, spinelike; rare, southwestern England..... .....**Spermothamnion barbatum**

15(14) On plants, ramuli elongate, spreading; common and widespread..... .....**Spermothamnion repens** (Plate 24)

16(13) Branchlets simple; gland cells absent.....**Antithamnion floccosa**

16(13) Branchlets bear ramuli; gland cells present.....17

17(16) Ramuli in one plane; tetrasporangia sessile; on northern coasts (Scotland)..... .....**Scagelia pylaisei** (Plate 24)

17(16) Ramuli in same plane; tetrasporangia stalked; widespread ....**Antithamnion plumula** (Plate 21)

18(4) Branching alternate, comblike or irregular 19

18(4) Branching forked 27

19(18) Small refractive vesicular cells present above each axial cell; tetrasporangia (winter-produced) intercalary .....
.....**"Trailliella" life-history stage of Bonnemaisonia hamifera** (Plate 4-5)

19(18) Small refractive vesicular cells absent, tetrasporangia not intercalary 20

20(19) Branching irregular or comb-like 21

20(19) Branching featherlike 22

21(20) Epiphytic/endophytic; erect filaments from colourless rhizoids penetrating deeply into host (*Ralfsia*); rare .....**Erythrotrichia welwitschii**

21(20) Epilithic or sand-binding; erect filaments from creeping prostrate filaments; common .....**Audouinella floridula** (Plate 1) 48

22(20) Epiphytic; tetrasporangia lateral on inner sides of ramuli, polysporangia absent 23

22(20) On rock; tetrasporangia terminal or lateral, polysporangia often present.....24

23(22) Cells near tips more than 30µm diameter, multinucleate; often in estuaries.....**Callithamnion roseum** (Plate 21) 72

23(22) Cells near tips less than 20µm diameter, uninucleate; often on *Codium* spp.....
.....**Callithamnion byssoides** (Plate 21) 72

24(22) Plant stiff, ultimate branches featherlike distally but often bare towards base; tetrasporangia on inner sides of ramuli .....**Pleonosporium borreri** (Plate 75) 75

24(22) Plant flaccid, ultimate branches not markedly bare towards base; tetrasporangia terminal or lateral 25

25(24) Branching irregularly alternate, not obviously in one plane; tetrasporangia sessile on inner side of ramuli .....**Callithamnion roseum** (Plate 21) 72

25(24) Branching regularly alternate, very largely in one plane; tetrasporangia on tips of ramuli 26

26(25) Tetrasporangia clustered; plant to 75mm long, featherlike branching very regular .....**Compsothamnion thuyoides** (Plate 75)

26(25) Tetrasporangia solitary, plant to 100mm long, branching not very regularly featherlike .....**Compsothamnion gracillimum**

27(26) Axes clothed in short, forked branchlets, axial cells to 2000µm diameter; reproduction by stalked, solitary, axillary monospores..... 75
.....**Monosporus pedicellatus** (Plate 75)

27(26) Axes nost so clothed, axial cells to more than 300µm diameter; monospores not produced 28

28(27) Axial cells strongly club-shaped, ultimate cells bead-like, branching wide-angled .....**Griffithsia corallinoides** (Plate 75) 75

28(27) Axial cells cylindrical or slightly club-shaped, ultimate cells not beadlike, branching narrow-angled.....29

Section H missing

Next page ??

SECTION I

1 Frond an unbranched filament, often single row of cells in part, cells with single central star-shaped plastid 2

1 Frond branched, plastids various 4

2(1) Colour blackish-purple, filaments to 150mm long, with rhizoidal basal outgrowths; often forming fleecy mat on rock, wood, etc. at high tide level, autumn to spring ..... **Bangia atropurpurea** (Plate 3)

2(1) Colour rose to red, filaments to 40mm long, without rhizoidal basal outgrowings, on plants and animals, as scattered filaments, tufts or fringes 3

3(2) Filament a flat ribbon distally, to 800µm thick; rare, south coast ..... **Erythrotrichopeltis boryana**

