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Water Framework Directive - Coastal Waters Rocky Shore Monitoring

Field Guide to British Seaweeds

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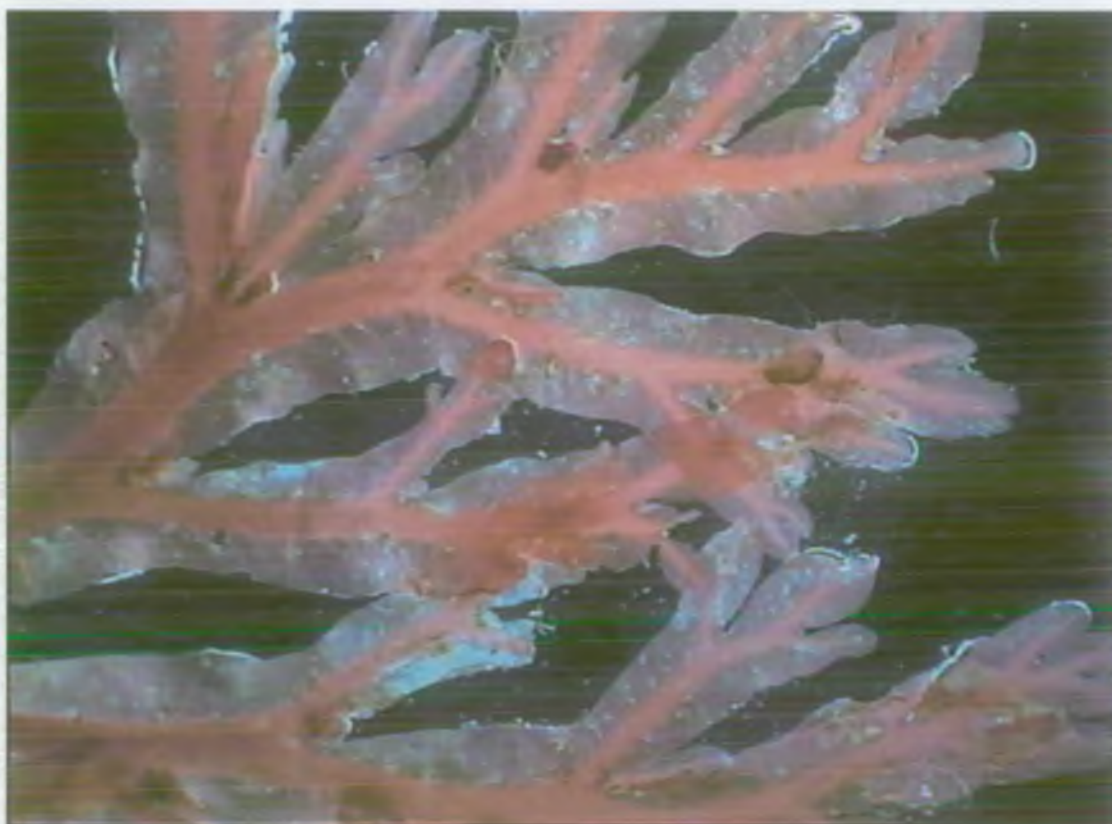
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A Field Guide to the British Seaweeds

**As required for assistance in the classification of water
bodies under the Water Framework Directive**



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A Field Guide to the British Seaweed

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INTRODUCTION

The EU Water Framework Directive (WFD) requires water bodies to be classified by their chemical and ecological status. Macroalgae are one of the biological quality elements to be used in defining the ecological status of a transitional or coastal water body. For this particular macroalgae component the directive states that for reference conditions the taxonomic composition should correspond totally or nearly totally with undisturbed conditions with all sensitive taxa present. As species richness remains broadly constant in the absence of environmental alteration this was proposed as an ideal measure of quality. Therefore, levels of macroalgae species richness would be used to set an ecological quality standard from which any deviation may be measured and used to classify water bodies as high, good, moderate and poor.

However, the identification of intertidal seaweed species requires high levels of taxonomic expertise. Therefore, a tool is being developed that may be used by less experienced persons to assist with the classification of water bodies. This tool utilises an alternative means of recording qualitative species data, which is to implement the use of a reduced species list (RSL) whereby the number of species from the RSL will be in proportion to total species richness thereby acting as a surrogate. The list is composed of species (approximately 70) that are most frequently present on a variety of rocky shores within a set geographical area. Additional measurements have been incorporated using the RSL including the proportion of green, red and opportunist species and an Ecological Status Group ratio. The tool also utilises basic shore descriptions to allow for natural variations to be considered.

The tool aims to fulfil the requirements of the WFD by enabling less experience algal taxonomist to classify areas of coastline. This guide aims to assist with such a process by providing detailed descriptions on shore sampling methodologies, examples of key characteristic from which to identify, a comprehensive yet straight forward algal key and detailed images on each species within the RSL.

SEAWEED COLLECTIONS AND SHORE SEARCHING

There are general patterns of zonation that occur within the intertidal so to find all possible seaweed species the shore needs to be searched thoroughly. This includes covering all possible habitats and the full extent of the shore from the upper most reaches bordering the terrestrial environment down to the lower reaches only exposed during low spring tides. Full algal surveys should include not only those species attached directly to the rock surface but also those algae growing in/on other host algal species and animals such as hydroids and dead shells:

- Only attached species to be collected (drift may be from elsewhere although may be worth noting presence of some alien species such as *Sargassum muticum*)
- Full range of subhabitat types to be sampled:
 - Rockpools, crevices, couloirs (or large crevices), ledges, overhangs and caves



- Upper shore rocks and freshwater seepage for Chlorophyta mats



- Under canopy algae for small, fine filamentous forms



- Turfs of mixed species including a variety of morphological forms



- **Epiphytes** – algae growing on other host algal species – for example:



- *Elachista* sp. and *Ulothrix* sp. on *Fucus*
- *Litosiphon* sp. on *Alaria* and *Chorda*.
- Encrusting Corallines on *Polyides*
- Many small epiphytes on various filamentous species such as *Cladophora*
- Red epiphytes on kelp stipes

- **Endophytes** – algae growing in other host algal species – for example:



- *Chlorochytrium*/*Sykidion* spp. in a variety of host species
- *Myrionema strangulans* in *Palmaria* and *Enteromorpha* sp.
- Variety of Chlorophyta, Phaeophyta and Rhodophyta sp. in *Cladophora*, *Polysiphonia* and *Ceramium*
- Many small filamentous epiphytes in gelatinous red and brown algae and particularly in decaying distal portions of *Dumontia* and *Chorda*

- **Epizoans** – algae growing on faunal species – for example:

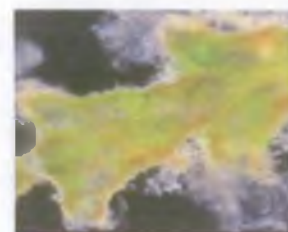


- *Audouinella* sp. on hydroids
- *Ralfsia* on Limpet shells

- **Endozoans** – algae growing in faunal species – for example:



- *Audouinella* sp., *Melobesia* and *Epicladia* in hydroids
- *Tellamia* sp in *Littorina littoralis*.
- Blue-green species, reproductive phases and *Chlorophyta* sp. boring in various periwinkle, limpet and mussel shells



- **Epilithic** – algae growing over the rock surface – for example:



- Encrusting corallines such as *Lithothamnion*, *Phymatolithon*.
- Other encrusters such as *Hildenbrandia* and *Ralfsia*

There is no systematic approach to intertidal rocky shore sampling, but all subhabitat types present should be identified and sampled. Due to the nature of algal sampling there is no guarantee of collecting or identifying all species present on a stretch of shore. To ensure maximum species richness is recorded, it is advised that sampling commence at the lower littoral zone of the shore working up the shore from low tide and covering the full tidal range of the shore. It is essential that the kelp zone is uncovered to expose those species attached to the stipes, and the lower shore rockpools which may be densely filled with a number of foliose and filamentous red species. Many low shore species may be found in rockpools. Searching should cover a wide extent of the shore and not be restricted to a single transect line to ensure all potential habitats are explored. Large rockpools can provide a wealth of algal diversity including many morphological forms such as encrusting and erect coralline forms, filamentous, gelatinous and cartilaginous forms. Turfs consisting of numerous red, brown and green species may be located in moist crevices, on the sides of boulders and steep rock outcrops and on overhangs. Often these turfs are covered over by a canopy layer of *Fucus* or other large conspicuous, cartilaginous forms. Due to the fine, filamentous and often microscopic nature of some tuft forming species it is advisable to take a scraping of the area and collect in a specimen tube, this is also applicable to the upper shore green mats.

Some species have distinct vertical zonation patterns on the shore which may help with shore searching. Many red species are found on the lower littoral and sublittoral areas of the shore, therefore it is essential that sampling should take place on a spring low tide to ensure the lower littoral gets fully uncovered. Many of these species are found attached to the stipes of kelp or large, cartilaginous species or may be found within crevices to avoid the force of the waves. Brown algal species can generally be found throughout the intertidal, although they have quite limited diversity on the upper shore. Many of the brown species are quite conspicuous and easier to locate such as the kelp and fucoid species which often cover large areas of the intertidal and subtidal. Other filamentous species can be more difficult to find but may be found in amongst turfs or on various species including red and green algae. The green algae are more commonly found on the upper shore often forming mats on the rock surface but are also found attached to larger algae. Green patches of algae are also found scattered throughout the mid-littoral both on the open rock surface and within rock pools but *Ulva* sp. may form patches on the lower shore and within rockpools.

More descriptive location details are given for each of the species from the reduced species list within the individual species descriptions.

Although collection of specimens should be kept to a minimum it is important to collect whole plants along with stipe and holdfast, as these may be important for identification. Reproductive structures may also be important for classification and identification as they may help distinguish between two very similar species. Some species also have alternative phases in their life history which may be morphologically very different, so may key out as separate entities. There may also be seasonal difference in appearance due to new growth or reproductive bodies. Plants with thin membranous parts may lose these in autumn and winter storms, leaving only the tougher midrib or stipe. Taking some of these factors into account, it is recommended that sampling take place consistently at the same time of year preferably between May and early October due to increased levels of species richness during this time. Sample collections take on average 90 to 120 minutes by two or more persons, but this may vary according to the extent and width of the shore.

Specimens should be collected and retained in either small plastic containers or plastic bags but not kept in water as this may aid decomposition, they must be kept cold and damp. It is useful to take a knife and forceps for collecting certain types of plants. Also take a field sheet and species check-list (Tables 1 and 2). Within the field sampling sheet basic information is required on shore name, time, date and tidal height as well as the general nature of the shore. The shore descriptions box enables a rough description of the shore to be noted, e.g. shore wide with large intertidal with a sandy bay to the west consisting mainly of one large rock outcrop within which are variously sized rockpools and a small cave on the upper shore to the east. Dominant shore type mainly refers to the type of hard substrate such as the presence of large rock outcrops, shingle, boulders etc.

Basic descriptions of dominant shore types

Rock ridges/platforms/outcrops – these refer to large areas of stable hard substrata forming either ridges across the shore, large flat rocky areas (platforms) or stand alone areas of rock jutting seaward which may also be cut off at high tide (outcrops).

Irregular rock – large rocky areas that cannot be described as any of the above.

Boulders – these generally refer to large rocks with small boulders measuring >20cm in diameter, medium boulders >50cm and large boulders >100cm.

Steep vertical rock – this is relatively self explanatory but may also include rocky cliff faces that are found at low water.

Non specific hard substrate – this refers to small rocky areas and can include artificial hard substrate, slip ways and harbour walls.

Pebbles/stones/small rocks – general rocks smaller than 20cm in diameter.

Gravel/shingle – rocks smaller than 1cm in diameter.

Subhabitat type refers to the smaller habitats within the full range of the shore and includes rockpools of various sizes, crevices, overhangs etc. The general comments section should be used to note if there is any large abundance of opportunists, freshwater seepage or any information of interest that may be important for future referrals.

Table 1: Field sampling sheet to record basic shore descriptions.

General Information							
Shore Name				Date			
Water Body				Tidal Height			
Grid Ref.				Time of Low Tide			
Shore Descriptions <i>Examples of general shore descriptions are given on page 9</i>							
Presence of Turbidity (known to be non-anthropogenic)	Yes	=0	Sand Scour	Yes	=0	No	=2
	No	=2	Chalk Shore	Yes	=0	No	=2
Dominant Shore Type			Subhabitats				
Rock Ridges/Outcrops/Platforms		=4	Wide Shallow Rock Pools (>3m wide and <50cm deep)				=4
Irregular Rock		=3	Large Rockpools (>6m long)				=4
Boulders large, medium and small		=3	Deep Rockpools (50% >100cm deep)				=4
Steep/Vertical Rock		=2	Basic Rockpools (none of the above)				=3
Non-specific hard substrate		=2	Large Crevices				=3
Pebbles/Stones/Small Rocks		=1	Large Overhangs and Vertical Rock				=2
Shingle/Gravel		=0	Others habitats (please specify)				=2
Dominant Biota							
Ascophyllum							
Fucoid							
Rhodophyta mosaics			Caves				=1
Chlorophyta			None				=0
Mussels			Total Number of Subhabitats				
Barnacles			>4	3	2	1	0
Limpets							
Periwinkles							
General Comments <i>To include comments on any anthropogenic influence, presence of artificial structures or sea defences. General uses and impacts</i>							

Milford Haven

West Angle

This was a moderately exposed and west facing sandy bay situated just outside of Milford Haven. The main sampling area was to the south of the bay consisting of large rock platforms. Mid and upper shore areas of the site appeared to be relatively devoid of algal species with large areas of bare rock ridges and platforms. These flat areas of rock were dominated by barnacles which covered the majority of the shore. Upper shore fucoids were present but in low abundance and only on the side of rock outcrops facing away from the sea. Despite the main rock surfaces appearing to lack any abundant algal growth the lower shore provided substantial subhabitats numbers and types to produce a high diversity of lower shore species resulting in this site being one of the most species rich in the area. The lower shore was covered with a variety of rockpools and gave way to more steeply sloping rocks towards the low water mark. These steep rock faces provided areas of dense cover of algae including *Himanthalia*, indicating exposure to wave action.

Port Hubberston

This shore was located into Milford Haven opposite to Angle Bay and surrounded by numerous oil facilities. The main sampling area consisted of steep rock outcrops which limited the extent of the shore. Despite this a typical shore zonation of a sheltered was exhibited with dense cover of fucoids along the full extent of the intertidal particularly at the west end of the shore. Initial appearance suggested this shore to be lower in algal diversity than Angle Bay and this was highlighted by the general lack of subhabitat diversity. The lower shore gave way to shingle and boulders at the low water mark, therefore the sublittoral was underdeveloped contributing further to the lack of algal diversity. Where dense furoid cover was devoid the shore became barnacle dominated. There were very few rockpools present on the mid and upper shore only and these tended to be quite small and shallow with limited species present.

Sawdern Point

This moderately exposed to sheltered shore consisted of a rock outcrop at the east end of Angle Bay. The rock surface was very rough in texture producing numerous crevices in which algal species could more easily attach. On the north side of the shore, nearest to Milford Haven, the shore type changed to large boulders and a less even shore giving rise to many subhabitat types. On the south side, which faces onto a more sedimentary area of Angle Bay, the shore is becomes classically sheltered densely covered with long stranded *Ascophyllum*. In general the shore didn't appear to be very species rich.

Table 2: Species lists for each of the areas

Species List	Eng Wales	NI	Scot Eng		Eng Wales	NI	Scot Eng
Rol					Rol		
Greens				Reds			
Blidingia sp.	1	1	1	Aglaothamnion/Callithamnion	1	1	1
Bryopsis plumosa	1			Ahnfeltia plicata	1	1	1
Chaetomorpha linum	1	1	1	Audouinella purpurea		1	
Chaetomorpha mediterranea	1	1		Audouinella sp.		1	
Chaetomorpha melagonium	1		1	Calcareous encrusters	1	1	1
Cladophora albida		1		Callophyllis laciniata			1
Cladophora rupestris	1	1	1	Catenella caespitosa	1	1	
Cladophora sericea	1	1	1	Ceramium nodulosum	1	1	1
Enteromorpha sp.	1	1	1	Ceramium shuttleworthianum	1	1	1
Monostroma grevillei		1		Ceramium sp.	1		
Rhizoclonium tortuosum		1		Chondrus crispus	1	1	1
Spongomorpha arcta		1		Corallina officinalis	1	1	1
Sykidion moorei			1	Cryptopleura ramosa	1	1	1
Ulothrix sp.		1		Cystoclonium purpureum	1	1	1
Ulva lactuca	1	1	1	Delesseria sanguinea			1
	9	12	8	Dilsea carnosa	1	1	1
Browns				Dumontia contorta	1	1	1
Alaria esculenta		1	1	Erythrotrichia camea	1		1
Ascophyllum nodosum	1	1	1	Furcellaria lumbricalis	1	1	1
Asperococcus fistulosus		1	1	Gastroclonium ovatum	1		
Chorda filum	1		1	Gelidium sp.	1	1	
Chordaria flagelliformis			1	Gracilaria gracilis	1		
Cladostephus spongiosus	1	1	1	Halurus equisetifolius	1		
Desmarestia aculeata			1	Halurus flosculosus	1		
Dictyosiphon foeniculaceus			1	Heterosiphonia plumosa	1		
Dictyota dichotoma	1	1	1	Hildenbrandia rubra	1	1	
Ectocarpus sp.	1	1	1	Hypoglossum hypoglossoides	1		
Elachista fucicola	1	1	1	Lomentaria articulata	1	1	1
Fucus serratus	1	1	1	Lomentaria clavellosa			1
Fucus spiralis	1	1	1	Mastocarpus stellatus	1	1	1
Fucus vesiculosus	1	1	1	Melobesia membranacea		1	
Halidrys siliquosa	1	1	1	Membranoptera alata	1	1	1
Himanthalia elongata	1	1	1	Nemalion helminthoides	1		
Laminaria digitata	1	1	1	Odonthalia dentata		1	1
Laminaria hyperborea	1		1	Osmundea hybrida	1	1	1
Laminaria saccharina	1	1	1	Osmundea pinnatifida	1	1	1
Leathesia difformis	1	1	1	Palmaria palmata	1	1	1
Litosiphon laminariae			1	Phycodrys rubens			1
Pelvetia canaliculata	1	1	1	Phyllophora sp.	1	1	1
Petalonia fascia		1		Plocamium cartilagineum	1	1	1
Pilayella littoralis	1	1	1	Plumaria plumosa	1	1	1
Ralfsia sp.	1	1	1	Polyides rotundus	1		1
Saccorhiza polyschides	1			Polysiphonia fucoides	1	1	1
Scytosiphon lomentaria	1	1	1	Polysiphonia lanosa	1	1	1
Sphacelaria sp.		1		Polysiphonia sp.	1	1	1
Spongonema tomentosum		1	1	Porphyra leucosticta			1
	20	22	26	Porphyra umbilicalis	1	1	1
				Ptilota gunneri			1
				Rhodomela confervoides	1	1	1
				Rhodothamniella floridula	1	1	1
					40	34	36
				Total	69	68	70

2. IDENTIFICATION OF SPECIMENS

All specimens should be laid out in large sorting trays where fronds and fine filamentous structures can be separated out and become more visible, this may be assisted by placing small amounts in a petri dish and examining under low magnification (dissecting microscope). Mats of algae need to be carefully separated and pulled apart so that all species can be identified. For more detailed examination using a compound microscope, particularly of small filamentous and microscopic species, a small amount of the specimen may be removed and placed on a glass slide with a little water and glass cover slip laid over the top. Microscopic examination is usually necessary to identify many of the larger filamentous species and to find and identify the smaller ones that may live inside or attached to larger ones.

Although identification of all species from the reduced species list can be achieved using this key, it may be necessary to confirm with descriptions and pictures from alternative keys. It is generally advisable to confirm all species identification with the appropriate guides and keys even those species that have been identified in the field.

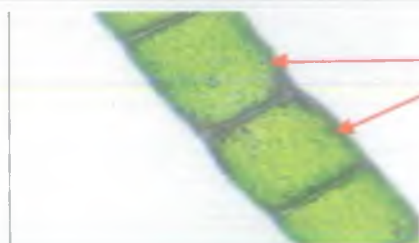
There is an amazing range of seaweed forms some of which can only be found by detailed field searching or under the microscope. But it is these morphological characteristics that are essential for identification. Some species may have their colour masked by an excess of other pigments – the red *Porphyra* usually looks brown, brown fucoids may sometimes appear green, old tips of *Dumontia* turn green, *Ahnfeltia* appears black as do some species of *Polysiphonia*. Therefore, it is essential to be aware of some of these pigment discrepancies before identification starts as this may lead to the use of the wrong key.

The varieties of algae forms are briefly described with microscopic and field photos to illustrate such forms:

- **Filaments** – a linear group of cells joined at their walls or a chain of cells
 - branched or unbranched



- uniseriate (one cell thick) and multiseriate or monosiphonous filaments which may be covered with many smaller cells (> 1 cell thick/wide)



Cells



Uniseriate

Multiseriate

- macroscopic (large filaments visible with the naked eye) or microscopic (requires magnification)
- free-living on rock or endophytic, endozoic, epiphytic (as described in above section)

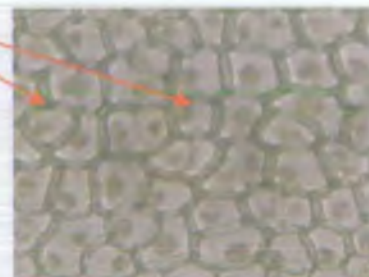
- **Pseudoparenchymatous forms** (growing by aggregation of filaments) or **parenchymatous** (composed of a mass of cells growing by cell division in 2 or more planes), multiseriate:

- Tubular – may appear flat as often sides are often compressed together giving the appearance of a ribbon shaped foliose plant.

