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The Fleet, and particularly its sublittoral region, is an unusual and important site for the algae. A total of some 150 species, belonging to the (green algae) Chlorophyceae, (brown algae) Phaeophyceae and (red algae) Rhodophyceae, have so far been recorded. The complete list is given in Whittaker (1978). Bacillariophyceae (diatoms) and Cyanophyceae (blue-green algae) are plentiful in the Fleet, but still need working out. Planktonic algae have been sampled by Dr D. Hibbard of The Culture Centre of Algae and Protozoa, Cambridge and a preliminary account of these has been given to the Fleet Study Group.

There is evidence in Batters (1902) that some of the rare species recorded in the last few years were already here at the end of last century. At that time Weymouth was a favourite collecting area as well as, or perhaps because it was, a popular holiday resort, as it is today. The filamentous green algae, Cladophora battersia and Cladophora retroflexa and the rare stonewort Lamprothamnion papillosum are species in this category.

There are two major regions of the Fleet to which the distribution of the algae can be related:

- I. The eastern end from Butterstreet Cove to Ferrybridge and Smallmouth (Figure 4). This is an area strongly affected by tides and with strongly saline water; at low tide, over much of the area, large expanses of sand and mud are exposed, crossed by channels.
- II. The western end from Butterstreet Cove to Abbotsbury. This is an area less affected by tides and with generally reduced salinity (Robinson *ibid*). There is a stretch of water some 1-1.5 m deep at low water of spring tides with an exposed margin which is usually very narrow.

#### I. The eastern Fleet

There is very little continuous solid substrate at all in the Fleet. What there is is mainly at the extreme eastern end and in the upper part of the shore, where it consists of retaining walls for the road, the bridge and occasional buildings. It carries a sparse zonation of algae such as can be found on the open shore and including the following species:

|   |                                   |                             |
|---|-----------------------------------|-----------------------------|
| + | <u>Prasiola stipitata</u>         | <u>Fucus spiralis</u>       |
|   | <u>Porphyra linearis</u> (winter) | <u>Fucus vesiculosus</u>    |
|   | <u>Blidingia marginata</u>        | <u>Ascophyllum nodosum</u>  |
|   | <u>Blidingia minima</u>           | <u>Polysiphonia lanosa</u>  |
|   | <u>Enteromorpha prolifera</u>     | <u>Cladophora rupestris</u> |

Lower down the shore there is an expanse of sand and mud with gravel and stones and a few small boulders large enough to carry Fucus vesiculosus and Fucus serratus. The smaller stones and sand not moved by the tide carry ephemeral populations of algae mostly belonging to the Chlorophyceae, included among which are the following:

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\* For positions of Fleet sites mentioned, see Figure 4A-D

+ Nomenclature of species as in Parke and Dixon 1976

Audouinella floridula  
Blidingia marginata  
Blidingia minima  
Enteromorpha intestinalis  
Enteromorpha prolifera

Percursaria percura  
Pilayella littoralis  
Rhizoclonium riparium  
Ulothrix flacca  
Urospora penicilliformis

The ephemeral algae disappear when the weather is hot and dry and reappear in the winter and when the air is moist.

The felt of filamentous green algae can be found right up to the salt marsh edge where it consists mainly of Enteromorpha prolifera (including E. torta), Percursaria percura and Rhizoclonium riparium.

At the western end of this section of the Fleet, the areas of mud are exposed at low tide for shorter periods than they are nearer to Ferrybridge and carry Zostera beds which have been, as yet, little studied for their algae. The sublittoral region here is represented by channels, up to 3 m deep, which cut through the exposed littoral region, the more continuous standing water of the Narrows and the final drainage channel which passes under Ferrybridge. The sublittoral in this part of the Fleet has high salinity water and is occupied by a range of larger algae attached to stones and also loose-lying. Such algae can move around with water movements and sometimes into sites where they can survive, but in which they might not initially have developed. The species occurring here, and some 55 species have so far been recorded, may have developed here or may have travelled in from the sea. They include:

Bolbocoleon piliferum  
Cladophora rupestris  
Codium fragile subsp. tomentosoides  
Phaeophila leptochaete  
Ulva lactuca