3(2) Filaments cylindrical distally (uniseriate below); common and widespread ..... **Erythrotrichia carnea** (Plate 3)

4(1) Plants with pigmented monosiphonous lateral ramuli; apical tufts of colourless hair-like ramuli absent 5

4(1) Monosiphonous pigmented ramuli absent; apical tufts of colourless hair-like ramuli present 11

5(4) Ramuli whorled; tetrasporangia zonate, on lateral ramuli; cystocarps naked ..... **Dudresnaya verticillata** (Plate 1)

5(4) Ramuli alternate; tetrasporangia tetrahedral, immersed in branchlets or crowded on special swollen branchlets (stichidia); cystocarps enclosed in protective structures 6

6(5) Main axes ecorticated throughout, usually seven pericentral cells; tetrasporangia immersed in branchlets ..... **Brongniartella byssoides** (Plate 28)

6(5) Main axes corticated, at least below, usually five or nine pericentral cells; tetrasporangia in stichidia 7

7(6) Branching all in one plane; corticating cells typically in alternate rings of long and short cells; nine pericentral cells ..... **Heterosiphonia plumosa** (Plate 28)

7(6) Branching in all planes; corticating cells not regularly arranged; five pericentral cells 8

8(7) Axes ecorticate above; ramuli long, narrow, tapering to sharp point; stichidia with long pointed apices; very rare, southern coasts ..... **Dasya corymbifera**

8(7) Axes corticate throughout; ramuli with blunt apices; stichidia blunt or with short pointed apices 9

9(8) Frond purple; stichidia long, narrow; subtidal, on muddy rocks, very rare, southern coasts ..... **Dasya ocellata**

9(8) Frond crimson to brownish red; stichidia short, ovate; intertidal or subtidal, on rock or other plants 10

10(9) Plant blood-red in colour; ramuli to 70µm diameter; stichidia not pointed; subtidal, rare, southern coasts ..... **Dasya punicea**

10(9) Plant crimson or brownish in colour; ramuli to 200µm diameter; stichidia with pointed apex; intertidal or subtidal, occasional, southern and western coasts ..... **Dasya hutchinsiae** (Plate 28)

11(4) Height to 1mm only; reddish-violet; cells in two to many irregular rows in gelatinous sheath, often single row of cells at filament tips rare, south Devon ..... **Goniotrichum cornu-cervi**

11(4) Height usually much more than 1mm; colour various; structure polysiphonous, without single rows of cells at apices 12

12(11) Plant obviously flattened or compressed in one plane 13

12(11) Plant not flattened or compressed or branched in one plane 15

13(12) Plant feather-like; ecorticate; eight or nine pericentral cells 14

13(12) Plant tufted, corticate; ten or more pericentral cells ..... **Pterosiphonia complanata** (Plate 39)

14(13) Erect axes simple or once or twice divided; frond linear; dark-red-purple in colour ..... **Pterosiphonia pennata**

14(13) Erect axes much-branched; frond not linear; reddish-brown ..... **Pterosiphonia parasitica** (Plate 39)

15(12) Three pericentral cells; minute gland cells present ..... **"Falkenbergia rufolanosa" life history stage of Asparagopsis armata** (Plate 14)

15(12) Four or more pericentral cells; gland cells absent 16

16(15) Cortication absent, even at extreme base 17

16(15) Cortication present, at least basally 31

17(16) Four pericentral cells 18

17(16) More than four pericentral cells 21

18(17) Erect axes little branched, to 30mm high, arising from prostrate rhizoidal branches; on sand-covered rocks 19

18(17) Erect axes usually much branched, to 200mm high, prostrate system discoid or rhizoidal; substrate various 20

19(18) Colour dark purple, erect branches simple or with few ramuli; rare, known only from Cork Harbour ..... **Lophosiphonia subadunca** (Plate 32)

19(18) Colour reddish brown to brick-red, erect branches alternately or unilaterally branched; frequent and widespread ..... **Polysiphonia macrocarpa**

20(19) Colour grey-brown, on muddy rocks and on plants; rare, southeast England.... .....**Polysiphonia insidiosa**