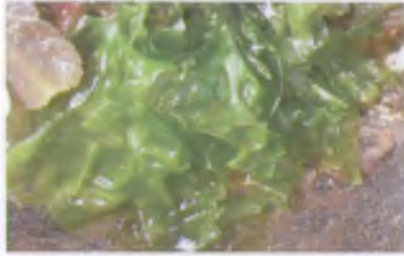


Mass of cells

Ribbons



- Foliose – plant is generally wide, flat and quite thin sometime only 1 cell thick often leaf like in appearance



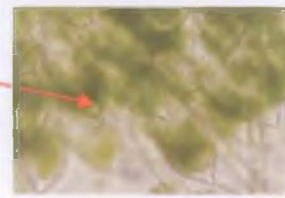
- **Encrusting forms** – algae that grow over the rock surface with no erect system



- **Coenocytic forms** – made up of acellular filaments, (not divided into cells) and cell contents move freely within the filament, multinucleate



No cell divisions

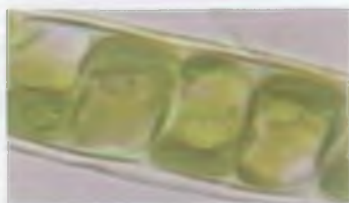


- **Large cartilaginous forms** – firm and tough but slightly flexible with leather like texture



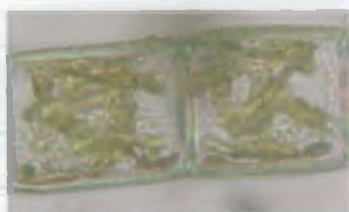
Special features that need to be considered in making identifications

- **Chloroplast morphology in cells (compound microscopic examination).**



Parietal

- Parietal – forming a cylinder around the cell inside the cell wall
- Axile – passing through the middle of the cell cavity
- Simple – a non-perforated plate or cylinder



Band/ ribbon shaped

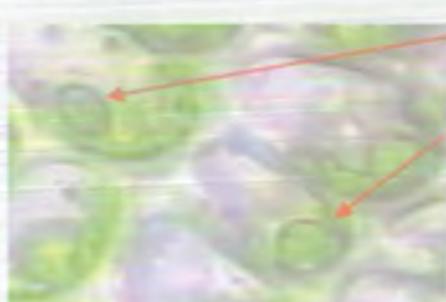
- Band/ribbon shaped – a girdle almost completely encircling the cell
- Discoid – often many discs per cell



Reticulate

- Reticulate – a network – sometimes made up of lots of filaments of chloroplast material or sometimes formed by lots of perforations and lobes on a parietal cylinder

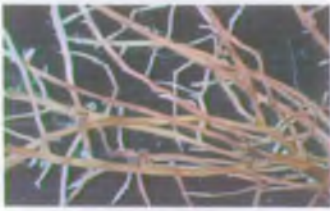
- **Pyrenoids** –centre of formation of storage product in the chloroplast –stains blue-black with iodine in potassium iodide in green algae only because starch is the storage product. There may be a single or many pyrenoids per cell found in or extending from the chloroplast.



Pyrenoids



- **Branching patterns:**



Irregular

- Irregular – branching in no consistent pattern and cells of varying shapes and sizes



Alternate

- Alternate - arranged in two rows with branching alternating between sides



Opposite

- Opposite – branches appearing on both sides of the main axis directly opposite from each other



Secund

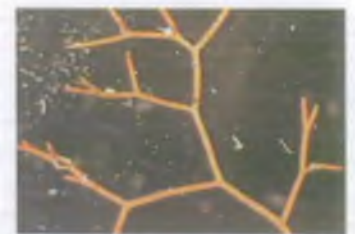
- Secund – arranged on one side of the main axis resembling a comb



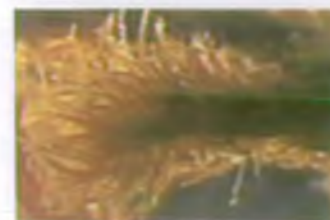
Dichotomous

- Dichotomous – branches forking regularly into two equal branches, division always in pairs resembling the letter 'Y'

- Subdichotomous – similar to dichotomous branching but with one branch of limited growth and the other continuing to grow



Subdichotomous



Whorled

- Whorled – several branches radiating from the main axis at the same level, surrounding axis in a ring, often quite bushy

- **Reproductive structures** – these can vary considerably between species therefore may aid with identification for example:

- *Fucus spiralis* – the fruiting bodies/receptacles are inflated, round and often have a rim of sterile material



- *Fucus serratus* – receptacles flattened with extended growth

- *Fucus vesiculosus* – receptacles inflated, elongated and pointed



- *Pilayella littoralis* – intercalary sporangia where the cells within which spores are contained are located between the base and apex of the plant

- *Ectocarpus* sp. and *Giffordia* sp. – plurilocular sporangia (reproductive structures with many compartments) are located on stalks, may be elongated, spindle, ovoid or conical shaped

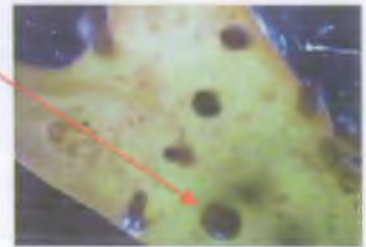


- *Sphacelaria* sp. – reproductive body a propagule, which is a structure consisting of a multicellular branch that detaches from thallus



Spermatangia

- *Mastocarpus stellatus* – cystocarps (female) existing as knobbles and spermatangia (male) present as dark stains on the thallus

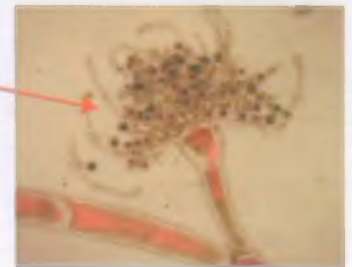


Cystocarps



Cystocarps

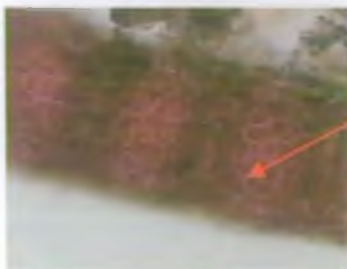
- *Halurus flosculosus* – cystocarps and spermatangia present as cups of fruiting bodies on stalks



Spermatangia

Other characteristics of interest

- **Apical cell** – a prominent cell at the apex or tip of plant for example in *Dictyota dichotoma*



- **Cortication** – an outer covering of small cells



- **Frond** – the erect part of a seaweed often used in the description of foliose algae



- **Distal**– Towards the base or point of attachment



- **Holdfast** – the structure for attachment to substrate, may be root-like, single cell or group of cell, disc or claw-like. Apparent encrusting forms may sometimes be basal portions of erect plants e.g. some encrusting calcareous forms may just be expanded basal portions of *Corallina*, some non-calcareous red ones may be bases of *Mastocarpus*



Claw-like holdfast



Discoid holdfast

- **Lamina** – the blade of flat, leafy or foliose algae



- **Membranous** – forming a thin layer, may be semi-transparent, often sheet-like

- **Pinnate** – branching arranged like feather plumes often in a single plane



Axial cell

Pericentral cells

- **Polysiphonous** – a ring of cells (siphons or pericentral cells) located around a central or axial cell

- **Stipe** – basal stalk-like portion arising from the holdfast and bearing lamina
- **Terete** – cylindrical in cross section



A FIELD KEY TO THE BRITISH SEAWEEDS

This identification guide is driven solely by the Water Framework Directive and only includes those species listed as those most frequently found on shores within the British Isles and Republic of Ireland. This list is referred to as the reduced species list (RSL). Separate lists have been compiled for Northern Ireland, Southern England/Rol/Wales and Northern England/Scotland.

This key is specific to the RSL and may exclude a number of characteristics and morphological forms that may usually be found in algal identification keys.

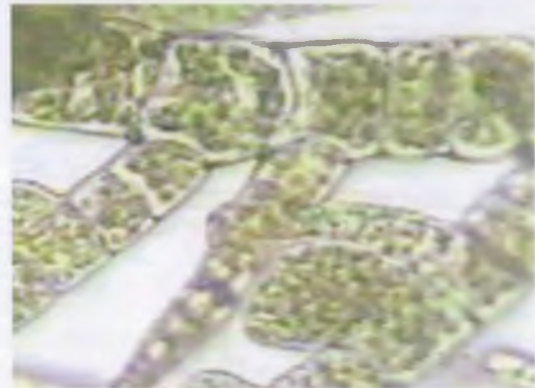
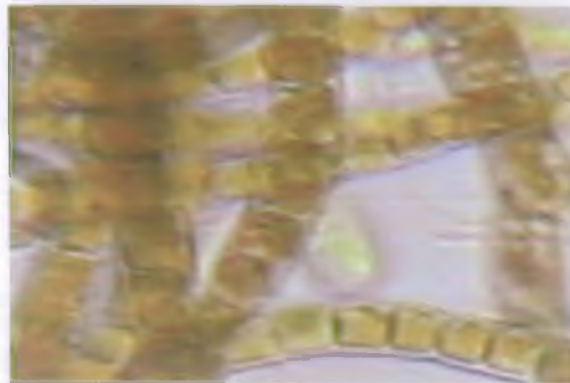
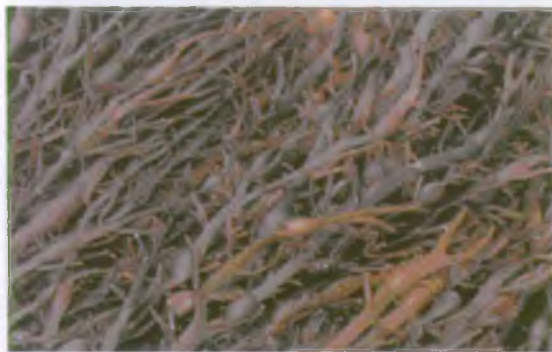
Chlorophyta The green algae are generally grass green in colour and tend to be delicate in morphological form with many existing as small filamentous, foliose or microscopic forms. They often turn brown during the decomposition process and may appear brown in the field due to the external presence of epiphytic diatoms. Most Chlorophyta species are located at the top of the shore although *Ulva*, *Enteromorpha* and *Cladophora* are also common on the mid and lower shore.

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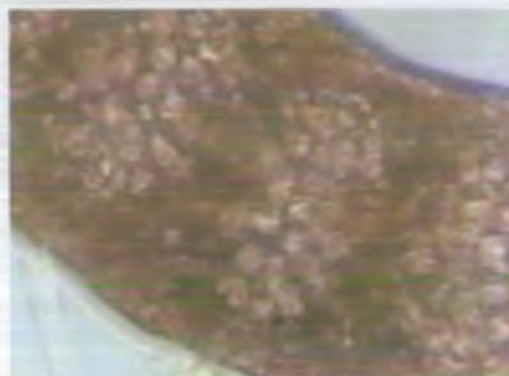
Phaeophyta The brown algae constitute many of the large cartilaginous forms, which can cover large areas of the shore, as well as finer forms, therefore have a large morphological range. They may be olive-green, or various shades of brown, from golden to dark brown. Bleaching and decomposition can cause a change in colour to a brownish yellow or green. Colour may also change considerably under the microscope due to the light so this needs to be taken account of when examining the small filamentous species.

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Rhodophyta The red algae exhibit a range of colours from dark red to black through to shades of pink, purple and brown and take on a variety of morphological forms. The decomposition of Rhodophyta species results in a change in colour whereby many cells turn green, they may also be bleached in bright sunlight changing to brown or yellow in colour. Therefore it is necessary to use fresh material in order to assist with the first line of taxonomic classification and to reduce confusion with some Phaeophyta species. Rhodophyta species are more commonly found on the mid to lower shore.

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Chlorophyta Species

Group A Plants are flattened, often thin and delicate may be easy to tear, and also tubular, cylindrical or hollow, which is often evident on cross section of the specimen. Smaller forms may also take on a slightly filamentous but cylindrical appearance (filiform) but microscopic examination will clarify this as they will be multiseriate (several cells wide).

Group B Plants filamentous in form, tend to be very fine, delicate and hair like. Generally consist of a single or numerous filaments of linearly arranged cells which may be more clearly seen under microscopic examination. These species are uniseriate (one cell wide).

Group C Plants microscopic, growing on or in other species of algae or rocks and shells, may be uni- or multi-cellular but are often difficult to locate.

Sykidion moorei

(this species is a single round cell located within *Blidingia* sp. only)

Group D Plants are siphonous, they do not have cross walls, and cellular material moves freely throughout the filaments. They resemble those species of Group B with a filamentous appearance.

Bryopsis plumosa

(this species tends to be very fine, delicate and feather like with a regular opposite branching pattern in a single plane only)

Group A

1. Plants completely flattened.....2
1. Plants tubular or appearing slightly filiform.....3
2. Plants one cell thick only, forming a very delicate and thin membrane, may tear very easily and with a sheet-like appearance almost translucent
Monostroma sp.
2. Plants two cells thick, forming a tougher thicker sheet, often bright green in colour
Ulva lactuca
3. Cells usually 4-12um wide with a basal disc and no rhizoidal cells, small filiform plants often found as a thin spongy mat or layer on Fucus or upper shore rock surface
Blidingia sp.
3. Cells greater than 12um, tubular plants, may be branched or unbranched often found in dense patches covering vast areas of the upper and mid shore attached by rhizoidal cells
Enteromorpha sp.

Group B

1. Plants unbranched or few branches.....2
1. Plants highly branched.....6
2. Rhizoidal growths or false branching of 1-3 cells long, cells generally longer than wide forming long filaments, forming a felty green mat at the top of the shore
Rhizoclonium tortuosum
2. Rhizoidal growths absent.....3
3. Plants with a reticulate (net-like) chloroplast.....4
3. Plants with a single band/cup shaped or parietal chloroplast where the chloroplast lines the inner cell wall
Ulothrix sp.

4. Plants forming a soft woolly mass of fine filaments often tangled around other algae on the upper shore and in rock pools *Chaetomorpha mediterranea*
4. Plants do not form a soft woolly mass.....5
5. Plants form a tough and wiry mass of thick filaments giving appearance of green garden/fishing wire or wire wool *Chaetomorpha linum*
5. Plants solitary filaments, cells large often appearing bead-like, usually found growing in sandy pools *Chaetomorpha melagonium*
6. Cells with a dense reticulate chloroplast appearing uniformly green.....7
6. Reticulate chloroplast not dense, with net work of fibrils clearly visible, appearance of false discoid chloroplasts and club shaped apical/terminal cells, plants often quite tufted and often entwined to form rope like growths
Spongomorpha arcta
7. Branching usually multidichotomous often with up to 6 branches arising from a single axial cell, often dark green in colour and may be quite coarse in texture *Cladophora rupestris*
7. Branching often comb-like but may also have dichotomous branches, lighter green in colour *Cladophora sericea*
7. Light green in colour with rounded apical/terminal cells, cells often long and slender with narrow apical cells *Cladophora albida*

Phaeophyta Species

- Group A** Plants are generally large and cartilaginous in form, consisting of a thick, tough and leathery frond. This group may take on a variety of morphological forms composed of wide flat fronds, channelled fronds, simple single blades and highly branched forms. These plants are not hollow except for the presence of air bladders which may be found in some species.
- Group B** Plants consist of a thick thread like form ranging from 1mm to 5mm wide. These are often cylindrical but may also be slightly flattened but are not hollow and do not contain air bladders. Some species may appear as a single rope like plant, other species may be highly branched and more delicate in form.
- Group C** Plants filamentous in form, tending to be very fine, delicate and hair like. Generally consist of a main axis up to 1mm thick and numerous filamentous branches usually less than 0.25mm. Branches may either be uniformly arranged or irregular. Filaments may be long, short, stiff or floppy, separated or tangled together into woolly cords. Usually less than 15cm long, but may extend up to 30cm. Found growing epiphytically on a host species or independently. Many species require microscopic assistance for identification.
- Group D** Plant flattened and quite thin may be easily torn but generally quite elastic. Consist of both branched and unbranched forms although not numerously branched.
- Group E** Plants tubular and hollow from 2mm to 12mm wide. May be easily torn as they can be quite thin and membranous.
- Group F** Plants forming distinct crusts or cushions on the rock and other hard surfaces.

Group A

1. Plants with distinct midrib.....2
1. Plants without distinct midrib.....5
2. Plants with a prominent claw-like holdfast (basal attachment) present, with long, wide fronds that may be easily torn. Characteristic of exposed shores.
Alaria esculente
2. Plants with indistinct disc-like basal attachment.....3
3. Plant with air bladders set in frond, usually in pairs either side of the midrib, (no. of bladders variable depending on degree of exposure) *Fucus vesiculosus*
3. Air bladders absent from plant.....4
4. Frond spirally twisted and present on the upper shore *Fucus spiralis*
4. Frond edge serrated and generally present on the lower shore *Fucus serratus*
5. Plant with in-rolled frond forming a distinct channel *Pelvetia canaliculata*
5. Frond not channelled.....6
6. Air bladders present.....7
6. Air bladders absent.....8
7. Plant with pod-shaped air bladders divided internally by cross-walls (resembling pea pods). Branching alternate giving a zig-zag appearance
Halidrys siliquosa
7. Air bladders ovoid at intervals along the main axis of the plant. Dichotomously branched but fairly infrequent, stalked receptacles often present along the main frond. Characteristic of sheltered shores.
Ascophyllum nodosum

- | | | |
|-----|--|--------------------------------------|
| 8. | Thallus consisting of a large wide flat frond..... | 9 |
| 8. | Thallus rope-like extending from a button or mushroom shaped holdfast, frond often very long, sometimes flat and divided | <i>Himanthalia elongata</i> |
| 9. | Flat expanded part of thallus not divided, with wavy edge and crinkly centre | <i>Laminaria saccharina</i> |
| 9. | Main thallus smooth and generally divided, giving large finger like appearance..... | 10 |
| 10. | Holdfast a large and warty bulb with ribbon-like, wavy stipe | <i>Saccorhiza polyschides</i> |
| 10. | Holdfast simple and claw shaped..... | 11 |
| 11. | Stipe smooth and flexible and slightly flattened at the top, can be almost entirely undivided in sheltered areas | <i>Laminaria digitata</i> |
| 11. | Stipe stiff, round and upright, generally rough and covered with red algal epiphytes | <i>Laminaria hyperborea</i> |

Group B

1. Plant completely unbranched, cylindrical bootlace extending to 8m in length. *Chorda filum*
1. Plant variously branched.....2
2. Branching mostly alternate, frond flattened with long main axis, older plants exhibit short spine-like branchlets giving a serrated appearance. *Desmarestia aculeata*
2. Branching mostly irregular.....3
3. Branches numerous, often with a covering of fine hairs, slightly gelatinous and slippery. *Chordaria flagelliformis*
3. Branches more coarse in texture. *Dictyosiphon foeniculaceus*

Group C

1. Plants consist of unbranched filaments growing as small tufts on larger seaweed.....2
1. Plants branched and occasionally tangled into woolly cords.....3
2. Uniseriate filaments found growing epiphytically on *Fucus* sp.
Elachista fucicola
2. Multiseriate filaments found growing on a number of large brown seaweed particularly *Alaria* and *Chorda*.
Litosiphon sp.
3. Plants stiff, retaining rigidity whilst in water.....4
3. Plants flexible in water often limp and floppy.....5
4. Plant usually less than 2-3cm, with irregular branching and often appearing as tufts on other seaweed.
Sphacelaria sp.
4. Branching very regular, whorled around main filament resembling a pipe cleaner and up to 25cm long.
Cladostephus spongiosus
5. Filaments tangled into woolly cords, up to 20cm long often found growing on *Fucus* sp.
Spongonema tomentosum
5. Filaments not tightly tangled into cords but may be slightly clumped.....6
6. Chloroplasts appearing as long ribbon shapes, with sporangia present as elongated spindles on stalks.
Ectocarpus sp.
6. Chloroplasts present as small discs with sporangia appearing as swollen cells within the main filament (intercalary).
Pilayella littoralis

Group D

1. Plant dichotomously branched, tips often appearing two pronged, quite thin and membranous. *Dictyota dichotoma*
1. Plant consisting of simple undivided ribbons, thin and membranous. *Petalonia sp.*

Group E

1. Plant unbranched and hollow with regular constrictions giving the appearance of a string of sausages. *Scytosiphon lomentaria*
1. Plant hollow with irregular width and length, often with rough texture due to presence of sporangia as small spots. *Asperococcus fistulosus*

Group F

1. Plant appearing as a brown/black crust generally growing on rocks surfaces and limpets. *Ralfsia sp.*
1. Plant appearing as a spherical, gelatinous and bulbous hollow sack. *Leathesia difformis*

Rhodophyta Species

- Group A** Plants calcareous, hard and limy present as both a crust forming over the surface of rocks and algal fronds, including microscopic forms, and as an erect system. Generally pink or purple in colour, but turning white on bleaching. This group also includes those non-calcareous encrusting forms, present as a large stain on the rock surface.
- Group B** Plants with main blade or frond flattened or compressed, often leaf-like, may occasionally be in-rolled, often with a wide blade which may vary from tough and leathery to thin, membranous and slightly elastic. This group may take on a variety of morphological forms composed of wide, flat or channelled fronds, simple single blades, split blades and highly branched forms.
- Group C** Plants not completely flattened, thin or leaf-like, generally thick, cartilaginous, wiry or gelatinous, appearing as a course or stiff cylindrical structure but may also be slightly compressed, bead-like or hollow ranging from 0.5mm to 5mm wide with no filamentous branching. Some species display minimal irregular branching, other species may be highly and regularly branched.
- Group D** Plants consisting of thread-like, multiseriate forms (several cells in width), consisting of a main axis up to 1mm thick and numerous filamentous branches usually less than 0.25mm and of varying length. Branches may either be uniformly arranged or irregular and are often fine, delicate and hair like. Requires microscopic identification.
- Group E** Plants very fine, filamentous and delicate, only one cell wide and may display limited branching or be highly and regularly branched. This group includes the small and epiphytic plants present as either prostrate or erect forms often appearing as a small spot or tuft on rock surfaces and other algae. Microscopic identification is necessary.