20(19) Colour dark-red to brownish red; in various habitats, common and widespread .....**Polysiphonia urceolata** (Plate 84)

21(17) Five or six pericentral cells.....22

21(17) More than six pericentral cells 23

22(21) Base discoid; erect fronds much branched; five pericentral siphons; single specimen recorded from Kirkcubrightshire .....**Polysiphonia richardsonii**

22(21) Base of branched creeping rhizoids; erect fronds simple or with few ramuli; four to six pericentral cells; very rare, known only from Cork Harbour ....**Lophosiphonia subadunca** (Plate 84)

23(21) Eight or nine pericentral cells 24

23(21) Ten or more pericentral cells 27

24(23) Branching forked; with tufts of colourless hairs (trichoblasts) at apices.....25

24(23) Branching featherlike; trichoblasts absent 26

25(24) Colour brick-red (darkening on drying); all branching forked, ramuli not narrowed at base; deep subtidal, rare southern coasts..**Polysiphonia furcellata**

25(24) Colour dark red to black; smaller branches alternate, ramuli markedly narrowed at base; occasional, widespread .....**Polysiphonia nigra**

26(24) Colour dark reddish-purple; on sand-covered rocks, very rare, southwestern England .....**Pterosiphonia pennata**

26(24) Colour deep red; on rock or other algae, occasional widespread ....**Pterosiphonia parasitica** (Plate 82)

27(23) Erect fronds simple or with few ramuli; twelve to eighteen pericentral cells; extensive stoloniferous prostrate system; forming mats on sand-covered rocks, very rare, southern coasts.....**Lophosiphonia reptabunda** (Plate 84)

27(23) Erect fronds freely branched; stoloniferous prostrate system absent; on various substrates.....28

28(27) On *Ascophyllum* (or *Fucus* spp.) in dense brown tufts; midtidal, common, widespread .....**Polysiphonia lanosa** (Plate 84)

28(27) On rock, stones or shells; lower intertidal or subtidal, occasional to rare 29

29(28) Pericentral cells twenty or more; very rare, known only from Guernsey ....**Polysiphonia opaca**

29(28) Pericentral cells fourteen or fewer 30

30(29) Articulations of main axes 1.5 diameters long, ramuli not tapered at base; colour red-brown; rare, southwest coasts .....**Polysiphonia simulans**
30(29) Articulations of main axes 2-3 diameters long, ramuli tapered at base; colour dark red to black; occasional, widespread .....**Polysiphonia nigra**
31(16) Plants corticate only at the base 32
31(16) Plants corticate throughout main axes 34
32(31) Four primary pericentral cells (four secondary cells often present).....37
32(31) More than four primary pericentral cells 33
33(32) Six pericentral cells; base discoid; rare, sheltered muddy estuaries, south coast .....**Polysiphonia denudata**
33(32) Twelve to twenty pericentral cells; base rhizoidal; common, widespread ....**Polysiphonia nigrescens** (Plate 77) 84 → now P. fucoides.
34(31) Ramuli short, spinelike; trichoblasts absent; less than six or more than eight pericentrals 35
34(31) Ramuli slender, elongated, forming tufts; trichoblasts often abundant (sometimes seasonal only); six to eight pericentrals..... .....**Polysiphonia brodiaei** (Plate 87) 84 Li
35(34) Frond markedly compressed; five pericentral cells; rare, ...**Pterosiphonia complanata** (Plate 79) 82
35(34) Frond cylindrical; eight to twelve pericentral cells; occasional to frequent..... 36
36(35) Branching narrow-angled, featherlike with short branchlets in two very regular rows .....**Pterosiphonia thuyoides** (Plate 30) 82
36(35) Branching wide-angled, branchlets very short, in two irregular rows..... .....**Polysiphonia fruticulosa** (Plate 34) 82
37(32) Plant at least in part cartilaginous; bright crimson, markedly seasonal (spring and summer); branches often tapered at base and apex; common, sandy and gravelly shores .....**Polysiphonia elongata** (Plate 72) 84
37(32) Plant flaccid, straw to violet, not markedly seasonal, not tapered at base; occasional on rocks, stones and other plants .....**Polysiphonia violacea**