Group A

1. Plant calcareous.....2
1. Plant non-calcareous forming a deep red staining on the rock surface
Hildenbrandia rubra
2. Plant appearing filiform, consisting of a jointed calcareous upright system resembling small bones and generally located in rockpools
Corallina officinalis
2. Plant forming a small or large crust or layer over the surface of rocks and other algae.....3
3. Plant microscopic appearing as a small disc of radiating cells present on a number of red algal species and hydroids *Melobesia membranacea*
3. Plant forming large crust over the rock surface, consisting of various textures and shades of pink, purple and red, may also be found covering the outer frond of algal species such as Polyides *Calcareous encrusters*

Group B

1. Plant with midrib or veins present.....2
1. Plant without midrib or veins.....5
2. Plant with distinct midrib.....3
2. Plant with indistinct, faint and interrupted midrib, blade quite wide and leafy but with coarse cylindrical stipe *Phyllophora sp.*
2. Plant without a midrib but with macro/microscopic veins present, blade edges often frilly and tatty looking with disc holdfast *Cryptopleura ramosa*

3. Branches and bladelets arising from the midrib only consisting of fine, narrow, delicate pointed fronds *Hypoglossum hypoglossoides*
3. Plant with branching from the outer frond margin and usually much branched also with fine delicate and relatively narrow fronds *Membranoptera alata*
3. Plant with branching from the main stipe only.....4
4. Plant with blade edge slightly ruffled resembling beech leaves, quite thin and delicate with wide blade *Delesseria sanguinea*
4. Plant with slightly serrated blade edge resembling oak leaves quite thin and delicate with wide blade *Phycodrys rubens*
5. Plant simple, split or lobed but not highly branched.....6
5. Plant variously and highly branched.....9
6. Plant membranous, thin and slightly elastic with no divided sections although main frond may occasionally be split.....7
6. Plant tough with wedge shaped divisions in main frond.....8
7. Plant with holdfast or attachment disc based in the centre of the frond
Porphyra umbilicalis
7. Plant with holdfast at the base of the frond, very delicate and found growing on other algae particularly *Fucus sp.* *Porphyra leucosticta*
8. Plant very tough and leathery, slightly cartilaginous, branching from base only with splits or wedge shaped divisions *Dilsea carnosa*
8. Plant tough but floppy and fleshy, irregular divisions with branchlets often occurring from main blade *Palmaria palmata*
9. Plant with dichotomous branching.....10
9. Plant without dichotomous branching.....11

10. Plant completely flattened often with broad wide wedge shaped frond often quite tough often with smooth fronds *Chondrus crispus*
10. Plant with in-rolled gutter like frond forming a channel quite dark in colour and tough often with rough frond and edges due to presence of reproductive bodies *Mastocarpus stellatus*
11. Plant with regular branching pattern.....12
11. Plant with irregular branching.....13
12. Plant quite fine and delicate with regular comb-like branching, very highly branched very pink in colour *Plocamium cartilagineum*
12. Plant with small but regularly alternate branching, with a tooth-like outline, usually deep pink/red in colour *Odonthalia dentata*
13. Plant highly divided into irregular but broad fan shaped sections with wide fronds quite floppy and fleshy *Callophyllis laciniata*
13. Plant highly branched often opposite but not obviously, plant terete in lower section but often broader and flattened towards the tips *Gelidium sp.*

Group C

1. Plant visibly constricted at intervals.....2
1. Plant not constricted at intervals.....4
2. Constrictions at irregular intervals, plant irregularly branched with segments variable, some flat some cylindrical, small and creeping *Catenella caespitosa*
2. Constrictions at regular intervals.....3

3. Plant bead like and deep pink in colour often with a number of branches extending from each articulation *Lomentaria articulata*
3. Plant with branching generally in one plane sometimes appearing flat
Lomentaria clavellosa
4. Branching dichotomous.....5
4. Branching irregular, regular, opposite or alternate but not dichotomous.....7
5. Plant consisting of small bundles present at the plant tips, base of branchlets constricted *Gastroclonium ovatum*
5. Branches not constricted at base with no bundles present at plant tip.....6
6. Plant cylindrical in cross section regularly dichotomously branched with claw-like holdfast *Furcellaria lumbricalis*
6. Plant cylindrical in cross section regularly dichotomously branched with disc-like holdfast *Polyides rotundus*
7. Branching regular.....8
7. Branching irregular.....9
8. Plant thick and fleshy with alternate branching occurring in a single plane appearing flattened *Osmundea pinnatifida*
8. Plant thick and fleshy with branching alternate or opposite, cylindrical with branching in all planes not flattened *Osmundea hybrida*
9. Plant gelatinous.....10
9. Plant not gelatinous.....11
10. Plant hollow often green at the tips of old plants where rotting has taken place, with limited branching *Dumontia contorta*
10. Plant very squashy, slippery and elastic very few branches present
Nemalion helminthoides

11. Plant black and wiry with disc-like holdfast, narrow branching very irregular and often found in sandy environments *Ahnfeltia plicata*
11. Plant elastic, long and straggly, branching very irregular sometimes becoming bushy, cartilaginous and firm *Gracilaria gracilis*

Group D

1. Plant polysiphonous.....2
1. Plant not polysiphonous.....4
2. Main branches polysiphonous, smaller branches monosiphonous and numerous, appearing tufted *Heterosiphonia plumosa*
2. Plant polysiphonous throughout.....3
3. Plant found growing epiphytically on *Ascophyllum* species often quite coarse and tufted in texture *Polysiphonia lanosa*
3. Plant with 12-20 siphons, lower, older filaments of plant covered with small cells (corticate), branching irregular with upper parts of plants more densely covered, generally dark brown or black in colour *Polysiphonia fucoides*
3. Not as above *Polysiphonia sp.*
4. Plant appearing banded, dichotomously branched with terminal branches generally in-rolled.....5
4. Plant not appearing as above.....6
5. Plant almost or completely covered in small cells (corticate), plants quite variable, irregularly dichotomous, terminal branches tightly in-rolled or straight, very common *Ceramium nodulosum*
5. Plant with multicellular spines present on the outside of filaments, not completely corticate, dichotomously branched and terminal branches strongly in-rolled *Ceramium shuttleworthianum*
5. Plants not as above *Ceramium sp.*

6. Branching whorled around main axis and highly branched resembling a bottle brush
Halurus equisetifolius
6. Branching not whorled.....7
7. Branching opposite.....8
7. Branching not opposite.....9
8. Plant with branching opposite and long and short branches regularly alternate, plants dark red and delicate but slightly rigid
Ptilota gunneri
8. Plant with opposite branching but long and short branches not regularly alternate, plants dark purple or brown and very delicate and fine
Plumaria plumosa
9. Plant with claw-like holdfast, quite long and highly branched, firm and cartilaginous often appearing straggly
Cystoclonium purpureum
9. Plant with discoid holdfast, often densely branched, terminal branches often short and tufted
Rhodomela confervoides

Group E

1. Plant highly branched.....2
1. Plant with limited branching.....3
2. Plant with bone shaped cells giving jointed appearance, with pointed terminal cells, bright pink in colour, with long branches, quite delicate and hair-like
Halurus flosculosus
2. Plant densely and usually alternately branched often appearing tufted, found growing on rocks and other algae, present in a variety of forms, often quite small and spongy
Callithamnion/Aglaothamnion sp.

3. Plant generally found attached to rock surface and macroscopic.....4
3. Plant found growing on other algae and typically microscopic.....5
4. Plant found growing on sand covered hard surfaces, pyrenoids highly visible under the microscope with flower shaped chloroplasts, branching limited
Rhodothamniella floridula
4. Plant found in turfs generally in moist overhangs, branching limited with reticulate (network system) chloroplast covering whole of cell
Audouinella purpurea
5. Plant with star shaped chloroplast several cells long commonly found on Polysiphonia and Ceramium species
Erythrotrichia carnea
5. Plant taking a variety of small microscopic forms, either as small erect forms a few cells long or appearing as red spots or stains on other algae with erect systems creeping throughout or over other algae
Audouinella sp. and Erythrocladia irregularis

SUMMARY OF SPECIES

Species List	General Morphology	General Location on the shore
Greens		
<i>Blidingia</i> sp.	Green mat, spongy, foliose but may appear filamentous	Generally found on the upper shore on rock surface or lower on <i>Fucus</i> fronds
<i>Bryopsis plumosa</i>	Fine feather like, very delicate, often quite small	Found on the mid shore in rock pools, may be hard to find
<i>Chaetomorpha linum</i>	Bright green, resembling thin curly garden wire or wire wool	Found on mid to upper shore on rock surface or in very shallow pools also on mud in estuaries
<i>Chaetomorpha mediterranea</i>	Very curly, looks like thin wool, often present in dense patches	Found on mid to upper shore, often tangled around other species
<i>Chaetomorpha melagonium</i>	Consist of a solitary robust strand, with obvious cells appearing beaded	Found in sandy bottomed rock pools on the mid shore
<i>Cladophora albida</i>	Filamentous, highly branched, light green in colour	Found throughout the intertidal in numerous habitats, often epiphytic
<i>Cladophora rupestris</i>	Filamentous, highly branched can be tufted, dark green and slightly coarse	Found throughout the intertidal in numerous habitats
<i>Cladophora sericea</i>	Filamentous, highly branched can be tufted, light green	Found throughout the intertidal in numerous habitats
<i>Enteromorpha</i> sp.	Foliose and tubular, often ribbon shaped, may be crinkly, very green	Found throughout the intertidal but very common on upper shore and around freshwater
<i>Monostroma grevillei</i>	Very thin, wide, foliose and membranous, pale green, easily torn	Found most frequently on upper shore (commonest in spring) on rock surface or rock pools
<i>Rhizoclonium tortuosum</i>	Thin, filamentous and branched, forming dense green mats	Found on upper shore particularly on open rock surfaces and harbour walls
<i>Spongomorpha arcta</i>	Filamentous, highly branched, light green in colour quite tufted	Found mid littoral often as part of mat as turf forming species
<i>Sykidion moorei</i>	Unicellular, single large round cell	Found in <i>Blidingia</i> sp.
<i>Ulothrix</i> sp	Fine, filamentous, green and unbranched	Found mainly on mid and upper shore rocky surfaces, often growing on <i>Fucus</i> sp.
<i>Ulva lactuca</i>	Foliose, with wide blade looks like lettuce leaf and very green	Found throughout the littoral down to lower littoral fringe

Browns		
<i>Alaria esculenta</i>	Up to 2 m long, with distinct midrib and wide, frilly, easily torn blade	Found on lower littoral in subtidal fringe on wave exposed areas
<i>Ascophyllum nodosum</i>	Large and cartilaginous with regular air bladders along frond	Found in mid to upper littoral areas but is generally typical of sheltered shores
<i>Asperococcus fistulosus</i>	Ribbon-like, foliose, hollow and tubular with rough frond surface	Found in the mid littoral in wide shallow rock pools with sandy bottom; also in sheltered shallow sublittoral
<i>Chorda filum</i>	Long and rope-like, completely unbranched, cartilaginous	Found mainly in mid littoral in wide shallow rock pools with sandy bottom
<i>Chordaria flagelliformis</i>	Filiform and branched covered with tiny hairs, may be gelatinous	Found mainly in mid littoral in wide shallow rock pools with sandy bottom
<i>Cladostephus spongiosus</i>	Coarse, highly branched and tufted, looks like pipe cleaner	Found throughout intertidal mainly in overhangs, damp places and turfs/mats; common in sandy areas
<i>Desmarestia aculeata</i>	Filiform, branched often short and spine like with serrated appearance	Found mainly in mid littoral in wide shallow rock pools with sandy bottom
<i>Dictyosiphon foeniculaceus</i>	Filiform and branched covered with tiny hairs not gelatinous	Found mainly in mid littoral in wide shallow rock pools with sandy bottom
<i>Dictyota dichotoma</i>	Thin membranous and foliose, with distinct dichotomous branching	Frond on mid to lower littoral, mainly in rockpools of various sizes
<i>Ectocarpus</i> sp.	Fine, filamentous, highly branched and often tangled into loose cords	Found growing throughout littoral, often on sandy areas and attached to other algae
<i>Elachista fucicola</i>	Small, filamentous, unbranched and tufted, brush-like	Found throughout the littoral growing epiphytically on <i>Fucus</i> sp.
<i>Fucus serratus</i>	Cartilaginous, with midrib and frond edge serrated	Grows mainly on lower littoral
<i>Fucus spiralis</i>	Cartilaginous, with midrib and frond spirally twisted	Grows mainly in upper littoral
<i>Fucus vesiculosus</i>	Cartilaginous, with bladders in pairs either side of midrib, no. of bladders varies with degree of exposure	Grows mainly in mid littoral
<i>Halidrys siliquosa</i>	Cartilaginous, with pod-shaped air bladders and zig-zag branching	Found in deep rockpools on mid to lower littoral
<i>Himanthalia elongata</i>	Cartilaginous, rope-like but flat, branched with distinct button holdfast	Found on open rock platforms mainly on lower littoral
<i>Laminaria digitata</i>	Large, cartilaginous, claw holdfast, wide divided frond with smooth flexible stipe	Found in littoral/subtidal fringe
<i>Laminaria hyperborea</i>	Large, cartilaginous, claw holdfast, stiff stipe covered in epiphytes with wide divided frond	Found in littoral/subtidal fringe

<i>Laminaria saccharina</i>	Cartilaginous, large frond, unbranched with wavy edge, and crinkly centre	Found in littoral/subtidal fringe
<i>Leathesia difformis</i>	Spherical, gelatinous, bulbous hollow sack	Grows in a variety of habitats but mainly in the mid to lower littoral on rock
<i>Litosiphon laminariae</i>	Fine, filamentous, unbranched and growing in small tufts	Grows mainly on <i>Alaria</i> and <i>Chorda</i> , so located in mid to lower littoral
<i>Pelvetia canaliculata</i>	Cartilaginous, with frond in-rolled forming distinct channel	Grows only in upper shore regions
<i>Petalonia fascia</i>	Thin, membranous, foliose, undivided frond and ribbon-like	Found throughout the littoral on various substrates
<i>Pilayella littoralis</i>	Fine and filamentous, branched, may form mass of filaments	Found throughout the littoral particularly on sandy substrate
<i>Ralfsia</i> sp.	Crust, black growing on rock surface or limpets	Found throughout the littoral
<i>Saccorhiza polyschides</i>	Large and cartilaginous, with warty bulb holdfast and wavy ribbon stipe	Grows in the littoral/sublittoral fringe
<i>Scytosiphon lomentaria</i>	Tubular, hollow, unbranched with regular constrictions	Found throughout the littoral but common in wide shallow and sandy rockpools
<i>Sphacelaria</i> sp	Filamentous, branched and coarse growing as stunted tufts	Found growing in turfs in overhangs throughout the littoral or attached to <i>Corallina</i> in pools
<i>Spongonema tomentosum</i>	Filamentous, branched and tangled into woolly cords	Often grows on <i>Fucus</i> so found throughout the littoral
Reds		
<i>Aglaothamnion/</i> <i>Callithamnion</i>	Fine, delicate, densely branched small and spongy appearing tufted	Growing in turfs or mats in overhangs and crevices in the mid to lower shore
<i>Ahnfeltia plicata</i>	Black, coarse and wiry, branching irregular with disc holdfast	Growing in sandy bottom rockpools in mid to lower littoral
<i>Audouinella purpurea</i>	Fine, filamentous, few branches and turf forming, mossy	Growing in turfs or mats in overhangs and crevices throughout the littoral
<i>Audouinella</i> sp	Small filaments, microscopic, few cells long, epiphytic	Grow epiphytically on a number of species so found throughout the littoral
Calcareous encrusters	Calcareous, in various shades of pink and purple covering rock surfaces; white when bleached	Found growing on hard substrate throughout the littoral zone and commonly in rockpools
<i>Callophyllis laciniata</i>	Floppy and fleshy, divided broad fan shaped sections	Grows in the lower littoral/sublittoral fringe
<i>Catenella caespitosa</i>	Small, creeping, variable with irregular branching and constrictions	Growing on upper shore in crevices

Ceramium nodulosum	Filamentous, variously branched, dark pink; may appear banded	Found growing throughout the littoral region within a variety of habitats
Ceramium shuttleworthianum	Filamentous, numerously branched, red/dark pink with spines; may appear banded	Found growing throughout the littoral region within a variety of habitats, often found on mussels
Ceramium sp.	Filamentous, numerously branched, dark pink may appear banded	Found growing throughout the littoral region within a variety of habitats
Chondrus crispus	Tough, flat, with wide wedge shape frond, dichotomous branching & stipe; highly variable form and easy to confuse with Mastocarpus	Grows throughout the littoral on a variety of surfaces
Corallina officinalis	Calcareous and jointed with bone like structure, light pink in colour	Found growing throughout littoral region within a variety of habitats, particularly rockpools
Cryptopleura ramosa	Blade wide, foliose, thin and leafy with veins, and frilly blade edges	Grows in the lower littoral/sublittoral fringe
Cystoclonium purpureum	Firm, cartilaginous, straggly, variously branched, long with claw holdfast	Found on the mid to lower shore usually within wide shallow rockpools
Delesseria sanguinea	Foliose, delicate, resembles thin beech leaf with distinct midrib & veins, ruffled edge	Grows in the lower littoral/sublittoral fringe
Dilsea carnosa	Tough and leathery with wedge shaped divisions, branching from base	Grows in the lower littoral/sublittoral fringe
Dumontia contorta	Soft, hollow sometimes gelatinous and slimy, limited branching	More common found in the mid to upper littoral in shallow rockpools
Erythrotrichia carnea	Fine unbranched filaments, epiphytic and microscopic	Grows epiphytically on variety of Polysiphonia and Ceramium sp. throughout littoral
Furcellaria lumbricalis	Tough, cartilaginous, cylindrical frond, dichotomous branching, claw holdfast	Found in sandy bottom rockpools usually in mid to lower littoral regions
Gastroclonium ovatum	Fleshy, cylindrical branches with small bundles at tips with base constricted	More common found in the mid to upper littoral in shallow rockpools
Gelidium sp.	Tough, slightly cartilaginous, irregular branching, broad flattened tips but cylindrical lower section	Found on mid to lower shore on rock surfaces, crevices and overhangs often forming turfs or mats
Gracilaria gracilis	Long, straggly, cartilaginous and firm, irregular branching and pointed tips	Found in the mid and lower littoral within pools and on open rock surfaces
Halurus equisetifolius	Filamentous with whorled branching resembling bottle brush	Grows in the mid to lower littoral particularly in rockpools and damp overhangs
Halurus flosculosus	Filamentous, fine, hair-like, highly branched, bright pink	Grows in the mid to lower littoral particularly in rockpools and damp overhangs

Heterosiphonia plumosa	Fine filamentous, with numerous small branches appearing tufted	Found throughout the littoral region within a variety of habitats but mainly rockpools
Hildenbrandia rubra	Deep red staining on the rock surface	Found on various hard substrates and rocks
Hypoglossum hypoglossoides	Foliose, delicate, branched with distinct midrib from which bladelets arise, pointed, small, narrow fronds	Found mainly on the lower shore often with other red in the littoral fringe
Lomentaria articulata	Pink, bead like, fleshy and numerous branched	Found in overhangs and crevices in amongst turf formers on mid and lower shore
Lomentaria clavellosa	Pink, bead like, fleshy and numerous branched in single plane, appearing flat	Found in overhangs and crevices in amongst turf formers on mid and lower shore
Mastocarpus stellatus	In-rolled gutter-like frond, tough and cartilaginous; variable form	Grows throughout the littoral on a variety of surfaces easy to confuse with Chondrus
Melobesia membranacea	Calcareous small spots or stains, microscopic and epiphytic	Grows epiphytically on a variety of filamentous species
Membranoptera alata	Foliose, delicate, branched with distinct midrib narrow, small, rounded fronds, branching from outer frond	Found in overhangs and crevices in amongst turf formers on mid and lower shore
Nemalion helminthoides	Gelatinous, squashy, slippery and elastic with few branches	Found mainly in the mid littoral on open rock surfaces or in shallow pools on southern/western shores
Odonthalia dentata	Narrow, slightly foliose but tough frond, regular alternate branching; tooth-like	Grows in the lower littoral/sublittoral fringe
Osmundea hybrida	Thick, fleshy, alternate or opposite branching in all planes	Found in a variety of habitats on mid and lower shore may be mingled with mats/turfs
Osmundea pinnatifida	Thick, fleshy, alternate branching in single plane, appears flattened	Found in a variety of habitats on mid and lower shore may be mingled with mats/turfs
Palmaria palmata	Tough but fleshy and floppy, divided blade with bladelets	Grows in the lower littoral/sublittoral fringe and can be very abundant
Phycodrys rubens	Foliose, delicate, resembles thin oak leaf with distinct midrib & veins, serrated edge	Grows in the lower littoral/sublittoral fringe
Phyllophora sp.	Blade foliose, thin and leafy with faint midrib & veins, cylindrical stipe	Grows in the lower littoral/sublittoral fringe
Plocamium cartilagineum	Fine, filiform and delicate with comb-like branching, very pink	Grows in the lower littoral/sublittoral fringe and sometimes mid-littoral pools
Plumaria plumosa	Fine, filamentous, delicate short and long branches not regularly alternate, dark purple or brown	Found in overhangs and crevices in amongst turf formers on mid and lower shore
Polyides rotundus	Tough, cartilaginous, cylindrical frond, dichotomous branching, disc holdfast	Found in sandy bottom rockpools usually in mid to lower littoral regions

Polysiphonia fucoides	Filamentous, pink to dark brown/black, variously branched	Found growing throughout the littoral region within a variety of habitats
Polysiphonia lanosa	Filamentous, coarse black and slightly tufted	Found growing on <i>Ascophyllum nodosum</i> only on mid to upper shore
Polysiphonia sp.	Filamentous, dark brown/black, variously branched	Found growing throughout the littoral region within a variety of habitats
Porphyra leucosticta	Thin, foliose, unbranched blade, membranous, attached to <i>Fucus</i> sp.	Grows on <i>Fucus</i> throughout the littoral
Porphyra umbilicalis	Thin, foliose, wide unbranched blade, membranous with central attachment	Generally found throughout the littoral
Ptilota gunneri	Fine, filamentous, very delicate with opposite long and short branches which are regularly alternate; red in colour	Found in overhangs and crevices in amongst turf formers on mid and lower shore
Rhodomela confervoides	Firm, cartilaginous, straggly, variously branched, long with disc holdfast	Found on the mid to lower shore usually within wide shallow rockpools
Rhodothamniella floridula	Fine, filamentous, short tufted, unbranched and forming a mat	Found on sand covered rocks as a sand binding species throughout littoral

SPECIES DESCRIPTIONS AND IMAGES

The next section describes each of the species within the reduced species list giving one or more photographs where possible. It should be noted that this guide should be used in conjunction with other identification guides such as those listed below to enable more accurate identification.

During sampling it is likely that other specimens of benthic macroalgae not within the reduced species list will be collected and it is essential that these are not confused with the required species as these may inappropriately inflate the total number of species recorded. Where this is likely to be problematic additional species of confusion have been noted in the descriptive text. Unfortunately this guide only covers those species within the reduced species list, therefore further comparisons may require those additional identification guides recommended. It is also possible for many species to exhibit several morphological forms depending on the local environmental factors or time of year. Some specimens collected may be old or tatty and may not display their true form so this needs to be taken into account whilst comparing specimens with guide photos. Many species may also look morphologically similar in the field such as some of the fine filamentous forms therefore field photographs for such specimens may be indistinguishable.

Additional recommended identification guides

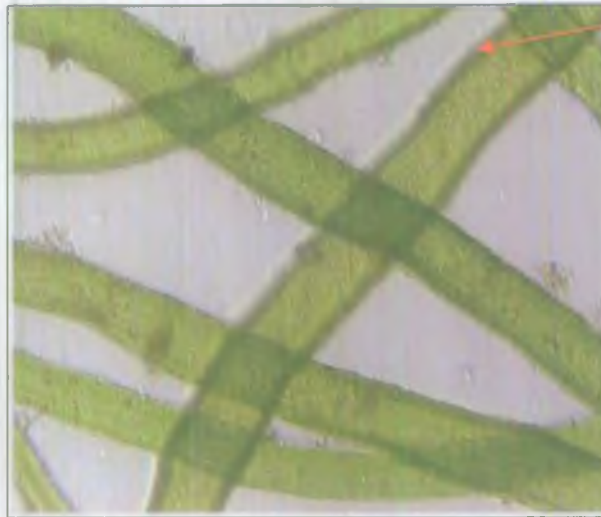
Purpose	Title	Author(s)
General seaweed species	A Hand Book of the British seaweeds	Newton, 1931
General Rhodophyta species	Seaweed of the British Isles. Vol. 1 part 1	Dixon & Irvine, 1977
	Seaweed of the British Isles. Vol. 1 part 3A	Maggs & Hommersand, 1993
	Seaweed of the British Isles. Vol. 1 Part 2A	Irvine, 1983
	Seaweed of the British Isles. Vol. 1 Part 2B	Irvine & Chamberlain, 1994
	Unpublished key to red seaweed	Ian Tittley (NHM, pers comm)
	A field key to the British red seaweeds	Hiscock, 1986
General Phaeophyta species	A field key to the British brown seaweeds	Hiscock, 1979
General Chlorophyta species	Seaweeds of the British Isles. Vol. 2	Burrows, 1991

green seaweeds

***Blidingia* sp.**

This is a tubular and foliose species, although due to its small size it often appears filamentous in form. It is found growing at the top of the shore often in mat form, covering large boulders. It is also found growing epiphytically on *Fucus* species although microscopic examination is required to distinguish it from *Ulothrix* species which are also known to grow on *Fucus* sp. The cells are generally small and cellular contents may be hard to distinguish but this characteristic may be used to separate it from *Enteromorpha* sp. where cells are larger. It has a round basal discoid holdfast unlike *Enteromorpha* which has rhizoidal cells. Some specimens also appear to have a slight margin where the outer filament walls seem thicker. *Blidingia* is also common in estuaries and on artificial structures e.g. bridge supports.

Cells usually less than 10um, so do not appear to have easily distinguishable contents



***Blidingia* growing on small boulders**

Cellular arrangement of Blidingia showing thickened filament walls and small size of cells



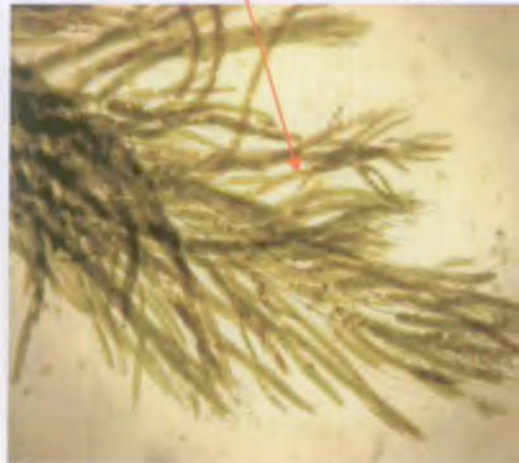
Bryopsis plumosa

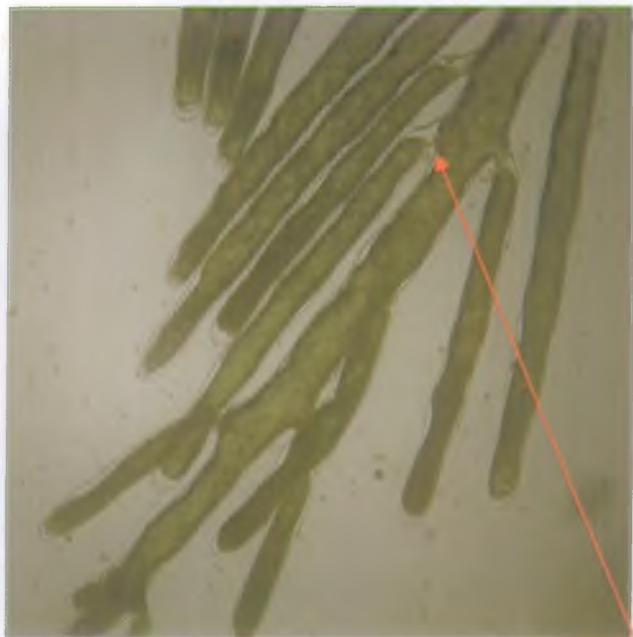
This is a coenocytic species in which there are no cellular divisions and the cell contents move freely throughout the filaments. The filaments/branches are regularly arranged in a single plane to form a delicate feather-like plant. Base of branches may be slightly constricted. May be hard to locate as it is generally present on the shore in low abundance, but can be found attached to the sides of variously sized rockpools. It may be easily distinguished from other green filamentous algae due to its fine delicate appearance. Not to be confused with *Vaucheria* which although not visibly similar is also coenocytic.



***Natural habitat of
Bryopsis in rockpools***

***Feather-like appearance
of Bryopsis***



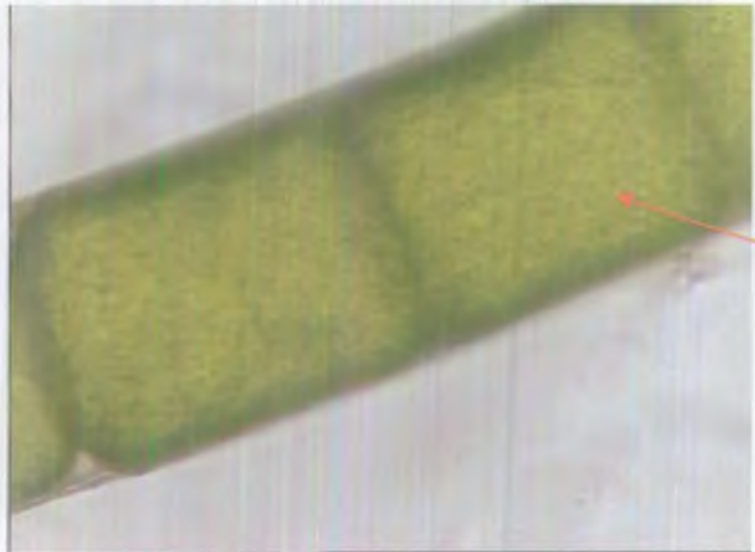


Coenocytic filaments with no cell divisions and constricted at branch base



Chaetomorpha linum

This is an unbranched filament with a reticulate or network-like chloroplast which generally fills the whole cell with colour with numerous pyrenoids present within each cells. The cells tend to be as long as broad or slightly longer and are often barrel shaped. This species of *Chaetomorpha* has a filament width of between 100-300um. It takes the appearance of thick, tough, wiry floating masses, like green garden wire or wire wool and is located on the upper or mid shore on open rock surfaces or in shallow rockpools and often in dense clumps. It may form mat-like blooms on soft sediments in estuaries





***Dense clumps of Chaetomorpha
linum appearing as tough wiry
masses***

***Large cells filled with reticulate
chloroplast***

Chaetomorpha mediterranea

This is an unbranched filament with a reticulate or network-like chloroplast which generally fills the whole cell with colour and numerous pyrenoids. The cells tend to be as long as broad or slightly longer and barrel shaped. This species of *Chaetomorpha* has a filament width of <100µm. It forms very soft green floating masses with the appearance of fine, curly wool, therefore may appear spiral under magnification. It is often found tangled around other species within the upper and mid reaches of the intertidal on open rock surfaces or in shallow rockpools and often in dense clumps.

Woolly green masses tangled around red species on open barnacle and mussel covered hard substrate



Spiral morphological form of filaments



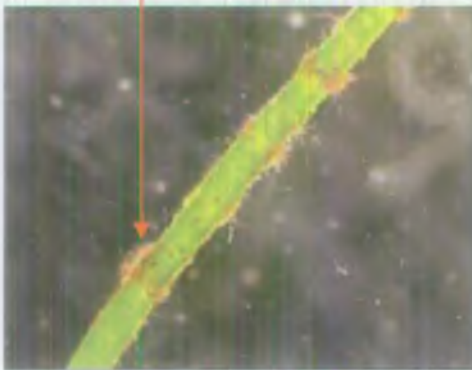
Filaments of Chaetomorpha mediterranea with elongated cells filled with reticulate chloroplast



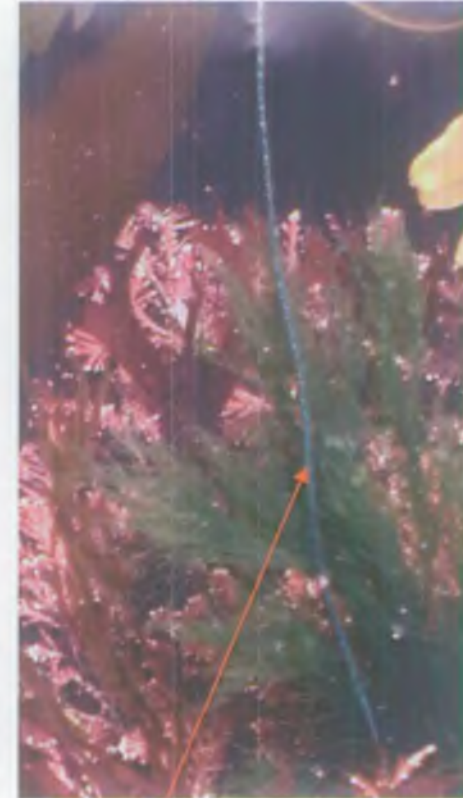
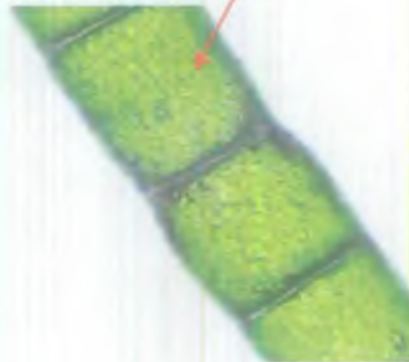
Chaetomorpha melagonium

This is an unbranched filament with a reticulate or network-like chloroplast which generally fills the whole cell with colour and numerous pyrenoids. The cells tend to be as long as broad or slightly longer and barrel shaped. This species of *Chaetomorpha* has cell size of up to 1mm and the cells may be visible to the naked eye giving a beaded appearance. It exists as a solitary, erect filament, often quite firm and coarse in texture, and is found in the bottom of rockpools in amongst numerous other algae. Desiccation of this species causes it to lose its rigidity, and it will subsequently collapse. May be found with epiphytes attached to the outer cell walls.

Presence of epiphytes on filament



Large barrel shaped cells filled with reticulate chloroplast

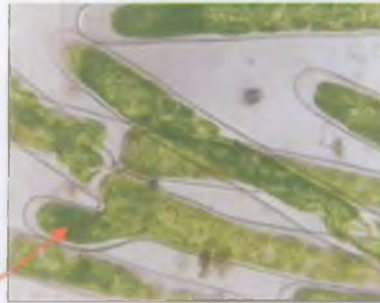


Solitary, erect filament found in amongst Corallina and Cladophora sp. in rockpool

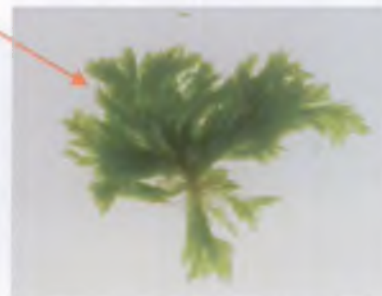
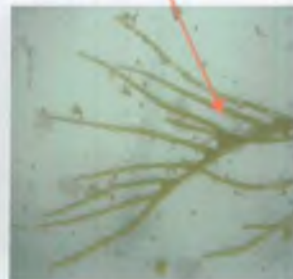
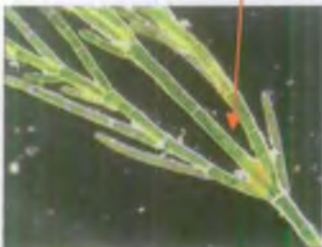
***Cladophora* sp.**

Highly branched filamentous species with a dense reticulate chloroplast with cells appearing uniformly green and with numerous pyrenoids visible on staining. Found as tufts or bushy plants throughout the intertidal but primarily on the upper and mid shore on open rock surfaces and within rockpools.

Cladophora albida – consisting of very fine and narrow filaments generally less than 20µm wide. It is delicate, fluffy and light green in colour with rounded apical cells and often epiphytic.



Cladophora sericea – consisting of broad filaments >80µm but lighter green in colour and less densely tufted/branched. Branching various including dichotomous and second or comb-like with narrowing apices.



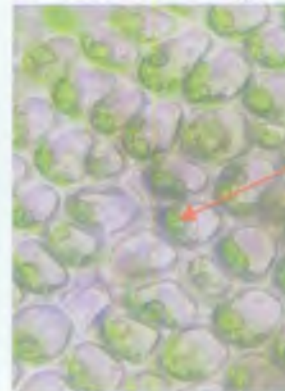
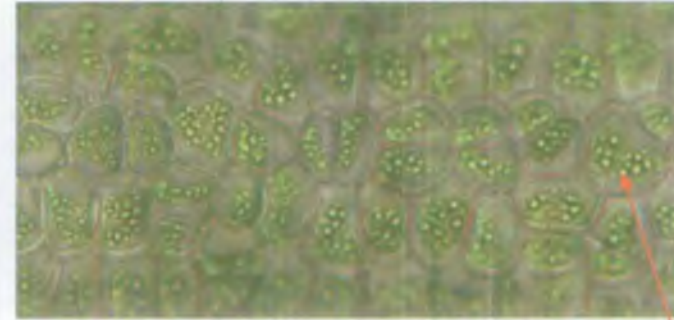
Cladophora rupestris – consisting of broad filaments >80µm as dark green and course, stiff, dense tufts with clear multidichotomous branching and may have 5-6 branches arising from 1 cell. Often supporting epiphytes.



Enteromorpha sp.

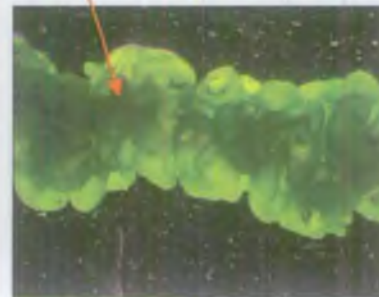
A tubular plant which can appear flattened and foliose. just one cell thick. Cells generally >12um wide with parietal chloroplast and pyrenoids varying in number and size. Morphology varies considerably between species ranging from highly branched to unbranched, regular and irregular cell arrangements, compressed, ribbon-like and bulbous forms. Generally bright green in colour and found throughout the intertidal area but most common on the upper shore particularly in upper shore rockpools around areas of freshwater input and on areas of soft sediment.

Cells may be irregularly or regularly arranged



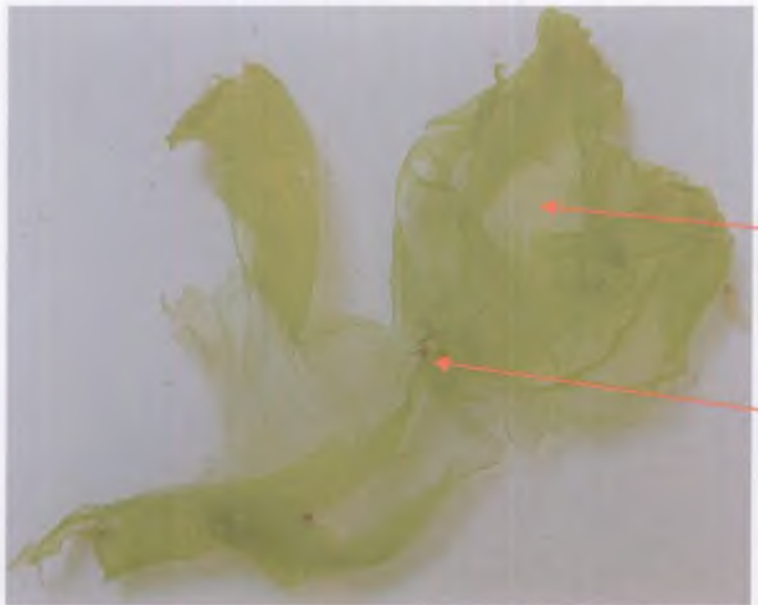
Pyrenoids may be numerous and small or single and large

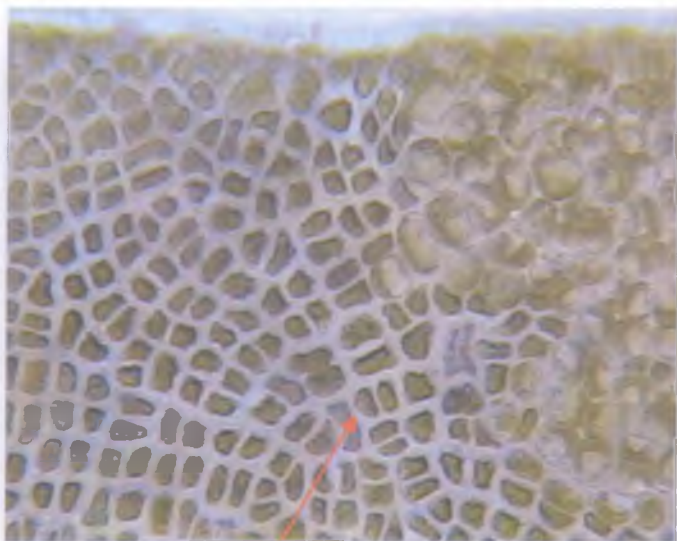
Plants may appear highly branched, ribbon-like and bulbous



Monostroma grevillei

A foliose plant only one layer of cells thick, very pale green in colour, very thin and membranous and quite easily torn. Cells with parietal chloroplast and with one to several pyrenoids, cells tend to be regularly arranged in packs of two or four. Broad, flat, fine and delicate leaf-like morphology with central basal attachment. Occurs in rockpools mainly on the upper shore and are most commonly present during the spring months



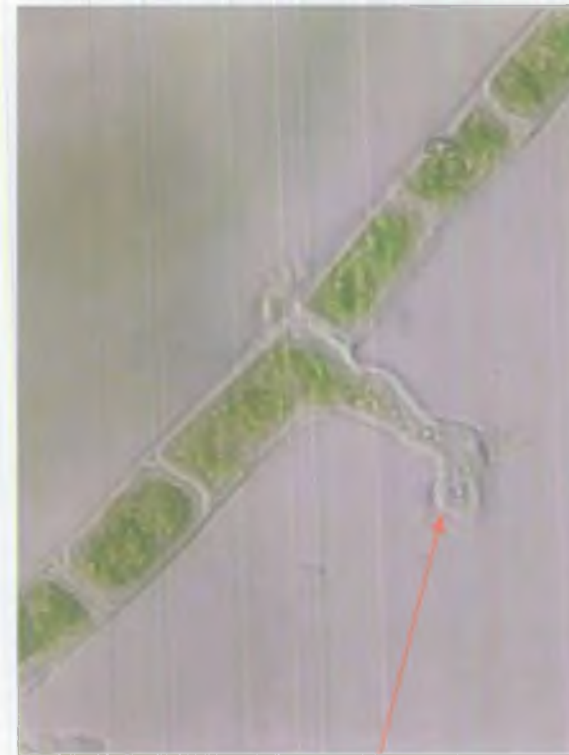


Cells arranged in packs of two or four

Thallus very fine, almost transparent with open flat form arising from the splitting of a primary tubular structure with central holdfast

Rhizoclonium tortuosum

Plant consists of long unbranched filaments with cells generally much longer than broad, mean cell diameter 10-30µm but up to 100µm long and 40µm wide, with reticulate chloroplast and numerous pyrenoids. Rhizoidal branches of between 1 and 3 cells long may be present, often referred to as 'false branching'. Rhizoclonium tends to form dense, entangled mats or turfs on upper shore rocks very close to the terrestrial boundary, found on large flat areas and around areas of freshwater influence, in estuaries and salt marshes. It requires microscopic identification to distinguish from other mat forming filamentous green algae.

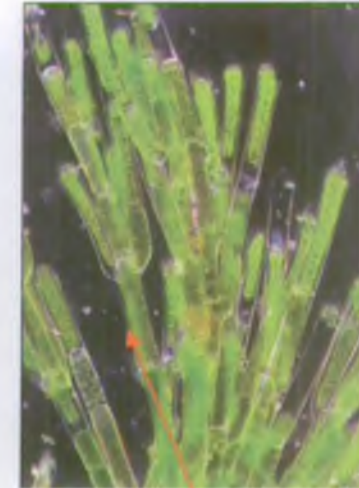


Filament consisting of long slender cells with 'false' or rhizoidal branching present.

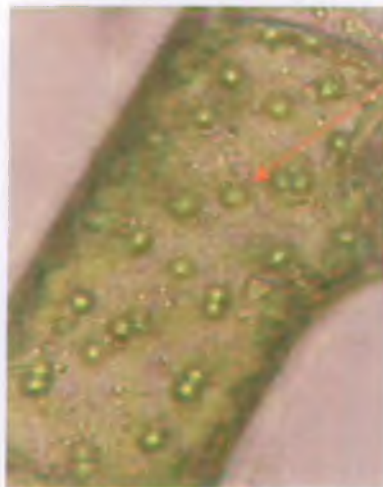
Filament forming a prostrate system appearing as mat particularly on upper shore flat surfaces

Spongomorpha arcta

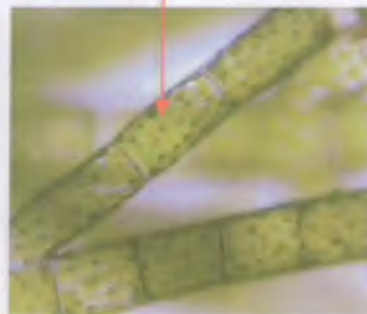
Highly branched filamentous and tufted in morphology and bright green in colour. Cells longer than broad with reticulate chloroplast consisting of a fine non-dense network of fibrils, which are clearly visible under the microscope, apical cells often slightly bulbous and conspicuous. Fine reticulate chloroplast also makes the numerous pyrenoids easily distinguishable. Branches may be straight, downward growing and rhizoidal or hook shaped which may lead to filaments become entangled and rope-like. Often found in moist overhangs within turfs of other green and red algae on the mid shore region. May be confused superficially with *Cladophora* sp.



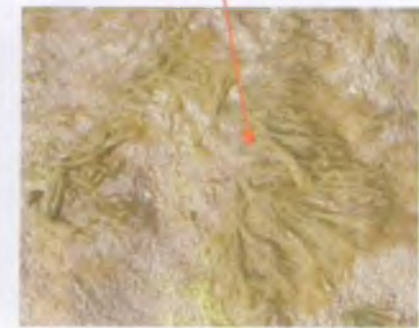
Branching and filaments may be straight or in-rolled forming hooks



Pyrenoids highly visible as green discs

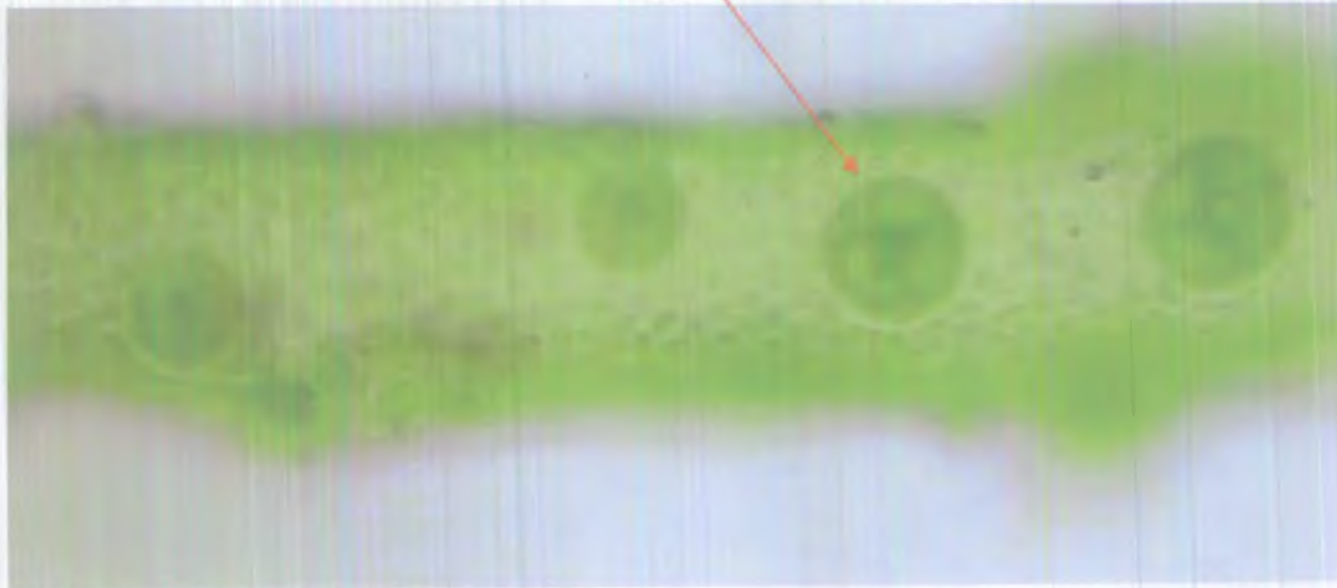


Plants are often highly branched and filaments may become entangled forming ropes



Sykidion moorei

Plant consisting of a single cell embedded between the mucilage walls of *Blidingia* species fronds. Easily distinguished from *Blidingia* cells as they are much larger.