SECTION SECTION J #✓

1 Main axes not obviously constricted at intervals 2
1 Main axes and branches obviously constricted at intervals 6

2(1) Plant very gelatinous; bright crimson; axes and branches with single central filament initially, later hollow; summer annual .....
.....**Gloiosiphonia capillaris** (Plate 11) 68

2(1) Plant not markedly gelatinous; colour various; without a single axial filament at any stage 3

3(2) Base discoid 4

3(2) Base rhizoidal or of stolons 5

4(3) Discoid base large (to 20mm diameter); branching sparse, mainly toward the base; colour pale yellowish to purple; frond becoming tubular; common.....
.....**Dumontia contorta** (Plate 11) 68

4(3) Discoid base small; branching variable but often pinnate and profuse; colour bright pinkish red; branchlets spindle-shaped; frequent .....
.....**Lomentaria clavellosa** (Plate 20) 71

5(3) Plant small (to 40mm) from creeping stolons; fronds flattened, ovate; crimson; on rock and *Laminaria* holdfasts, occasional.....
.....**Lomentaria orcadensis** (Plate 20) 71

5(3) Plant large (to 250mm), from much-branched rhizoidal base; axes cylindrical with crowded spindle-shaped branchlets; brownish-red to olive-green; on rocks and stones, common .....**Gastroclonium ovatum** (Plate 20) 71

6(1) Plant constricted at irregular intervals, segments sometimes flattened; growing at upper intertidal level; plants small (to 20mm high); blackish-purple, with creeping stolons; frond not truly hollow...**Catenella caespitosa** (Plate 20) 71

6(1) Plant constricted at regular intervals; segments swollen; growing at lower intertidal or subtidal levels; plants red in colour; base discoid or of creeping filaments; frond hollow in part 7

7(6) Colour purplish; recurved branches attaching to substrate and forming stolons; forms polysporangia with 8-12 spores; rare, southern England and Channel Islands .....**Gastroclonium reflexum** (Plate 20) 71

7(6) Colour pink to brown-red; branches not obviously recurved; tetrasporangia produced 8

8(7) Base a small disc; axes slightly constricted; cystocarp without opening .....
.....**Chylocladia verticillata** (Plate 20) 71

8(7) Base rhizoidal, creeping; axes slightly or strongly constricted; cystocarp with opening (ostiole) 9

9(8) Frond gelatinous; pinkish-red; axes slightly constricted; nodal diaphragms present; on algae, southern and western coasts ....**Champia parvula** (Plate 71)

9(8) Frond soft but not gelatinous; crimson to brownish-red; axes strongly constricted into beadlike portions; nodal diaphragms absent; on rocks, more rarely on algae, widespread and abundant ....**Lomentaria articulata** (Plate 71)

SECTION K

1 Plant multiaxial (apex of several cells) 2

1 Plant uniaxial (apex a single cell) 6

2(1) Frond simple or forked, often repeatedly 3

2(1) Frond with well-marked main axis bearing lateral branches 5

3(2) Colour brownish-purple; frond soft and spongy; often simple or forked from near base only, outer cells small, coloured; on rock or shells, lower intertidal, exposed shores .....**Nemalion helminthoides** (Plate 51)

3(2) Colour clear pink to brownish-red; frond relatively firm; regularly forked; outer cells large, colourless; on stones or shells, subtidal sandy shores 4

4(3) Frond turgid, 2-4mm wide; central filaments distinctly visible in pressed specimens; pink in colour.....**Scinaia turgida** (Plate 51)

4(3) Frond not turgid, 1-2-(3)mm wide; central filaments not visible; brownish-red in colour.....**Scinaia forcellata** (Plate 51)

5(2) Ultimate branchlets numerous, short, wide-angled; axial cells large, rectangular, giving rise to repeatedly forked lateral filaments of much narrower cells with terminal hairs; colour pale reddish-brown; widespread but sporadic .....**Helminthora divaricata** (Plate 51)