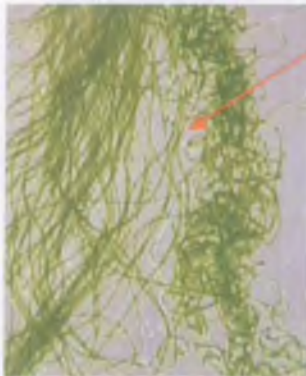
Ulothrix sp.

Plant consisting of long unbranched filaments bright green in colour. Cells usually much shorter than broad or may be equal length and breadth, approximately 10-30um, with a single band shaped parietal chloroplast covering about $\frac{3}{4}$ of the inner cell wall, pyrenoids (one to many) often visible within the chloroplast. Ulothrix present in a number of morphologies with wide or narrow filament wall and filament width variable and as straight or curled filaments often as a result of reproductive bodies. Plants may be found in turfs on rock surfaces or commonly found growing epiphytically on *Fucus* species where microscopic identification is required to distinguish from *Blidingia* and other filamentous species known to grow on *Fucus*. May be confused with *Urospora* sp. which have larger barrel shaped cells.

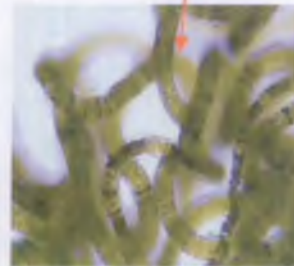
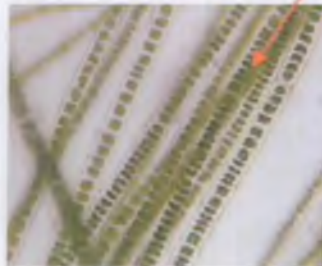


Filaments with thin or thick walls, cells wide and flat or broad and pyrenoids often clearly visible

***Ulothrix* often found growing on *Fucus* sp.**



Filaments either straight or curled up forms may also be found together

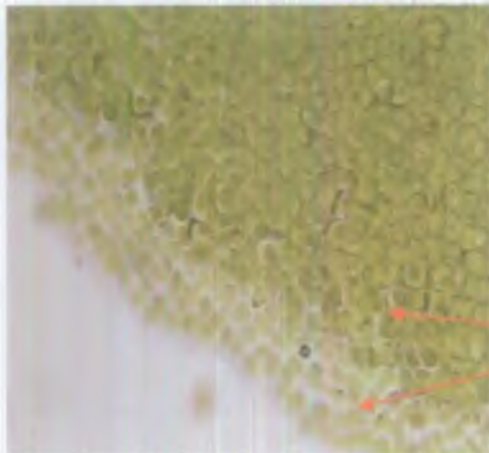


Ulva lactuca

A flat foliose plant two layers of cells thick which can be seen by focusing up and down under the microscope. Cells of various shapes and sizes with no regular arrangement, chloroplasts parietal sometimes filling the whole cell other times appearing more band shaped with one to several pyrenoids per cell. Plant found throughout the littoral zone, but commonly located on the lower littoral. Morphological form a tough bright green broad frond resembling a lettuce leaf. Other species of *Ulva* may be found but *U. lactuca* is the most common.

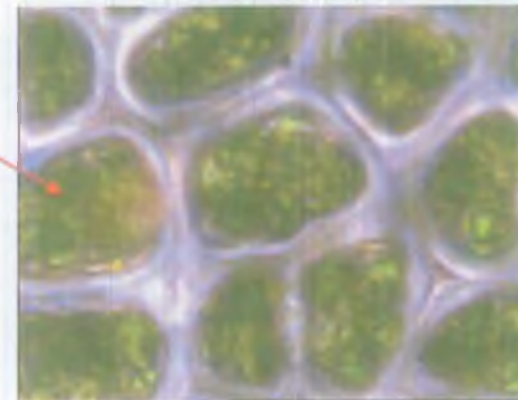


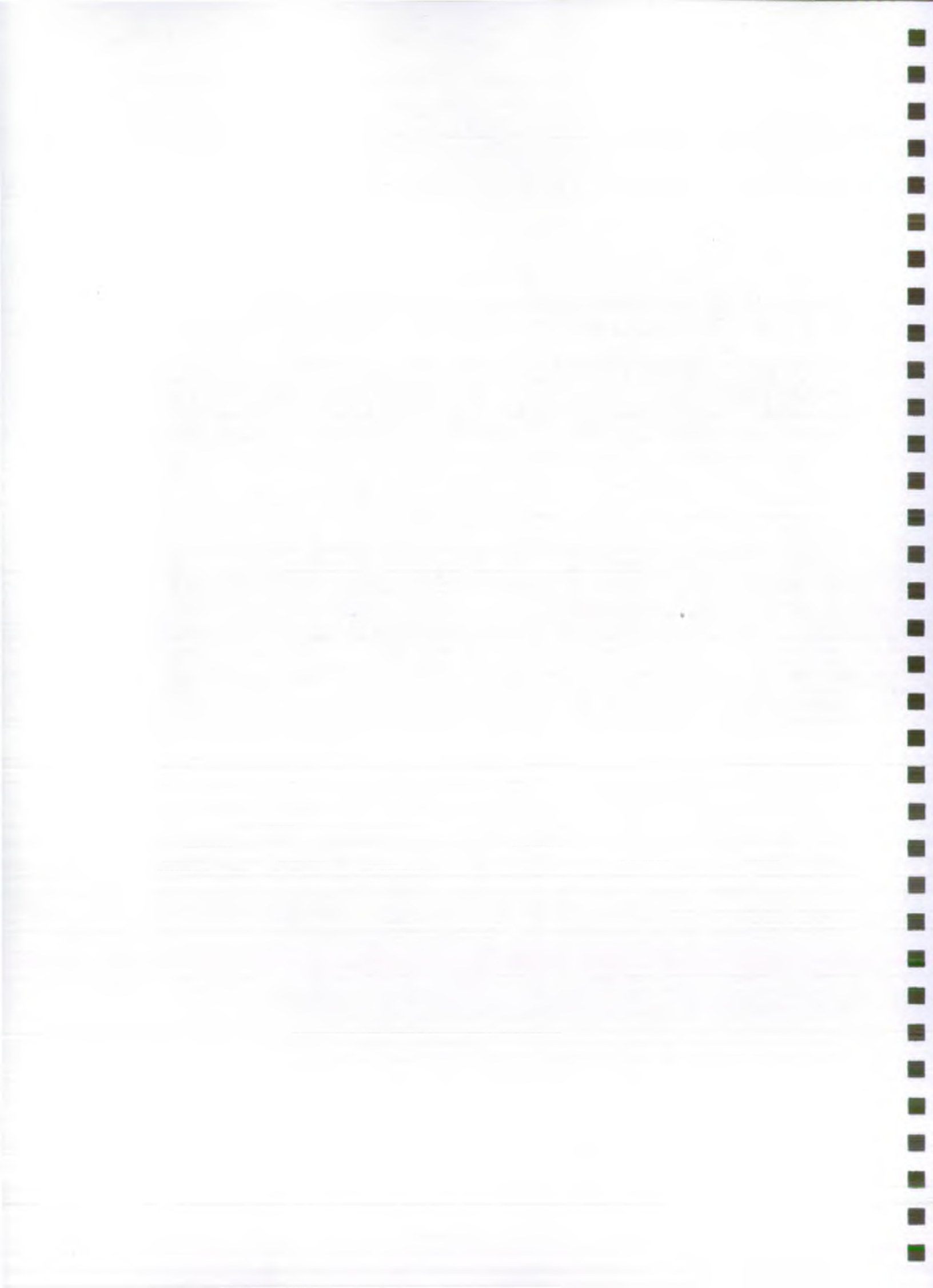
Ulva found in natural habitat on the lower shore mixed in with numerous other brown and red species



Chloroplast filling the whole cell

Distinct two layers of cells



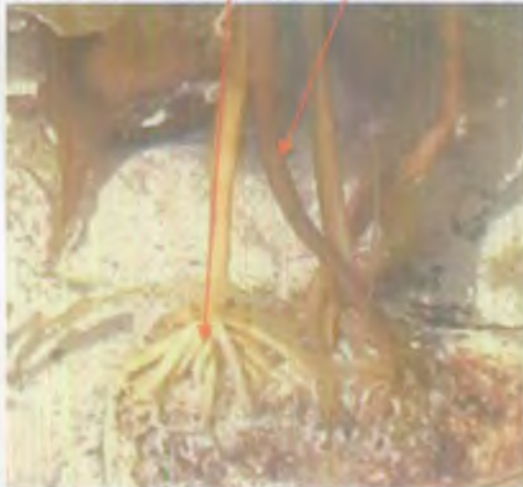


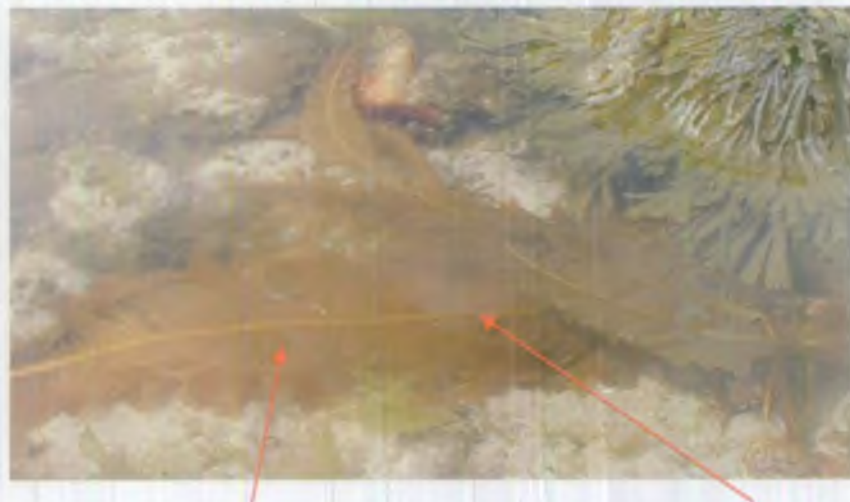
brown seaweeds

Alaria esculente

Plant consisting of a distinct thick flattened and leathery midrib and cylindrical stipe leading to a claw shaped holdfast. The lamina tends to be slightly wavy, membranous and is often quite torn and tatty due to its slightly delicate consistency. A large plant often found growing up to 5m long and generally located in the lower littoral and sublittoral but may be found within lower shore deep rockpools. Light brown/tan in colour.

Claw-like holdfast extending to cylindrical thick stipe





*Distinct midrib with delicate and torn lamina
often feather-like within a rockpool, and on open
hard substrate looking slightly membranous*



Ascophyllum nodosum

Frond very long, branched and strap-like with single large ovoid bladders present in intervals along the length of the frond, which may be between 1 and 5 cm long. If present receptacles are found on stalks within marginal notches. Fronds can grow up to 150cm long and may be found in great abundance particularly on very sheltered shores where they can cover vast areas of the littoral area. Stunted forms also exist but are generally found on more exposed shores. Often greeny brown in colour

***Ascophyllum* often very abundant on sheltered shores**



Large air bladders at intervals along the main frond, presence of *Polysiphonia lanosa* also a characteristic of *Ascophyllum*

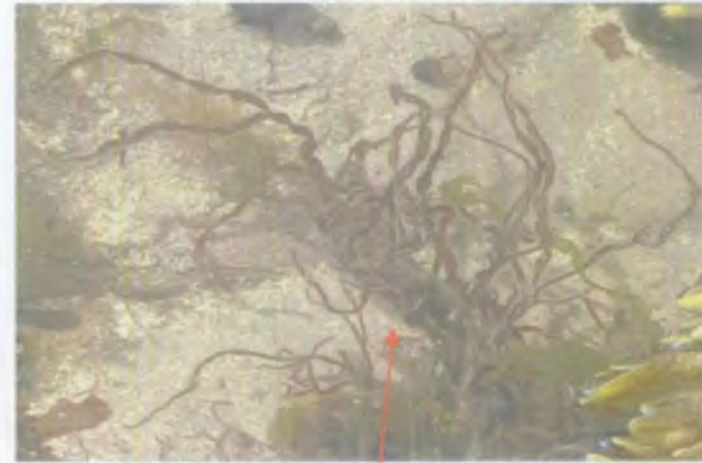


Stunted form



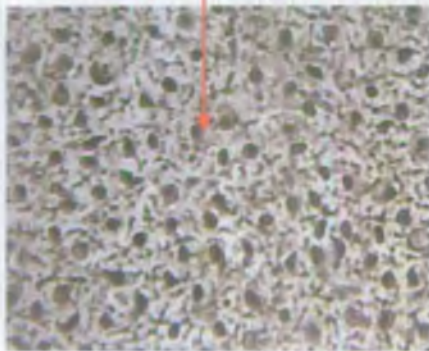
Asperococcus fistulosus

Fronds irregular in width, often slightly crinkled and randomly constricted. Plant appears tubular, hollow and often bulbous looking, quite delicate and may be easily torn and may grow up to 30cm long, often resembles a tough brown *Enteromorpha*. Branching very limited and tends to be restricted to the base of the plant only. Clusters of reproductive bodies appearing as small scattered spots. Generally located in rockpools throughout the littoral but most commonly found in the mid littoral. Not to be confused with *Scytosiphon* sp.

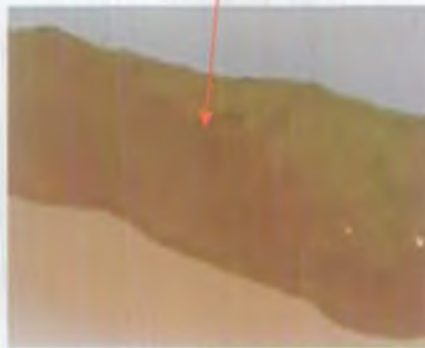


***Asperococcus* growing in a rockpool**

***Cells of Asperococcus*
as seen under high
magnification**



***Sori (reproductive
bodies) appearing as
spots along the frond***



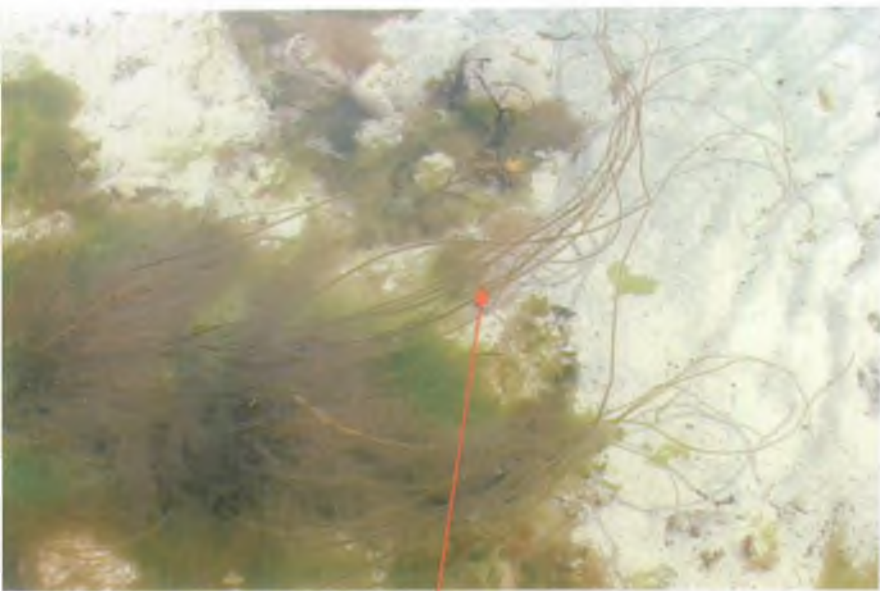
Plant showing limited branching



Chordaria flagelliformis

Plant often very fine, delicate, slightly gelatinous and light brown in colour. Branches very irregular but numerous and can appear as thick crinkly filaments or filiform and growing up to 70cm long. Filaments may have an all-over covering of fine hairs. Found most frequently in the mid littoral area within wide shallow rockpools. May be confused with *Dictyosiphon* sp.





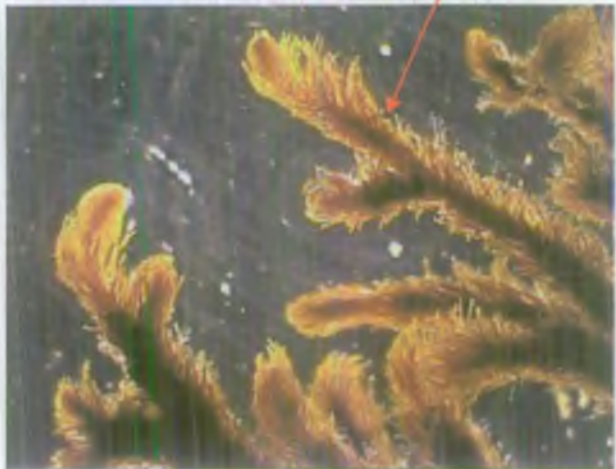
Chorda Filum

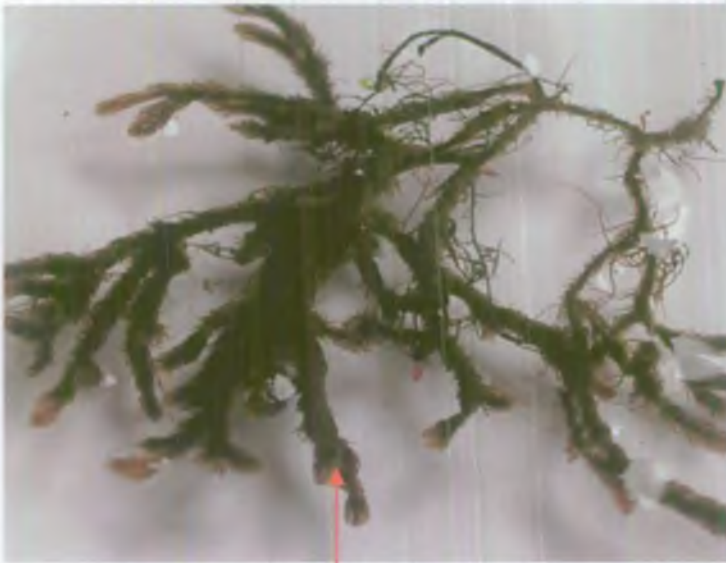
Plant completely unbranched, long, cylindrical and resembling a bootlace, may be quite tough but elastic and can grow up to 8m long. Found on the lower littoral fringe and within wide shallow and often sandy bottomed rockpools in the mid littoral.

Cladostephus spongiosus

This is a coarse, stiff species and variously branched, consisting of numerous tiny branchlets which are arranged around the main filaments/axis in a ring formation (whorled) causing dense tufting and resembling a bottle brush. This plant grows in the mid and lower littoral particularly on overhangs and mixed in with other turf forming species and can grow up to 25cm long.

Whorled arrangement of branchlets covering the whole plant





Plant displaying course and wiry consistency and with limited branchlets on the lower/basal filaments



Plant in its natural habitat in amongst other algae as a dense tuft

Desmarestia aculeata

Frond often quite narrow, generally less than 2mm, flattened, coarse and reddy brown in colour. The long main axis is highly and regularly alternately branched and can grow up to 180cm. Side branches may be quite long but in older plants branchlets appears short, spine-like and look serrated. Found most frequently in the lower littoral particularly in sandy or unstable substrate bottomed pools



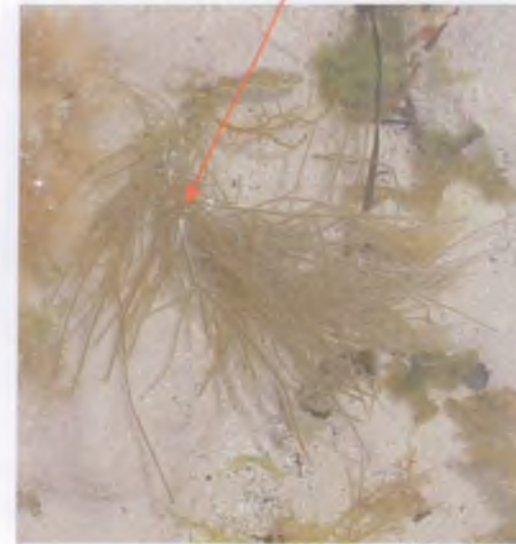
Desmarestia in its natural habitat, with a distinct serrated appearance in older plants and with the long main axis clothed in long branchlets as seen in younger plants



Dictyosiphon foeniculaceus

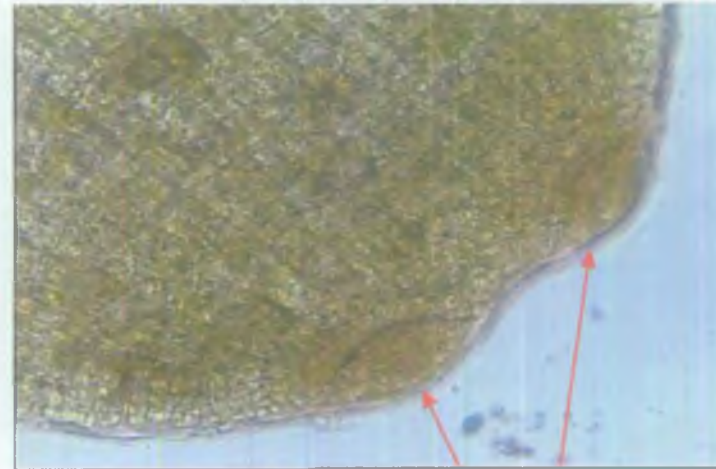
Plant quite fine and delicate and light brown in colour. Branches very irregular and generally from main axis appearing as straight thick filaments or filiform and growing up to 70cm long. Filaments often have an all-over covering of fine hairs. Found most frequently in the mid littoral area within wide shallow rockpools often with sandy bottom. May be confused with *Chordaria* sp.

Dictyosiphon in natural habitat



Dictyota dichotoma

Frond quite thin and foliose, generally flat but may become spiralled in narrow fronded specimens, with frond width varying considerably between plants. Plant exhibits regular dichotomous branching which may be quite prolific. Frond tips usually bifid (divided into 2) and with prominent and large apical cells. Tend to be located in rockpools in the mid and lower littoral and often on sandy substrate



Frond tips showing bifid characteristic and prominent apical cells



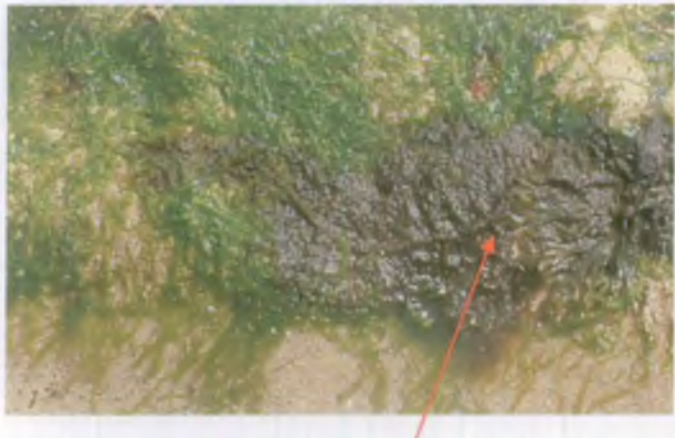
Distinct dichotomous branching



Dictyota in natural rockpool habitat

Ectocarpus sp.

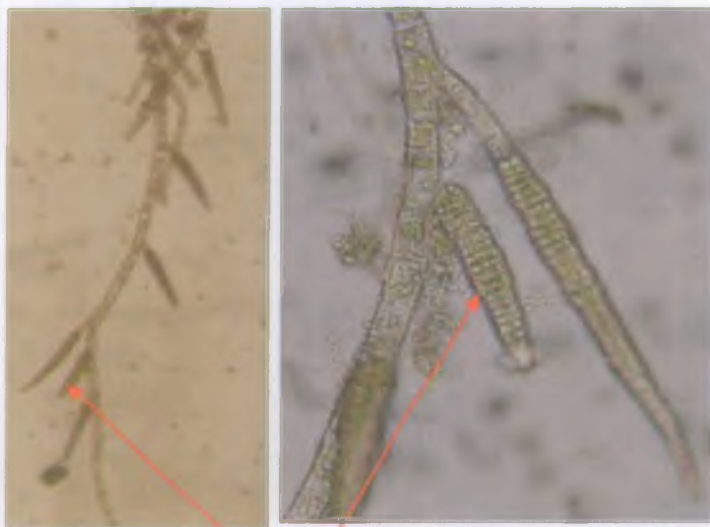
Fine filamentous form with no distinct main axis, often confused with other filamentous brown species such as *Giffordia* and *Pilayella*. Profusely branched appearing hair-like, branches can sometimes be secund and opposite but generally irregular. Characterised by its ribbon shaped chloroplasts and long spindle shaped sporangia. Found growing within mixed mats on open hard substrates and epiphytically on *Fucus* or other large algae. Requires microscopic identification.



Growing on sandy substrate attached to Enteromorpha but is also found growing on hard substrate



Ribbon shaped chloroplasts

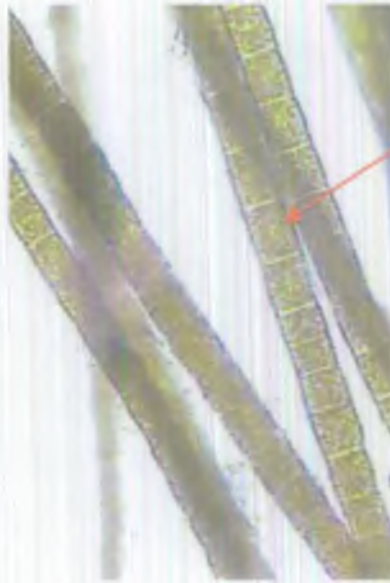


***Long spindle shaped sporangia
extending from small branches or
stalks, some species may have
shorter fatter sporangia***

Elachista fucicola

Fine filamentous form, unbranched with cells generally as long as broad.

Characteristically found growing on *Fucus* sp. as little tufts appearing brush-like or densely covering the whole frond as very fine hairs, often with a lump at the base of each tuft. Commonly found throughout the whole littoral but does depend on the presence of *Fucus*



Simple unbranched filaments

Growing as short sparse tufts on Fucus



Densely covering Fucus as fine hairs

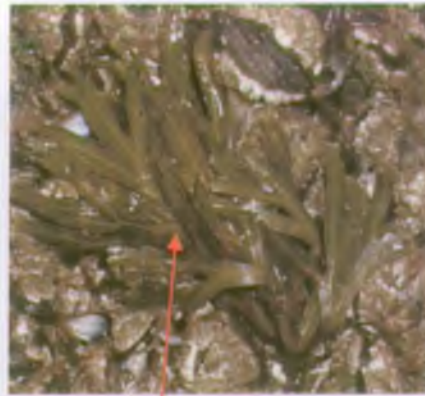


Fucus sp.

Plants tough, cartilaginous and not easily torn, with midrib and greeny/brown in colour with three more common species



Fucus serratus – characterised by its serrated edge and long flat reproductive tips, found on the lower littoral area of the shore.



Fucus vesiculosus – characterised by the presence of pairs of air bladders or vesicles (bladders are occasionally known to be absent), reproductive tips tend to be large and swollen, found in the mid littoral.

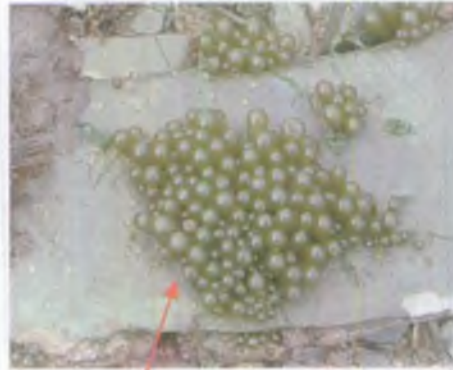


Fucus spiralis – characterised by its spiralled frond, swollen reproductive tips with distinct sterile rim of cells, found in the upper zone of the shore



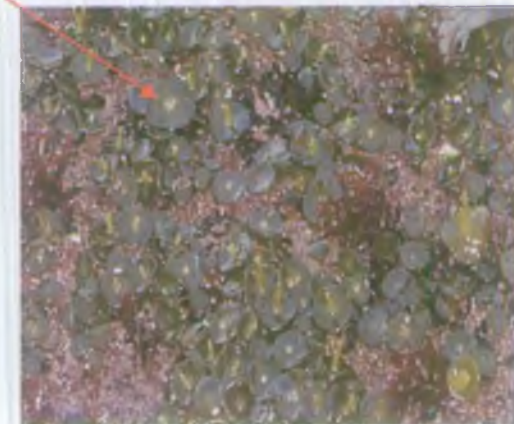
Halidrys siliquosa

Plant tough and cartilaginous with pod like air bladders divided internally by cross-walls. Exhibits regular alternate branching with a 'zig-zag' appearance. Generally found within mid to deep rockpools in the mid to lower littoral zones



Himanthalia elongata

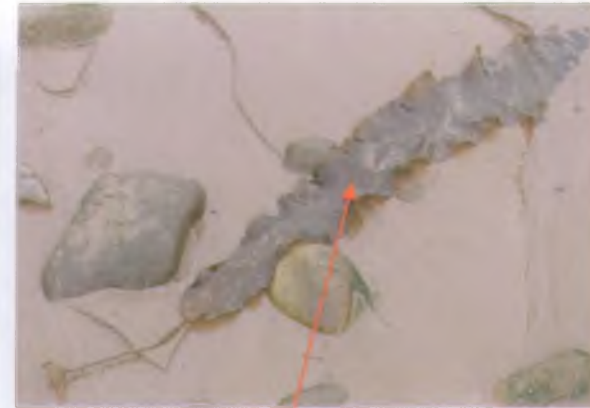
Plant a long tough, cartilaginous strap shaped frond, characterised by its large button shaped and slightly stalked attachment structure. Not highly branched but distinctly dichotomous with branches growing up to 150cm long, and found in the lower littoral on rock outcrops or large shelves



Laminaria sp.

Thick leathery, very tough and cartilaginous frond with thick cylindrical and distinct stipe and claw-like holdfast.

Found growing in the lower littoral fringe and subtidally often forming dense kelp beds.

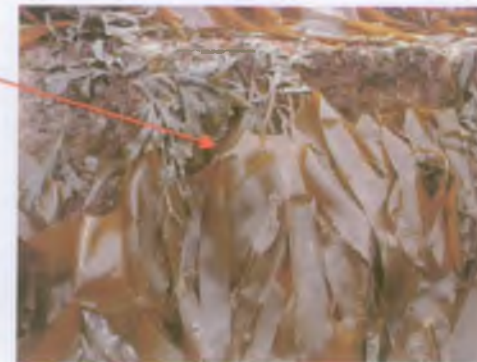


Laminaria saccharina – characterised by its crinkly, wavy edge and undivided blade growing up to 4m

Laminaria hyperborea – Rough stipe usually covered with numerous red algal epiphytes, stipe very stiff and stands upright with very broad finger-like split lamina growing up to 3m long.

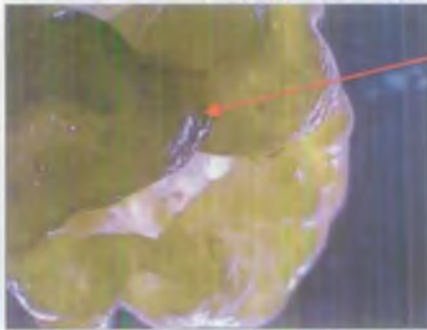


Laminaria digitata – stipe flexible and smooth only stands upright in water, with broad split frond appearing finger-like growing up to 2m long



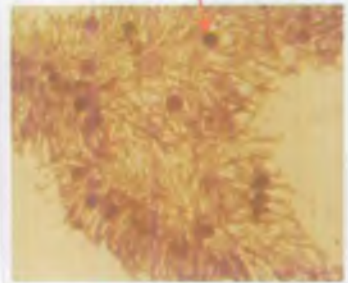
Leathesia difformis

Plant spherical, bulbous and hollow, gelatinous and can be easily squashed, but slightly more solid when young. Often found growing on other algae particularly *Osmundea* and *Corallina* but may also form dense patches on open rock surfaces and on the sides of rockpools. Found throughout the mid and lower littoral areas and can grow up to 5cm long/wide. Not to be confused with *Colpomenia* sp.



Plant bulbous and hollow

Plant made up of numerous filaments with reproductive bodies appearing as dark spherical patches



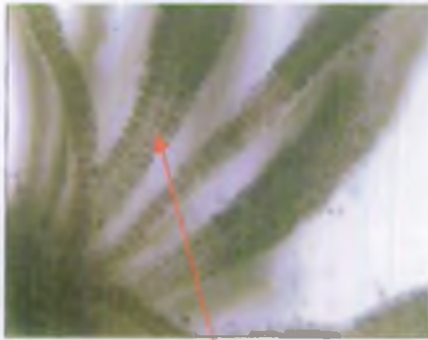


***Growing on solid substrate
and within crevices, and
found in rockpools***



Litosiphon laminariae

Epiphytic plant growing as fine multiseriate filaments on the fronds of Alaria. Found as small dark tufts and located in the lower littoral and sublittoral. Not to be confused with other similar filamentous species.



Multiseriate filaments of Litosiphon



Pelvetia canaliculata

Frond characteristically in-rolled forming a central channel, although quite limp they are tough and slightly elastic with swollen reproductive frond tips. Found growing in dense tufts on the upper region of the shore extending to up to 15cm long. Often found growing out of cracks or crevices and may be greeny brown in colour or sometimes slightly yellow.



**Natural morphology
and habitat of Pelvetia**



Petalonia fascia

Frond thin, membranous and foliose, but also quite tough, strong and elastic. Frond appearing as a simple undivided ribbon shape which narrows to a short stipe at the base, branching only occurs from the base. Frond can vary but can be wavy and crinkly at the edges growing up to 30cm long, can be mistaken for juvenile Laminaria plants. Found in rockpools particularly shallow ones with a soft substrate.





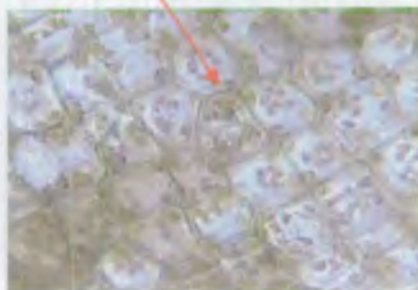
*Plant in sandy
bottomed rockpool*



*Frond of Petalonia with
reproductive buds shown
as dark small patches*

*Plant only branched from
base with simple
attachment structure*

*Cells of Petalonia as seen under greater
magnification showing regular arrangement
and discoid chloroplasts*



Pilayella littoralis

Fine filamentous form with no distinct main axis, often confused with other filamentous brown species such as *Ectocarpus* and *Pilayella*. Profusely branched appearing hair-like, branches can sometimes be secund and opposite but generally irregular. Characterised by its discoid shaped chloroplasts and intercalary sporangia appearing as swollen cells within the filaments throughout the plant. Found growing within mixed mats on open hard or soft substrates and epiphytically on *Fucus* or other large algae. Requires microscopic identification.



Growing on rock surfaces and may also be found growing along side Enteromorpha on sandy substrate



**Intercalary sporangia
used to distinguish
from other brown
filamentous species**



Sacchoriza polyschides

Thick, leathery, tough and cartilaginous, with thick flat stipe extending from bulbous and distinct base. Base of stipe with ribbon-like growths protruding from sides. Lamina large, broad and flat which is split to form several blades. Found growing in the lower littoral and subtidal regions of the shore

*Bulb-like base with
crinkly sides to
lower stipes*



***Ralfsia* sp.**

Dark brown/black crust found growing throughout the littoral zone on limpets and open rock surfaces, no erect system present.

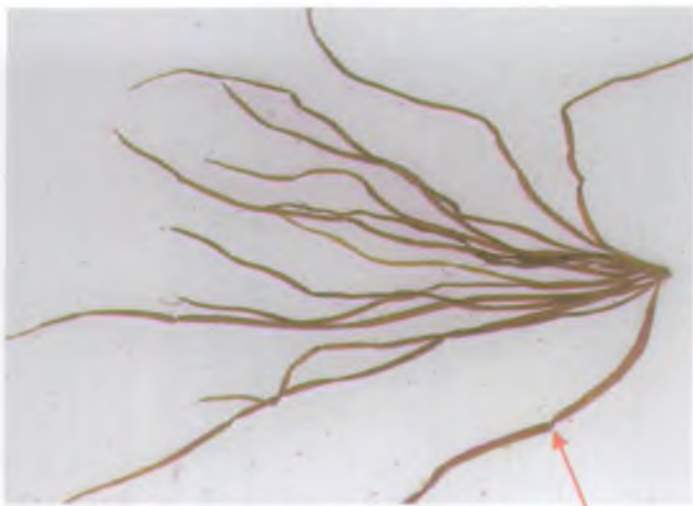


Scytosiphon lomentaria

Plant characterised by its regular pronounced constrictions present down the length of the frond giving the appearance of a string of sausages. Frond generally quite narrow and hollow and unbranched with frond developing from main base only, which is a distinct disc. Found growing throughout the littoral on both open hard surfaces with other algal species and within sandy bottomed rockpools. Not to be confused with *Asperococcus* sp.

***Scytosiphon* found growing in amongst
Enteromorpha on hard substrate**





Plant branched from base only with characteristic constrictions at intervals

Discoid basal attachment



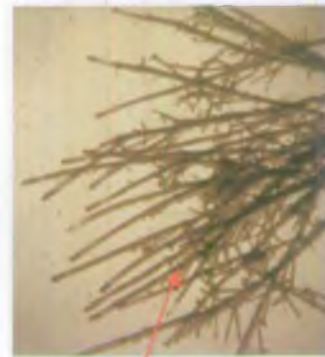
Sphacelaria sp.

Plant small, usually less than 2-3cm long, tufted and stiff retaining its shaped even in water. Consisting of numerous multiseriate filaments which may be 2 to many cells wide, branching numerous and is generally irregular except in ultimate branches where it may become pinnate and opposite or alternate. Characterised by a prominent large and slightly bulbous apical cell and the presence of propagules which detach from filaments during reproduction. Found growing within mixed turfs in overhangs and epiphytically on *Corallina*.



Prominent rounded apical cells

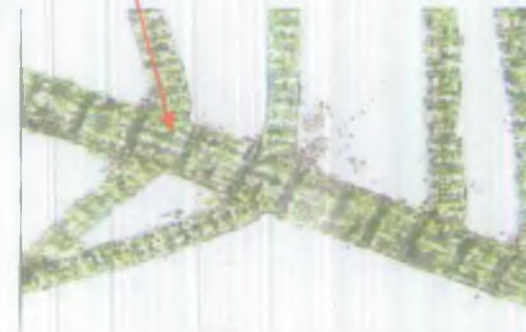
Reproductive structures exist as propagules



Densely tufted and stiff



Branching pinnate and alternate or opposite



Spongonema tomentosum

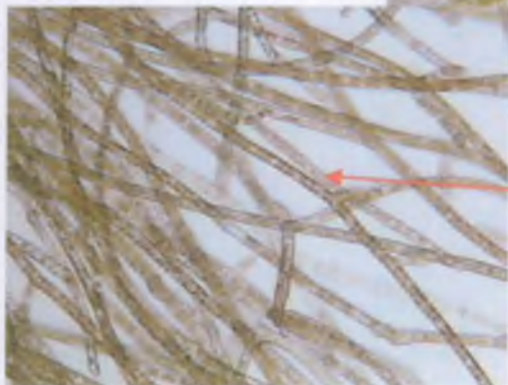
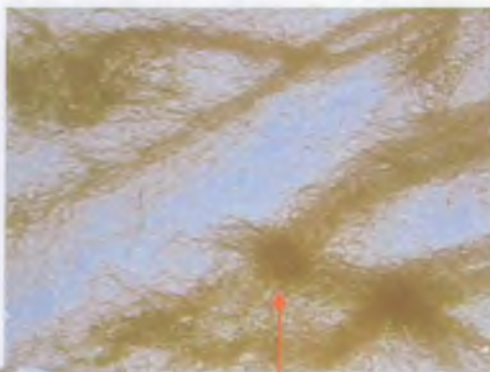
Fine and filamentous and tangled into distinct woolly cords due to curled hook-like branches and generally limp, floppy and hair like. Highly and irregularly branched and consisting of uniseriate filaments but requires microscopic identification to distinguish from *Ectocarpus* and *Pilayella*. Commonly found attached to *Fucus* sp. throughout the littoral, may also be found in turfs and within rockpools.



Characteristic hooked ultimate branches can be used to distinguish from other brown filamentous species



Filaments form tangled woolly cords and attach to Fucus sp.



Filaments uniseriate and numerous and irregularly branched



red seaweeds

Aglaothamnion/ Callithamnion

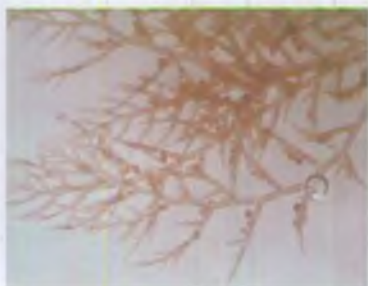
The form of these two genera are generally very fine and delicate consisting of numerous branched uniseriate filaments (single row of cells). Plants are often quite bushy and spongy due to the covering of numerous branchlets or ramuli extending from the main axis. Branching patterns can vary from regularly alternate to subdichotomous and dichotomous with both rounded and pointed apices. Cells are longer than broad and are often bone shaped. They tend to be quite small and are often found living amongst turfs in overhangs and attached to mussels, or epiphytically on a variety of algae. *Aglaothamnion* spp. tend to have a single visible nucleus whereas *Callithamnion* spp. are known to have several nuclei.





Cells of Callithamnion sp. clearly showing the numerous nuclei present as light pink spots. Aglaothamnion species only have one nucleus per cells.

The variety of forms of Aglaothamnion and Callithamnion and in its natural turf forming habitat and showing its various branching patterns



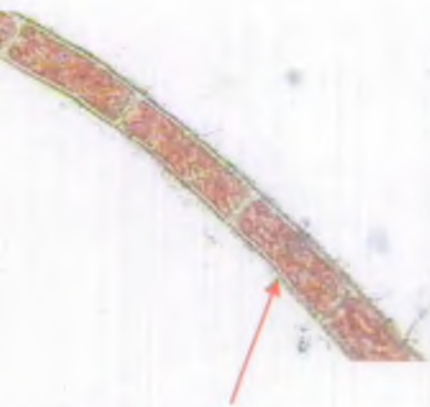
Ahnfeltia plicata

Plant completely cylindrical throughout, very coarse, black and wiry with narrow fronds of 0.5mm or less. Branching is highly irregular with branches very variable in length but growing up to 15cm long. It is tolerant of sand cover and tends to be located in sandy bottomed pools attaching by a discoid holdfast. It is found in the lower littoral most commonly in rockpools.

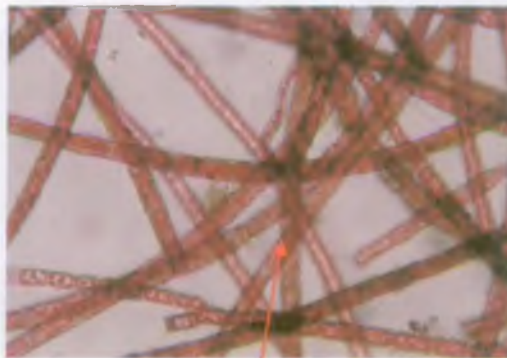
Audouinella purpurea

Small microscopic plant consisting of uniseriate filaments. Cells tends to be longer than broad and are completely filled with a dense reticulate chloroplast resulting in a dark pink colour. Branching is minimal and completely irregular. Plants tend to be very tangled and are located within turfs forming a moss on overhangs and general dark damp areas throughout the littoral. Not to be confused with *Rhodothamniella floridula*.

Typical black wiry form of Ahnfeltia with close up of cylindrical fronds



Long, narrow cells of A. purpurea with dense reticulate chloroplast

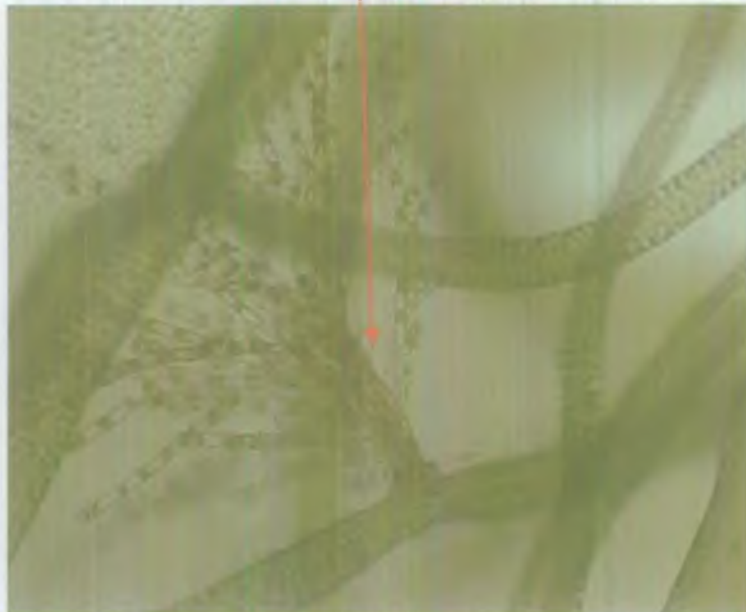


Uniseriate filaments of A. purpurea found in tangled mats or turfs

Audouinella sp.