5(2) Ultimate branchlets few, becoming long, narrow-angled; axial cells narrow, giving rise to repeatedly forked lateral filaments of progressively wider cells, terminal cells without apical hairs; colour purple-red; rare southwestern coasts .....**Helminthocladia calvadosii**

6(1) Colour brownish to purplish-red; plant small (to 50mm); whorled lateral filaments strongly incurved and with curved terminal cells (banana-shaped); tetrasporangia sessile, tetrahedral; very rare, south coast..**Crouania attenuata**

6(1) Colour bright red to crimson, plant to 300mm long, whorled lateral filaments spreading with terminal cells not curved tetrasporangia stalked and zonate or absent 7

7(6) Main axis soon appearing polysiphonous; tetrasporangia stalked, zonate .....**Dudresnaya verticillata** (Plate 68)

7(6) Main axis never appearing polysiphonous; tetrasporangia absent 8

8(7) Main axis markedly broader than branches, usually naked below; irregularly feather-like branching; axis becoming hollow; terminal cells of lateral filaments angular, compacted .....**Gloiosiphonia capillaris** (Plate 17)

8(7) Main axis not markedly broader than larger branches, branching irregularly from near base; axis solid throughout; terminal cells of lateral filaments bead like or cylindrical, not compacted 9

9(8) Plant more than 100mm tall; main axes and branches clothed throughout with spindle-shaped ramuli, 1-4 mm long; central filament surrounded by large, colourless isodiametric cells; locally common, southern and western coasts ....**Naccaria wiggii** (Plate 1)

9(8) Plants less than 100mm tall; main axis not clothed with short spindle-shaped ramuli; central filaments surrounded at maturity by narrow, down-growing filaments; very rare, southern coasts.....10

10(9) Cystocarps developing equally all round axis; main axis not constricted; terminal cells of lateral filaments beadlike, to 15µm diameter..... .....**Atractophora hypnoides** (Plate 1)

10(9) Cystocarps developing unilaterally; main axis constricted; terminal cells of lateral filaments cylindrical, 5-7µm diameter 11

11(10) Axial whorls of four determinate branches .....**Calosiphonia vermicularis**

11(10) Axial whorls of three determinate branches ...**Schmitzia neapolitana** (Plate 1)

(These two species are difficult to distinguish apart).

SECTION L

1 Base rhizoidal, plants often forming entangled mats 2

1 Base discoid or spreading, individual plants discrete 9

2(1) Plants small (to 20mm long), black-purple, frond with beadlike segments, branching in all planes; tetraspores zonate; at upper shore levels..... .....**Catenella caespitosa** (Plate 20)

2(1) Plants often more than 20mm long, deep red to red purple, frond not segmented, branching irregularly featherlike, or forked; tetraspores cruciate or tetrahedral; at various shore-levels 3

3(2) Branching forked, ramuli spinelike or pincerlike; tetrasporangia tetrahedral; rare, south and western coasts .....**Microcladia glandulosa** (Plate 28)

3(2) Branching featherlike or irregular, ramuli spinelike or spathulate, not pincerlike; tetrasporangia cruciate 4