Other *Audouinella* species tend to be much smaller and only a few cells in length and require a microscope just to locate them. They grow epiphytically on a variety of other algal species e.g. *A. davesii* is commonly found on the fronds of *Palmaria palmata* but may also be found within hydroids and can live throughout the littoral. The cell size and shape may vary as can the chloroplast but it rarely fills the whole cell as with *A. purpurea*. Plants tend to be short and variously branched growing from either a unicellular or multicellular base. Plants can also be erect, prostrate or a combination of the two. They can be differentiated from *A. purpurea* by their microscopic size.

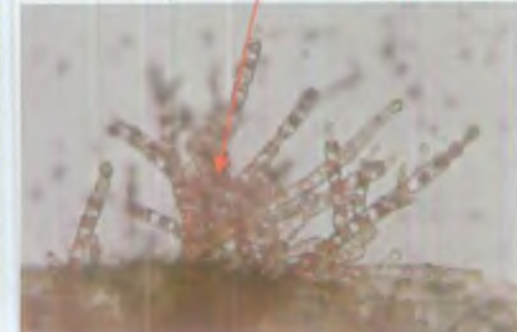
Audouinella davesii found growing on the frond of *Enteromorpha* sp.



A number of *Audouinella* sp. are often found in hydroids

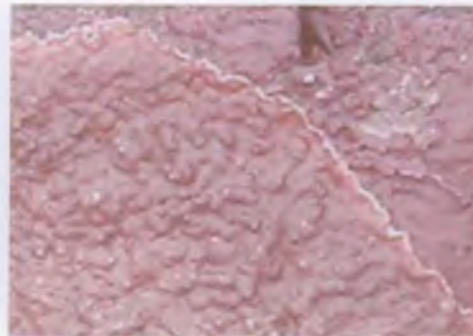
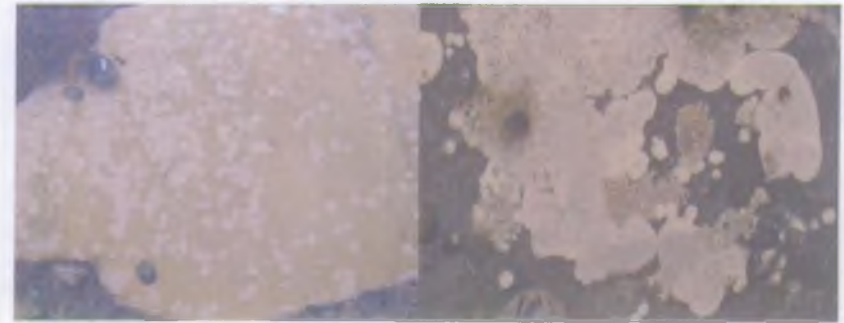


Audouinella sp. showing unbranched form growing from a multicellular base and highly branched form.



Calcareous encrusters

Calcareous encrusters incorporate a number of Species from various genera including *Lithophyllum*, *Lithothamnion*, *Phymatolithon*, and *Mesophyllum*. They are very distinct forming a hard coating over rock surfaces and occasionally on the fronds of other algae such as *Titanoderma* which is often found on *Polyides*. They grow in a variety of colours ranging from light to dark pink, deep red and purple and may also be slightly speckled with the edges often bleaching. Not to be confused with the basal portion of *Corallina* sp. They are found throughout the littoral and sublittoral appearing in a variety of forms including a smooth shiny surface, lumpy, knobby crusts, with smooth edges or highly convoluted ridges. Very common.

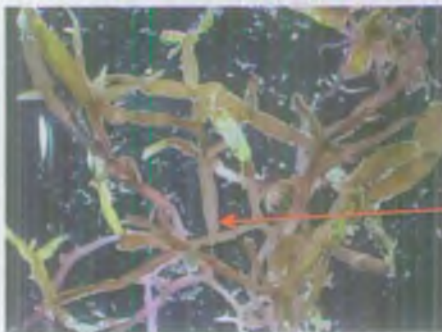


Callophyllis laciniata

This is a foliose species and tends to be very thin, membranous, soft and fleshy. Fronds are wide and often much divided or split into broad fan shaped sections and are bright pink in colour. The edges may be slightly frilly and reproductive bodies are found in the slightly frilly edges of the fronds which often form bladelets.. Found in the lower littoral and sublittoral fringe frequently located on kelp stipes and holdfasts. May be distinguished from *Cryptopleura* sp. by the absence of a midrib or veins.



Foliose nature of Callophyllis with reproductive bodies



Catenella in natural habitat and showing its variable form with irregular constrictions

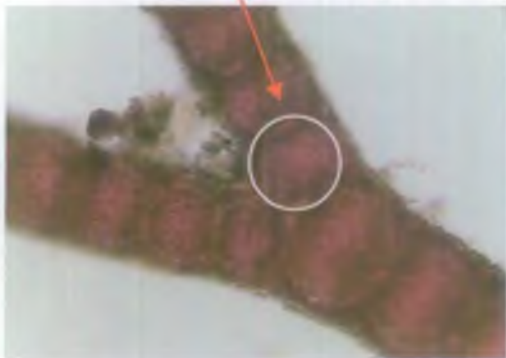
Catenella caespitosa

Plant is small, soft and slightly squashy and only grow to 2cm long. It has very irregular branching and is constricted at irregular intervals along the plant. It is generally filiform but segments may be cylindrical and or very flattened often appearing slightly fleshy. It is found most commonly in the upper littoral area but may be found in the mid littoral. Not to be confused with *Gelidium* sp.

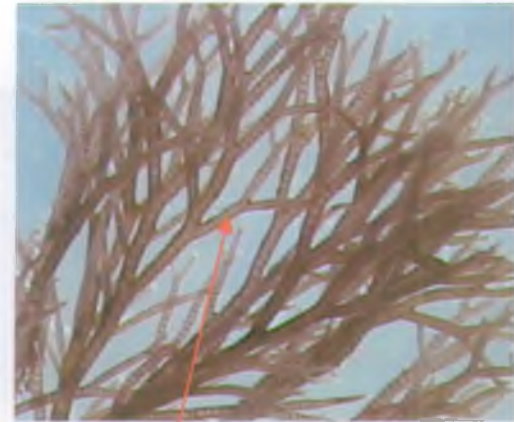
Ceramium nodulosum

This is a highly branched filamentous species, often characterised by its banded or striped appearance which may be visible with the naked eye. Although the main axis consists of a single row of cells there is a covering of small cells which become particularly dense at the junction between axial cells, which results in the banding. The branching pattern is usually dichotomous or subdichotomous where terminal branches may be tightly in-rolled. Fine hairs may also be present along the full length of the filament but these are not to be confused with spines. Although there is a number of *Ceramium* spp. this is the most common and can be found throughout the littoral within rockpools, on open rock surfaces and growing epiphytically on a range of red and brown species. The form can be quite variable.

Single row of axial cells

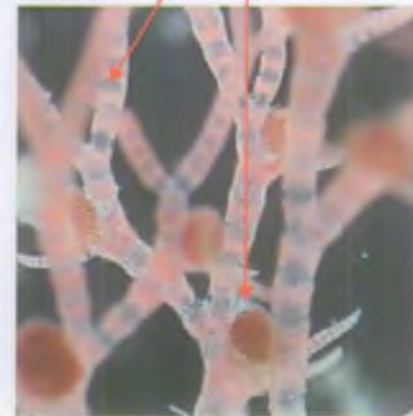


Dense covering of small cells between axial cells and strongly in-rolled apices



Highly and dichotomously branched

C. nodulosum filament with fruiting bodies and obvious banding

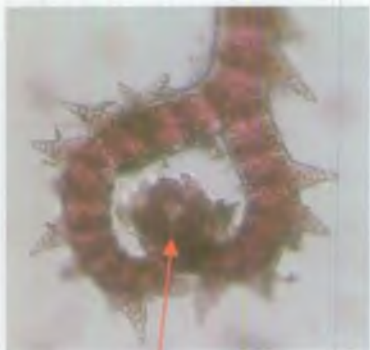


Ceramium shuttleworthianum

This is a highly branched filamentous species with the main axis consisting of a single row of cells. The covering of small cells is often incomplete resulting in a clearly banded effect. This species is mainly characterised by the presence of multicellular spines on the outside of each node and the strongly hooked or in-rolled apices. The branching pattern is regularly dichotomous and is often densely matted. This species of *Ceramium* is found in the mid and lower littoral on rocks, mussels, other algae and within overhangs and crevices.

Ceramium spp.

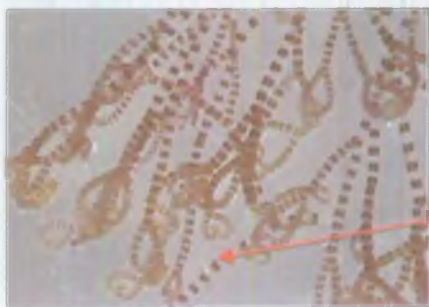
Species displaying slight variations of the characteristics of *C. nodulosum* and *C. shuttleworthianum*. Some species may be completely covered with small cells (corticate) other may have very distinct banding with cells present at the nodes only. Spines may be present or absent, the spines may be multicellular or single celled and may whorled, dense or sparse.



***Strongly hooked apices with
spines on outside of nodes***

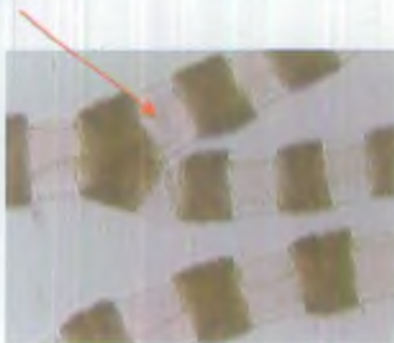
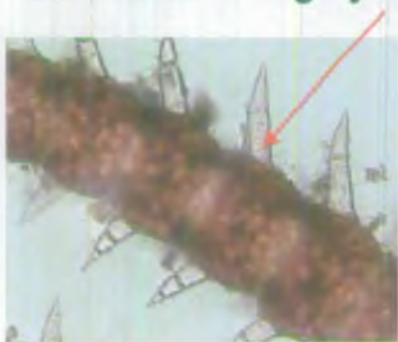


***Spines greater than
one cell in length and
with multicellular base***



***Banding visible with
the naked eye***

***Other Ceramium species may be spined, highly
corticated or highly banded***



Chondrus crispus

This species is cartilaginous, often quite tough and slightly elastic, with frond displaying regularly dichotomous divisions. Fronds are completely flat and may be quite wide and wedge shaped. The stipe is also completely flat and much narrower than the main frond. Colour may vary from light brown and yellow to deep red or purple. Found throughout the littoral zone on a variety of surfaces, very common. Not to be confused with *Mastocarpus stellatus* which has a slightly channelled frond. May be fluorescent in water.

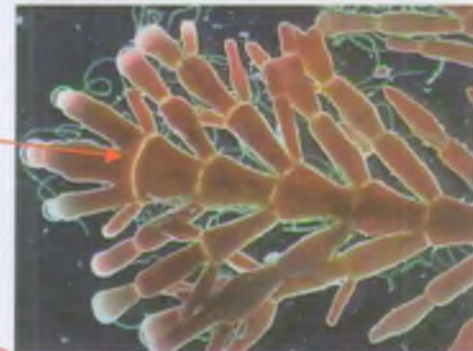
Chondrus in its natural habitat in a range of colours and showing its narrow stipe and flat dichotomous frond



Corallina officinalis

Plant consisting of erect jointed calcareous structure often appearing bone-like. Branching pattern regularly opposite. Pink in colour often turning completely or partially (just the tips) white due to bleaching. Some fronds may appear elongate where as others may be more fan shaped. Found in the mid littoral through to the sublittoral most commonly within rockpools but may be found on open rock surfaces.

Corallina found commonly in rockpools consisting of a calcareous bone-like frond light pink in colour.



Cryptopleura ramosa

Plant is thin, membranous, foliose and quite delicate. It is light pink and often iridescent. The main frond is divided into wide sections, although the general shape can be highly variable with narrow long or broad fronds. Microscopic veins are present but there is no distinct midrib. Apices often rounded with a slightly frilly or ruffled edge within which tetraspores may be present, branches may also be slightly hooked or curled. This species can grow up to 2.5 cm wide and 20 cm long. It is found in the lower littoral generally within pools attaching to rock, kelp stipes and other algae via a short stipe and disc holdfast.

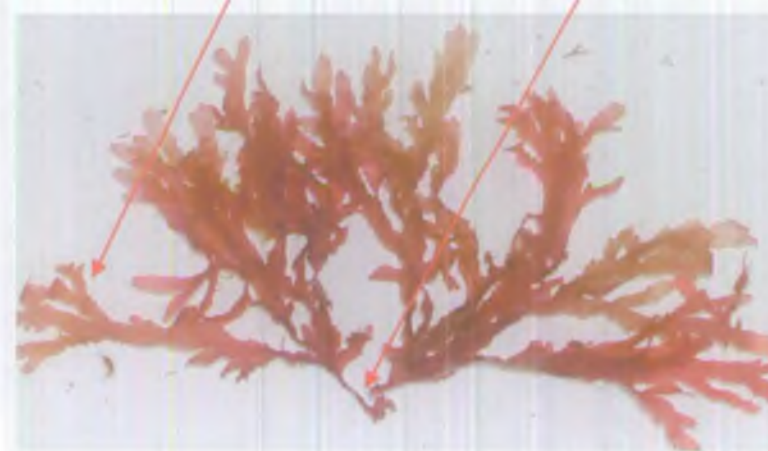


Frond with microscopic veins present throughout and tetraspores located on the outer edges of the plant



Plant showing broad frond with ruffled edges

Plant displaying highly branched form with narrow delicate fronds and minimal stipe

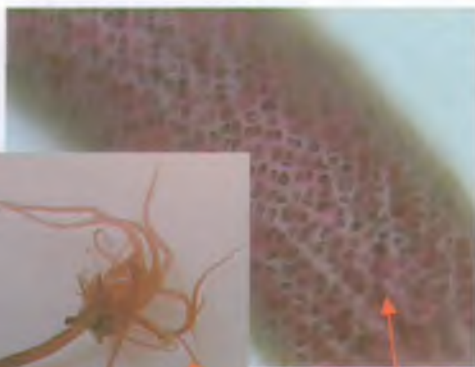


Cystoclonium purpureum

This is a filiform plant often with a distinct main axis which may be up to 2 mm wide. It is highly and irregularly branched, growing up to 60 cm long and can appear quite straggly. This species is often distinguished from similar species such as *Rhodomela* sp. by its distinct claw-like branched holdfast. Cystocarps can appear as swellings within the smaller branches. It is found in the mid to lower littoral and sublittoral fringe, generally located within rockpools and may be brownish red or purple in colour.

Delesseria sanguinea

Plant with distinct and uninterrupted midrib and side veins. Very thin, foliose, membranous and delicate, plant with limited branching generally occurring at the base and arising from a main thick stipe. Fronds long and broad growing up to 40 cm long with edges appearing ruffled often resembling elongated beech leaves. Pinkish red in colour it is found in the lower littoral and sublittoral fringe and within deep lower littoral rockpools, may be found attached to kelp stipes. Not to be confused with *Phycodrys rubens*.



General appearance of Cystoclonium with claw-like holdfast, cellular structure and presence of cystocarps

Delesseria with distinct leaf like appearance due to thick midrib and veins



Branching of Delesseria from main stipe near base only



Dilsea carnosa

Plants thick (up to 1 mm), tough and leathery but slightly elastic and may reach up to 30 cm in length and 20 cm in width. Deep red in colour consisting usually of wedge shaped fronds that may be split or worn in older plants. This species is unbranched but several fronds may arise from the base through tapering of the frond which may resemble a short stipe. Found mainly in the lower littoral and sublittoral fringe attached to solid substrate via a disc like holdfast



***Dilsea* in natural habitat and showing split lobe and basal attachment**

Dumontia contorta

Plants tubular and completely hollow throughout sometimes appearing a little gelatinous and membranous. Branching is irregular and may be quite minimal with branches mainly extending from main axis. The point of branching may be slightly constricted but generally width of filaments ranges from 1 to 10 mm broad and can grow up to 50 cm long. The tips of the plant often turn green when rotting but the plant tends to be dark red or brown in colour. Found throughout the littoral often in shallow rockpools on both rocky and sandy substrates. Common throughout the UK and Ireland. Not to be confused with *Nemalion helminthoides* which is also gelatinous but completely solid.



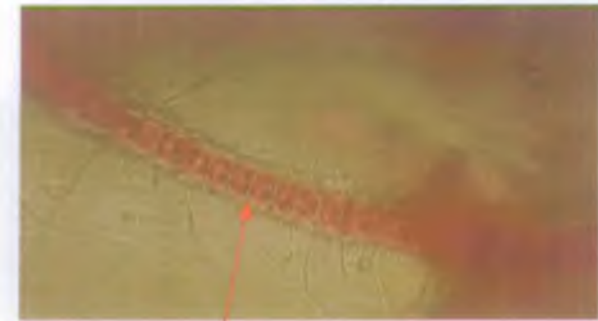
Various microscopic views of *Dumontia* showing the different cellular structures

***Dumontia* in natural habitat and showing branching pattern**



Erythrotrichia carnea

This is a small, filamentous and unbranched species which is found growing epiphytically on a range of red, green and brown species. The filament can be several cells long and extends from a small multicellular disc. It is often very pink in colour and may be distinguished from other microscopic filamentous species by its stellate (star shaped) chloroplast. Not to be confused with *Audouinella* sp. which are often shorter in length, branched and may have hairs or with *Bangia atropurpurea*.



Uniseriate unbranched filament of Erythrotrichia

Furcellaria lumbricalis

Plants completely cylindrical, cartilaginous and quite tough and dark red/brown in colour but tips may turn green in older plants. Branching is regularly dichotomous and tends to be most dominant at the apices which tend to taper appearing fork-like. This species can grow up to 30 cm long and 1-2 mm thick. It is often confused with *Polyides* but may be distinguished by its claw-like basal attachment. It is most frequently located in sandy bottomed pools in the lower littoral.

Furcellaria with claw-like holdfast, with dichotomous branching and forked apices and in natural habitat,



General form of Furcellaria

Gastroclonium ovatum

Plant filiform and completely cylindrical throughout also quite cartilaginous and fleshy. The most characteristic feature is the presence of small bulbous sacs which are bunched together at the frond tips. Branching is irregular and generally restricted to the upper portions of the plant with limited branching at the base although many fronds may arise directly from the base. It grows up to 25cm long and is generally brownish red in colour although it often bleaches to brownish yellow. It is located on rock surfaces in the lower littoral and sublittoral fringe.

Plant showing sparsely branched frond with numerous sacs on the upper portions of the frond



Gelidium sp.

Species quite variable in size and shape but plants are generally flesh and cartilaginous. *G. pusillum* tends to have narrow fronds which are cylindrical but may be compressed in parts, it is dark red/black and wiry with variable branching but often arranged in two opposite rows. *G. latifolium* and *G. sesquipedale* are slightly broader and more foliose with regularly flattened fronds and redder in colour. All species tend to creep over the rock surface, in crevices and overhangs forming mats, and are located in the mid to lower littoral. Not to be confused with *Catenella caespitosa*.



G. latifolium
showing broader
compressed frond



***Gelidium pusillum* in**
natural habitat and
under magnification



Gracilaria gracilis

Plants filiform, cartilaginous and slightly elastic growing up to 60cm long and 1-3mm wide. Branching is generally irregular but secund at times and may be quite dense in some plants often giving a straggly appearance. It is usually dark brown in colour although may turn green on bleaching. This species is quite tolerant of sand and can be located in the lower littoral and sublittoral fringe and within rockpools attached via a discoid holdfast.

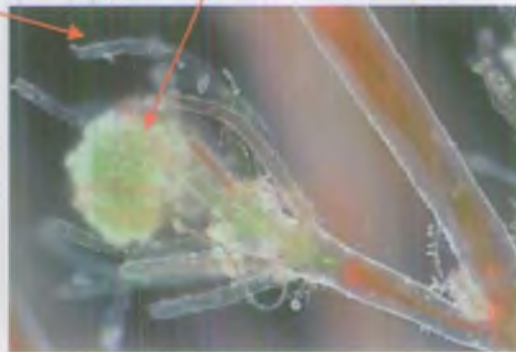
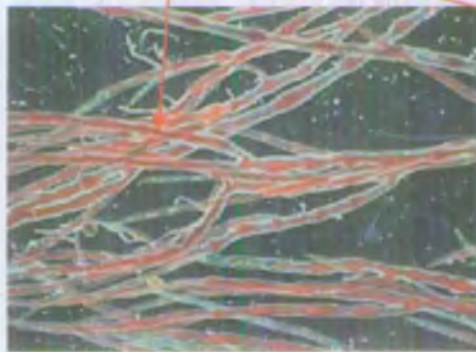
General form of Gracilaria



Halurus flosculosus

Plant consisting of uniseriate filaments of cylindrical cells often slightly swollen at each end with apices narrow and pointed. Plant tends to be slightly rigid with the texture of coarse hair, with worn plants appearing tatty. It is bright red/pink in colour and grows up to 20cm long. It is highly and dichotomously branched with reproductive bodies extending from special branches; these are also often surrounded by small incurved branchlets or ramuli. Rhizoidal branches may be present in muddy substrates. Found mainly in the mid to lower littoral within rockpools and in the sublittoral fringe.

Long hair-like filaments of H. flosculosus with incurved branchlets surrounding reproductive bodies



Halurus equisetifolius

Plant filamentous consisting of main axis numerous covered with closely packed and densely whorled uniseriate branches, which are short and incurved giving a bottle brush appearance. Main axis branching is limited and irregular. Generally quite coarse in nature and dark red in colour growing up to 20cm long. It is located in the lower littoral and sublittoral fringe on rock surfaces.

Spongy appearance through covering of small Whorled branches may resemble a bottle brush.

Heterosiphonia plumosa

Plant filamentous and quite bushy with a polysiphonous cylindrical main axis and monosiphonous and short branching. Fronds generally wide spreading giving a slightly delicate feather-like appearance accentuated by the short and numerous tufted branchlets which may be simple or forked. It is bright pink in colour, pinnate and flattened, growing up to 20cm long. It is found in rockpools within the lower littoral and sublittoral fringe and often on growing on other algae in particular the stipes of kelp.

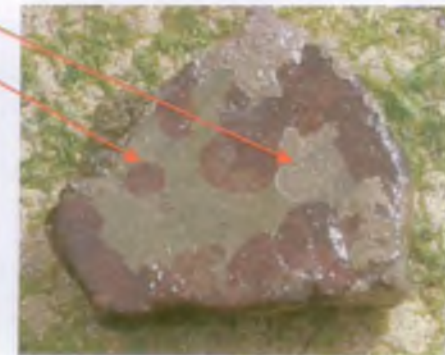
Flattened feather-like appearance of Heterosiphonia showing numerous small tufted branchlets



Hildenbrandia rubra

This is a prostrate species growing as a crusts on rock surfaces appearing as a dark red stain. Plants may be quite extensive covering a vast area of rock and is found throughout the littoral region. Reproductive bodies may be visible within pits under magnification. Very common and easily distinguished from other encrusting algae.