4(3) Frond cylindrical or only slightly compressed, narrow (1mm or less).....5
4(3) Frond compressed, relatively broad (2mm or more) 6
5(4) Plant cylindrical or slightly compressed throughout; cortical cells small (3.5-5um); sharp boundary between central and cortical cells; tetrasporangia formed in elongate stichidia and regularly arranged; subtidal, epiphytic on maerl.....**Gelidiella calcicola** (Plate 2)
5(4) Plant cylindrical or slightly compressed, ultimate ramuli spathulate; cortical cells larger (7-11.5um); indistinct boundary between central and cortical cells; tetrasporangia formed on oval bladelets and randomly arranged; intertidal in crevices or as underflora .....**Gelidium pusillum** (Plate 2)
6(5) Plant arising from small conical holdfasts; branching pinnate; medulla with a single prominent axial filament: tetrasporangia absent from upright plant; southern England (Scilly I.) .....**Pikea californica** (Plate 2)
6(5) Plant arising from peg-like hold fasts or from a prostrate system, attachedd by tiny discoid holdfasts; irregularly pinnately branched; medulla without prominent axial filament; tetrasporangia present on upright plant; widespread 7
7(6) Main axis branched from near base .....**Gelidium latifolium** (Plate 2)
7(6) Main axis and main branches bare for lower quarter or more 8
8(7) Fronds deep red; outline of frond parallel sided; distal ramuli numerous, short, spinelike; internal rhizoids in a narrow subsurface layer; very rare, south Devon and Corwall .....**Gelidium sesquipedale** (Plate 2)
8(7) Fronds dark purplish-red; outline of frond triangular; ramuli few, spathulate; internal rhizoids in centre of frond; frequent, widespread .....**Pterocladia capillacea** (Plate 2)
9(1) Branches spirally arranged, some modified into hooks .....**Bonnemaisonia hamifera** (Plate 52)
9(1) Branches emerging all in one plane, none forming hooks 10
10(9) Ultimate branchlets comblike .....**Plocamium cartilagineum** (Plate 10)
10(9) Ultimate branchlets forked or pinnate 11
11(10) Branching forked 12
11(10) Branching regularly or irrengularly pinnate 17
12(11) Colour purple to purplish-red; no distinct apical cell; tetrasporangia cruciate.. 13
12(11) Colour bright to brownish red; apical cell distinct; tetrasporangia (where present) tetrahedral 15
13(12) Frond thick, flat, to 300mm long, segments to 12mm wide; cystocarps large, prominent, sessile; rare, known only from south Devon .....
.....**Gracilaria multipartita** (Plate 10)

13(12) Frond cylindrical to compressed, less than 100mm long, segments to 2mm broad; cystocarps sunken or absent 14

14(13) Frond soft and gelatinous, compressed, with one or two dichotomies; base a small disc; cystocarps sunken; very rare, southern and western coasts ..... **Grateloupia dichotoma** (Plate 8) 56

14(13) Frond tough and stiff, only apices compressed, several to many dichotomies; base a spreading disc; cystocarps unknown; rare, widespread ..... **Gymnogongrus griffithsiae** (Plate 12) 62

15(12) Branches fringed with small lateral proliferations; tetrasporangia unknown ..... **Sphaerococcus coronopifolius** (Plate 10) 60

15(12) Branches not fringed with lateral proliferations; tetrasporangia tetrahedral.. 16

16(15) Narrow winglike monostromatic margins to frond usually present, veins present; widespread and common..... **Membranoptera alata** (Plate 18) 48

16(15) Monostromatic margins absent; very rare, subtidal, northern coasts..... **Pantoneura angustissima** (Plate 18) 48

17(12) Ramuli short, spinelike, numerous 18

17(12) Ramuli, if present, blunt, spindle-shaped, few 21

18(17) Fronds soft, pale crimson; ramuli long and short, alternating regularly; cystocarps stalked 19

18(17) Fronds tough, dark crimson or brownish-red; ramuli irregular; cystocarps sessile 20

19(18) Gametangial plants dioecious; cystocarps ovoid, antheridia elongate (1mm long, 300µm wide); rare, Cornwall..... **Bonnemaisonia clavata** micro

19(18) Gametangial plants monoecious, cystocarps spherical, antheridia oval (less than 100µm diameter); occasional and widespread ..... **Bonnemaisonia asparagoides** (Plate 4) 52 micro

20(18) Plant small (to 40mm high); bright crimson; branching rather narrow-angled; frond typically flat, fan-shaped; locally frequent, northern and eastern coasts ..... **Callophyllis cristata** (Plate 10) 6 60

20(18) Plant larger (to 150mm high); brownish-red; branching very wide-angled (almost right-angled); frond bushy; very rare, southern Devon and Channel Islands..... **Gigartina teedii**

21(17) Frond terete or somewhat compressed; translucent pink, brittle; very rare known only from the south coast..... **Gracilaria bursa-pastoris**

21(17) Frond compressed to flattened; dark purple-red to purple-brown, not brittle, cartilaginous..... 2 3

22(21) Apical cell in depression at blunt tipe of branch; base a spreading disc; often forming flattened rosettes; stunted turf-forms on wave-exposed shores .....

.....**Laurencia pinnatifida** (Plate 79) 81

22(21) Apical cell not in depression, branch tips pointed; base a well-defined disc; lower intertidal pools to subtidal; neither rosettes nor turf-forming.....23

23(22) Deep purplish-red fronds; branches with deeply incised margins, segments with large alternate teeth distally; locally abundant in northern Britain 3 83
.....**Odonthalia dentata** (Plate 18) 2

23(22) Dark purplish-brown fronds; branches and branchlets tapered at base and apex, not toothed; local, southwestern England and Wales 69
.....**Grateloupia filicina** (Plate 18)...24

24(23) Plant large (to 750mm long), branching abundant and proliferous.....
.....**Grateloupia filicina** var. **luxurians**

24(23) Plant small (to 120mm long), branching common .....
.....**Grateloupia filicina** var. **filicina**

SECTION M

1 Apices of main branches very blunt or concave 2

1 Apices of main branches pointed 5

2(1) Ultimate ramuli short, firmly attached, not markedly tapered at base 3

2(1) Ultimate ramuli usually long, readily detached, markedly tapered at base 4

3(2) Brownish to yelowish-red; brittle; ramuli wide-angled, spiral and opposite; with refringent cells in cortical cells; usually epiphytic .....
.....**Laurencia obtusa** (Plate 79) 81

3(2) Dark purple to bright greenish-yellow; not brittle; ramuli narrow-angled, alternate or opposite; lacking refringent cells; usually epilithic.....
.....**Laurencia hybrida** (Plate 79) 81

4(2) Frond iridescent blue to yellowish, ramuli long, linear, often strongly curved; very rare, southern England .....**Chondria coerulescens**

4(2) Frond brown-red, ramuli relatively short, straight to slighty curved; common, southern and western shores .....**Chondria dasyphylla** (Plate 79) 81

5(1) Branching pinnate.....6

5(1) Branching forked 10

6(5) Plant cartilaginous; main axis not filiform; may form a springy turf..... 6 64
.....**Gigartina acicularis** (Plate 14)

6(5) Plant not cartilaginous but soft; main axis filiform; does not form a springy turf.....7

7(6) Branches modified into hooks or barbs 9
7(6) Branches not modified into hooks or barbs.....8
8(7) Male and female reproductive structures on separate plants, antheridial clusters large (1mm long, 300µm wide); rare, southern England ....**Bonnemaisonia clavata**
8(7) Male and female reproductive structures on one plant, antheridial clusters small (less than 100µm diameter); widespread ....**Bonnemaisonia asparagoides** (Plate 6) 52
9(7) Lower parts of main axes without ramuli; barbed branches present; entangled among other algae (holdfast unknown); rose-pink to yellow in colour..... .....**Asparagopsis armata** (Plate 9) 52
9(7) Lower parts of main axis with ramuli; hooked branches present; attached by a discoid holdfast; deep-red to black in colour..... .....**Bonnemaisonia hamifera** (Plate 6) 52
10(5) Rhizoids or stolons present or plants with secondary attachment structures 11
10(5) Rhizoids or stolons absent or plants without secondary attachment structures 16
11(10) Ultimate branchlets taper sharply at both ends.....12
11(10) Ultimate branchlets not sharply tapered at insertion.....14
12(11) Axis polysiphonous with five pericentral cells .....**Chondria tenuissima**
12(11) Axis differentiated into medulla and cortex 13
13(12) Frond brittle; plant multiaxial; cystocarps small, not easily seen; branches flattened .....**Agardhiella subulata** (Plate 11) 61
13(12) Frond not brittle; plant uniaxial; cystocarps easily seen as swellings on lateral branchlets; branchlets not flattened .....**Cystoclonium purpureum** (Plate 11) 83
14(11) Apices tightly inrolled; amongst saltmarsh plants near high water mark..... .....**Bostrychia scorpioides** (Plate 28) 70
14(11) Apices straight or slightly curved; on rocks, lower intertidal and subtidal.....15
15(14) Colour purple-red; branching pinnate or irregular, branches curved, wide-angled and reattaching; tetrasporangia cruciately arranged; south and west coasts .....**Gigartina acicularis** (Plate 14) 64
15(14) Colour brownish-black; branching dichotomous, branches straight, narrow-angled, erect; tetrasporangia zonately arranged; widespread ....**Furcellaria lumbricalis** (Plate 11) 61
16(10) Base a small disc 17
16(10) Base a widely expanded disc or spreading crust 23