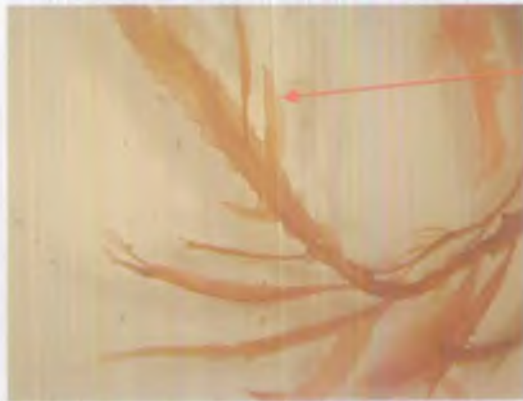
Hildenbrandia as a dark red stain on rock surfaces very different from other, calcareous encrusters



Hypoglossum hypoglossoides

This species is foliose, very delicate, and membranous, light pink in colour and growing up to 20cm long and 4mm wide. Its may characteristic features are the presence of a distinct midrib from which bladelets arise. The fronds are pale pink and narrow with pointed tips and may be variously branched. It is commonly found in the lower littoral often under overhangs and in the sublittoral fringe. Not to be confused with similar branched foliose species with midribs such as *Membranoptera* sp. and *Apoglossum* sp.

Delicate and membranous nature of Hypoglossum showing branches extending from central midrib only and with slender and pointed apices



Lomentaria articulata

The main characteristic of this species is its clearly beaded appearance. It is very fleshy, soft and bright pink/red in colour and has prominent constrictions at regular intervals along the frond creating elongated oval segments. Branching can be quite dense, it is often dichotomous and may be both whorled or opposite generally extending at right angles from the main axis. It is found throughout the littoral particularly in overhangs and within mats or turfs. Also commonly located on the sides of rockpools. Generally very common.



Lomentaria in its natural habitat and showing its distinct beaded appearance

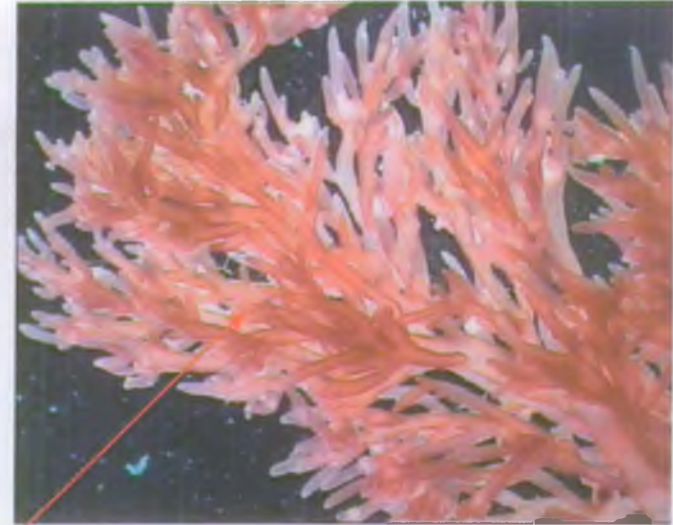


Lomentaria clavellosa

This plant is very fleshy, soft and rose pink in colour and growing up to 15-30cm long depending on local conditions. Branching pattern is generally irregular, numerous with branches constricted at the base. General form may vary according to level of exposure; in exposed conditions branching tends to be pinnate appearing flattened, but in sheltered areas branching is much more variable and luxuriant. It is found throughout in lower littoral pools down to the sublittoral and may also grow on sandy or muddy substrates.



Reproductive body of L. clavellosa showing constrictions at base of branches and its general form



Natural form of Mastocarpus showing variable colour, presence of cystocarps and channelled frond

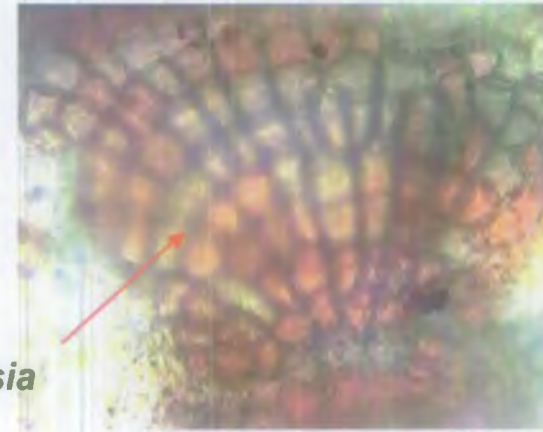


Mastocarpus stellatus

Plant cartilaginous and tough, deep red in colour although often turning greeny brown on bleaching and growing up to 17cm in length. The frond is sometimes quite broad but narrows at the base and is in-rolled causing a channel-like appearance, though channelling may be slight. The frond may also be covered in reproductive bodies (cystocarps) present as small knobbs. Plants may be quite variable in morphology with some appearing twisted and with regularly dichotomous branching. It can be found throughout the littoral although is most common on the lower shore. Not to be confused with *Chondrus crispus*, which is very similar in morphology but is completely flattened.

Melobesia membranacea

This is a small microscopic, calcareous and epiphytic species. It is an encrusting species but considerably different from the general calcareous encrusters. This plant requires a high level of magnification to be identified. It is characterised by its disc-like appearance of radiating cells and is found throughout the littoral commonly on hydroids and other algae.



Radiating cells of Melobesia



Membranoptera alata

Plant foliose, thin, membranous and quite delicate it is characterised by its leafy appearance and distinct midrib, small side veins are also present but less obvious. Branching occurs from the frond margin or directly from the main stipe and it is usually highly branched either alternately or subdichotomously. Plants grow up to 20cm long and frond widths are up to 5mm, older plants may appear tatty where fronds have been worn away. It is found in overhangs and crevices and on the sides of rockpools generally in the mid to sublittoral areas and is very common.



Membranoptera with distinct midrib and delicate frond and with less prominent side veins

Nemalion helminthoides

Plant very slippery, gelatinous, squashy and completely solid throughout growing up to 25cm long and 5mm wide; it may also be quite elastic. Branching is limited and irregular, with most branching occurring towards the base of the plant. Is it frequently reddish brown in colour and is found attached to limpets and barnacles in the mid and lower littoral. It has a southern distribution. It may be confused with *Dumontia* or *Helminthocladia* but this latter species is generally more clothes in branchlets



Nemalion with few branches and growing on barnacles



Odonthalia dentata

This species is quite tough despite the broad, flat and slightly foliose nature of the frond growing up to 30cm long and 15mm wide. It is characteristically alternately branched with sharply pointed apices giving a tooth edge appearance. The thickening of the central frond area gives rise to an interrupted midrib. It is deep red in colour and can be located in the lower to sublittoral fringe particularly around the base of kelps.

General nature of Odonthalia



Osmundea hybrida and *Osmundea pinnatifida*

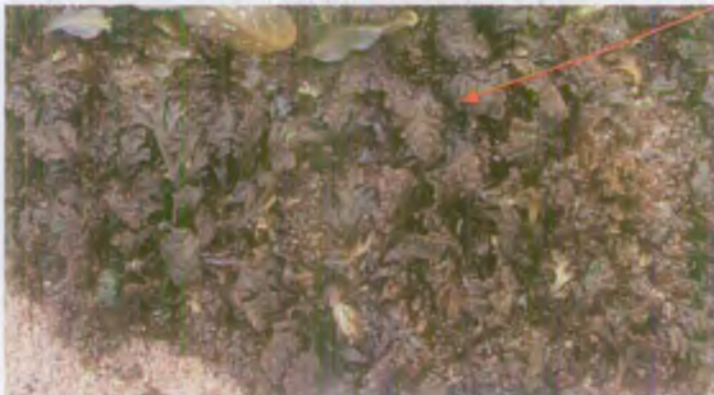
Both these species are very cartilaginous and fleshy and dark red-brown in colour but can appear yellowish when bleached. Branching pattern varies according to species. *O. hybrida* has branching from all round the main axis which tends to be alternate or opposite. It is generally cylindrical but may be slightly compressed in parts and can grow up to 15cm long with a discoid basal attachment. In contrast *O. pinnatifida* tends to be more compressed with branches in a single plane only with slightly wider fronds. Microscopic examination will reveal a groove in the frond tip and a stoloniferous holdfast. *O. Hybrida* has a terminal pit rather than a groove. Both species are located in the mid through to sublittoral region and tends to be found in amongst turfs in crevices or overhangs and on the sides of rockpools, often found together.



Cylindrical arrangement of branches and discoid holdfast on O. hybrida



Compressed form of O. pinnatifida, with single plane branching, also showing its wide frond morphological form in its natural habitat

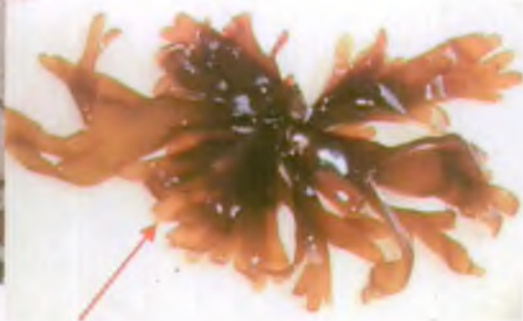
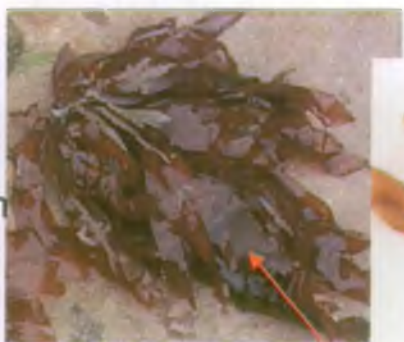


Palmaria palmata

Plant foliose, fleshy and thin but slightly tough and elastic. Fronds are quite broad and long often wedge shaped and small blades arise from the frond margins. It is very variable in shape and size, some with very broad and undivided fronds and others with long thin and much branched fronds, but branching is generally variable and irregular. Plant is dark red in colour and can grow up to 30cm long. It is commonly found in the lower littoral and sublittoral fringe within pools and on open rock surface also frequently found attached to kelp stipes.

Phycodrys rubens

Plant with midrib and side veins very distinct throughout. General morphology is thin, membranous, delicate and foliose resembling an elongated oak leaf with notched frond edges and may be up to 9cm wide and 20cm long. Branching variable and generally from main stipe. Found in the lower littoral and sublittoral and often attached to kelp stipes. Not to be confused with *Delesseria*.



Palmaria showing highly branched form

***Phycodrys with distinct midrib and veins
and branching from main stipe***



***Phyllophora* sp.**

Plant tough, cartilaginous and foliose, it is variable in size depending on the species often with a prominent, narrow, cylindrical and long stipe. Plants may be broad and fan shaped or with long narrow fronds. Branches and division variable often with simple blades extending from frond margin with narrowing at branch base with an interrupted and indistinct midrib. Found in the lower to sublittoral fringe on a range of substrate types and often attached to kelp stipes.

***P. Traillii* with short terete stipe and with numerous branchlets extending from frond margins**



Plocamium cartilagineum

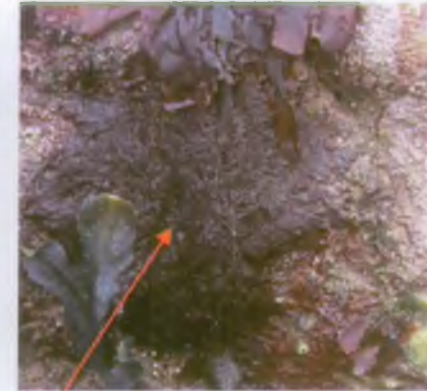
Plant is rose pink in colour, filamentous, highly branched and slightly delicate. Its main characteristic feature is the distinct comb-like (secund) branching that occurs throughout the plant. The fronds tend to be flattened but may appear very bushy due to numerous branching; growing up to 3mm wide and 15cm long. It is found in the lower littoral and sublittoral often around kelp stipes.

***Plocamium* with comb-like branching and showing natural highly branched and bushy morphology**

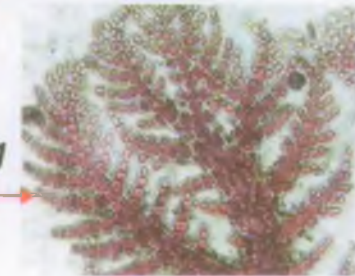


Plumaria plumosa

This species is dark purple and filamentous with a soft, fine, and very delicate morphology consisting of numerous branches and growing up to 10cm long. The plant is generally monosiphonous but lower portions may be covered in small cells. Branches are both long and short although these are not regularly alternate and may appear tatty in older plants. They are commonly found in amongst mats on both vertical rock and within overhangs in the mid but mostly lower littoral. Not to be confused with *Ptilota gunneri*.



Plumaria with long and short branches, in its natural habitat and showing monosiphonous fronds



Polyides rotundus

Plants are cartilaginous and tough, completely terete throughout and usually dark red or black in colour. Its branching is generally quite regular and dichotomous and tends to be more highly branched towards the apices which taper to a point. This species is very tolerant of sand and is most commonly found in sandy rockpools attaching with a discoid holdfast. Easily confused with *Furcellaria* and requires basal portion for correct identification.



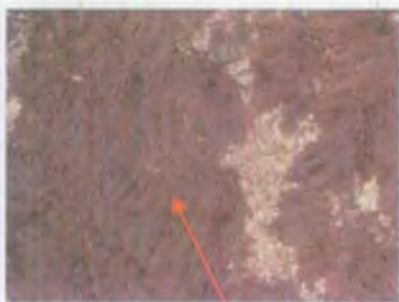
Polyides showing terminal dichotomous branching and discoid holdfast

Polysiphonia fucoides

Plants are generally dark red to black in colour growing up to 30cm long and quite coarse in texture. Branching is irregular and tends to be concentrated towards the upper portions of the plant often appearing scraggy. It is a polysiphonous species consisting of 12-20 siphons with a small covering of cells occasionally in the lower fronds. It is very common throughout the littoral found in numerous habitats.

Polysiphonia lanosa

P. Lanosa is dark purple to black, filamentous, it can grow up to 8cm long and is often quite coarse . It is a polysiphonous species consisting of 12-24 siphons around a prominent central siphon or cell, with distinct dichotomous branching often appearing quite tufted. It only grows epiphytically on *Ascophyllum* on the upper and mid littoral and this is used to distinguish it from other species of *Polysiphonia*.



***P. fucoides* in natural habitat, its general morphology and showing the 12 secondary siphons**

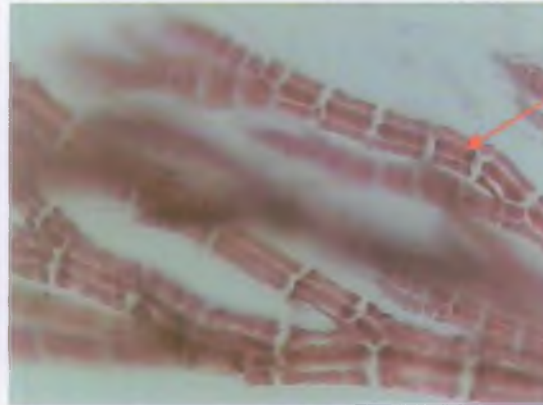
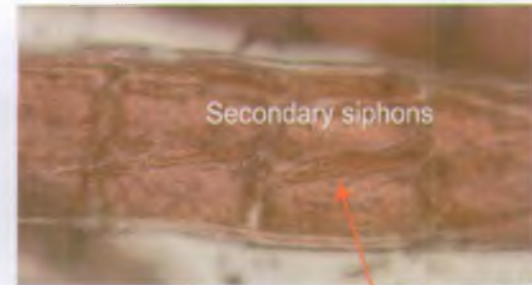
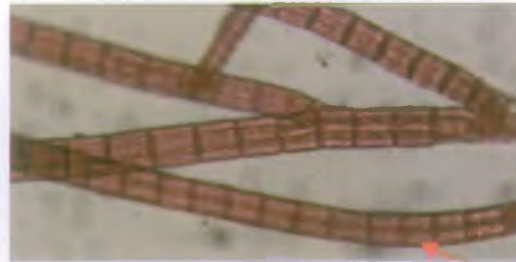


***P. lanosa* with dichotomous branching, growing on *Ascophyllum*, and showing numerous siphons with distinct central siphon**



Polysiphonia spp.

These plants are filamentous and polysiphonous but will vary considerable between species. The colour may be light pink to deep red and purple or black. The number of primary siphons range from 4 to 24 and depending on the species secondary siphons may also be present. These characteristics are used to distinguish between species.

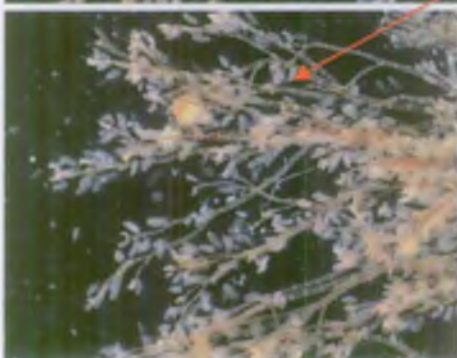


Some Polysiphonia species may only have 4 to 6 primary siphons others may have secondary siphons present, often the central siphon cannot be easily seen



Cystocarps

Reproductive bodies may be present as cystocarps or tetraspores



Tetraspores



They may be found in a number of habitats throughout the littoral including rockpools, overhangs and crevices and may also be located in amongst turf formers. Shape, size and location of the reproductive bodies are also quite variable.

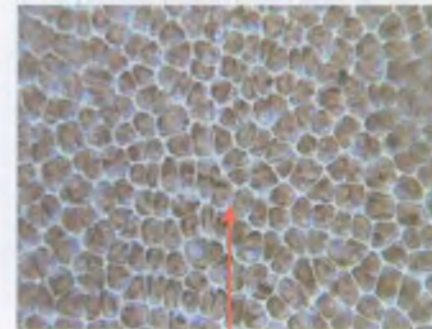
Porphyra species

These plants are foliose and very membranous, thin and polythene-like, tending to be quite elastic. They are mostly brownish red in colour with various morphological forms but they all tend to be unbranched although some fronds may be highly torn. Species may be differentiated by the location of their basal attachment and preferred habitat including position on the shore and host species. *P. umbilicalis* is characterised mainly by its central holdfast from, forming a rosette like frond and is located throughout the littoral mainly on open rock surfaces. *P. leucosticta* is a much smaller plant, often quite delicate, pink-red in colour and is found growing epiphytically on other algae particularly on the fronds of *Fucus* sp. attached by a basal holdfast. Also found growing throughout the littoral.



***P. umbilicalis* with rosette appearance and central holdfast**

***P. umbilicalis* in its natural habitat growing on open rock surfaces**

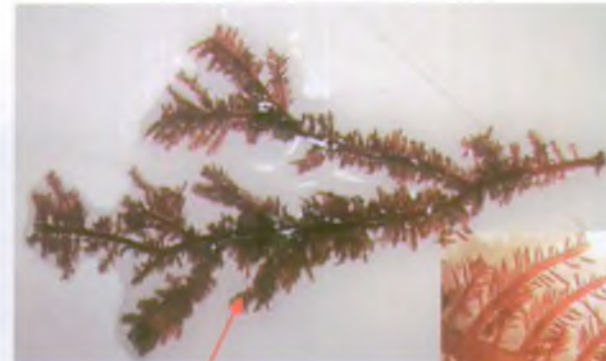


***P. leucosticta* cellular arrangement and found growing on *Fucus* sp.**

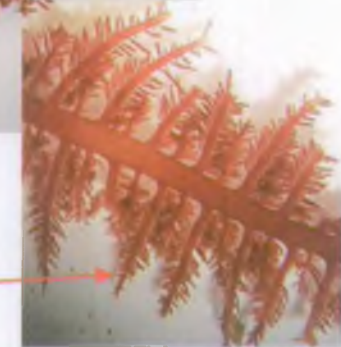


Ptilota gunneri

Plants usually dark red or purple in colour, generally very delicate and fine, almost feather-like but quite rigid and growing up to 30cm long. Branching generally irregular but with distinct alternate arrangement of long and short apical branches, branching also tends to be in one plane. Often growing in amongst turfs in crevices, overhangs and vertical rock in the mid and lower littoral and often found on kelp stipes. Not to be confused with *Plumaria plumosa* which is morphologically similar but without the regular long-short branching arrangement.



***Ptilota* with regular and stiff branching pattern**



Rhodomela confervoides

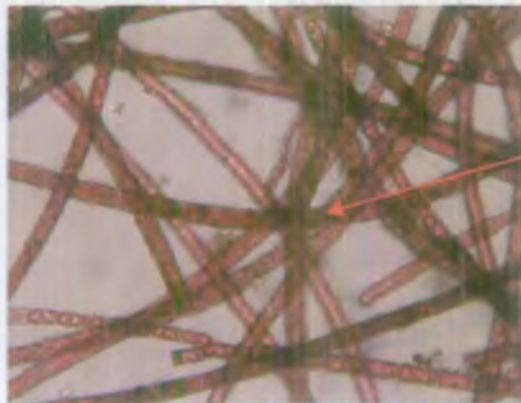
This species may be quite variable in form depending on habitat and season and size may range from 20-60cm long. Plant is fine and filiform but often quite cartilaginous with irregular branching extending from a more distinct main axis, often appearing quite tatty. Branching may be short, tufted and spine-like and often densely branched. It is reddish brown in colour and is found in shallow rockpools in the mid to lower littoral attaching by a discoid holdfast. May be found in sandy habitats due to its tolerance. Not to be confused with *Cystoclonium purpureum* which although morphologically similar has a claw-like basal attachment or with *Rhodomela lycopodiodes*.

Dense, short branching on *Rhodomela* and showing discoid attachment



Rhodothamniella floridula

This plant consists of uniseriate and microscopic, fine filaments made up of long slender cells. It is pink in colour and its branching tends to be quite limited but generally alternate or dichotomous. The main characteristic of this plant is its sand tolerance, it is a sand binding species and can produce vast carpets over sandy hard substrates. It is a mat forming species growing up to 2cm long and can be found in the mid to lower littoral and may also be located in non sandy environments such as overhangs, vertical rock and crevices in with other turf forming algae. It is similar to species of *Audouinella* and may be distinguished from *A. purpurea* by the presence of pyrenoids and lack of reticulate chloroplast resulting in a more sparse colouring of the cell.

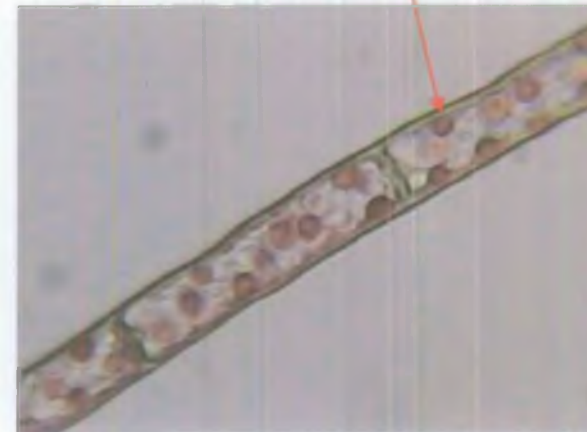


Long narrow filaments with limited branching



Forming a turf and trapping sand and silt on open rock surfaces

Showing distinct pyrenoids and sparse pink colouring of cells



Acknowledgments

By Emma Wells.

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