17(16) Plant small, delicate and flaccid; pinkish-red; slightly flattened; northern coasts; subtidal.....**Pantoneura angustissima** (Plate 16) 78

17(16) Plant large, not delicate or flaccid but cartilaginous or brittle (at least in part); dark-red in colour; intertidal and subtidal.....18

18(17) Plant filiform (less than 1mm wide), polysiphonous (siphons obscured by cortication in surface view); tetraspores tetrahedrally arranged, in lateral branches or stichidia.....19

18(17) Plant cylindrical (1-3mm wide), not polysiphonous, thallus differentiated into a cortex and medulla; tetraspores cruciately or zonately arranged; not in lateral branchlets.....21

19(18) Main axis clothed with coarse short spine-like ramuli.....20

19(18) Main axis clothed with finer softere ramuli .....**Rhodomela confervoides** (Plate 83)

20(19) Main axis densely clothed with short ramuli, some developing into lateral tufts; northern coasts.....**Rhodomela lycopodioides** (Plate 31)

20(19) Main axis not densely clothed but open; widespread.....**Rhodomela confervoides** (Plate 83)

21(18) Axial medulla entirely pseudoparenchymatous; cystocarps large, sessile, scattered; widespread 22

21(18) Axial medulla pseudoparenchymatous with interspersed filaments; sterile on British coasts; rare, southern England .....**Solieria chordalis**

22(21) Colour conspicuously reddish; fronds brittle; slightly compressed .....**Gracilaria bursa-pastoris**

22(21) Colour dark purplish; fronds elastic; not compressed .....**Gracilaria verrucosa** (Plate 11) 61

23(16) Branching regularly dichotomous throughout 24

23(16) Branching not regularly dichotomous 25

24(23) Frond to 75mm high, 0.5mm diameter; wiry; medullary cells to 25um diameter; carpotetrasporangia produced in swollen outgrowths.....**Gymnogongrus griffithsiae** (Plate 12) 62

24(23) Frond to 200mm wide, 2mm diameter; cylindrical; medullary cells 25-33um diameter; tetrasporangia cruciately arranged and immeresed in the thallus.....**Polyides rotundus** (Plate 11) 61

25(23) Plant polysiphonous with five pericentrals but surrounded by a cortical layer; ultimate branching comb-like and sometimes hooked; tetrasporangia in stichidia.....**Halopitys incurvus** (Plate 29) 81

25(23) Plant not polysiphonous; ultimate branching nor comb-like or hooked; tetrasporangia not in stichidia.....26

26(25) Frond cylindrical (2-3mm diameter); cystocarps stalked; rare, southwestern England.....**Gigartina pistillata** (Plate 14) 64

26(25) Frond filiform (to 0.5mm diameter); cystocarps not stalked; widespread.....27

27(26) Spiky brittle, bright-red tufts, to 110mm tall, sparingly branched; tetrasporangia in swollen spear-shaped tips of fronds; holdfast to 10mm diameter.....**Cordylecladia erecta** (Plate 11) 61

27(26) Wiry, cartilaginous, entangled blackish (sometimes bleached) tufts to 150mm tall, abundantly branched; tetrasporangia not on erect plant; holdfast to 30mm diameter.....**Ahnfeltia plicata** (Plate 11) 61