Acrothrix gracilis  
Asperococcus bullosus  
Asperococcus fistulosus  
Cladosiphon zosterae  
Cladostephus spongiosus  
Chorda filum  
Colpomenia peregrina  
Dictyota dichotoma  
Feldmannia irregularis  
Fucus serratus  
Laminaria saccharina  
Litosiphon pusillus  
Myrionema strangulans  
Punctaria latifolium  
Cystoseira foeniculacea

Calliblepharis ciliata  
Ceramium ciliatum  
Ceramium diaphanum/strictum  
Ceramium pedicellatum  
Ceramium rubrum  
Chondria dasyphylla  
Chondria tenuissima  
Chondrus crispus  
Chylocladia verticillata  
Cordylecladia erecta  
Cystoclonium purpureum  
Gracilaria bursa-pastoris  
Grateloupia filicina  
Grateloupia filicina var. luxurians  
Membranoptera alata  
Naccaria wiggii  
Phyllophora crispa  
Phyllophora palmettoides  
Plocamium cartilagineum  
Polysiphonia nigrescens  
Rhodophyllis divaricata  
Schottera nicaeensis  
Solieria chordata  
Sphondylothamnion multifidum  
Spyridia filamentosa

Though all of them can be found in the sublittoral region of the open sea, some of them are rare species. Grateloupia filicina var. luxurians and Solieria chordata were recorded in Britain for the first time quite recently, the former by Farnham and Irvine (1968) and the latter by Farnham and Jephson in Parke and Dixon (1976). They are known from only a very few south coast localities and nowhere else in Britain.

## II. The western basin of the Fleet

The sublittoral region of the western basin of the Fleet is an important habitat for algae. Interchange with the salt water of the sea is slow in this western basin and the freshwater streams running in are few and small.

The most obvious feature of the vegetation here is the extensive beds of Zostera involving Z. angustifolia and Z. nollii: for the distribution of the Zostera species see Whittaker (ibid). There are two algal systems associated with the Zostera beds, each with a seasonal cycle of occurrence.

The first cycle involves the leaves of Zostera plants which carry a variety of small algae as epiphytes and endophytes: some of the algae are characteristic of this environment, if not confined to it, and some are rare plants. The following are among the algae found on Zostera leaves:

Endoderma perforans  
Phaeophila viridis  
Ochlochaete ferox  
Ulvella lens

Cladisiphon zosterae  
Giraudia sphacelarioides  
Phaeostroma pustulatum  
Audouinella virgatulum  
Fosliella farinosa

The Zostera plants die down in the winter and the leaves are shed. We do not know at which stage in the growth of the Zostera leaves the algae appear; certainly they continue to grow after the leaves are shed and may contribute to their decay. This cycle needs investigation, particularly with reference to overwintering stages of the algae concerned.

The second cycle involves algae developing round the bases of the *Zostera* plants in the early part of the year. The dominant algae in this complex are:

Chaetomorpha linum  
Cladophora vagabunda  
Enteromorpha flexuosa

but the following algae occupy this habitat also, but in smaller quantity:

|                                    |                                |
|------------------------------------|--------------------------------|
| <u>Ceramium ciliatum</u>           | <u>Polysiphonia nigrescens</u> |
| <u>Ceramium diaphanum/strictum</u> | <u>Polysiphonia urceolata</u>  |
| <u>Ceramium rubrum</u>             |                                |
| <u>Calliblepharis ciliata</u>      | <u>Colpomenia peregrina</u>    |
| <u>Gracilaria verrucosa</u>        | <u>Striaria eattenuata</u>     |

The substratum is gravel, shells and stones over sand and mud. The water is shallow, only about 1 - 1.5 m at low water of spring tides, and in the bright summer sun, the water warms up; as a result the plants produce bubbles of gas which float the algal masses to the water surface. Such trailing masses have been called 'flannel-weed' by Whittaker (1978). The 'flannel'weed' becomes darkened in colour by blooms of associated blue-green algae and diatoms and the dark masses float around in the water and are washed up on the strand in huge quantities.

In some parts of the western Fleet, especially at Abbotsbury, Chaetomorpha linum forms shining masses as a single species: such masses have been called 'silk weed' by Whittaker (1978).

Another alga which forms large populations in this western end of the Fleet is Ulva lactuca. It is known that the growth of this alga is stimulated by levels of ammonia in the water of around  $0.7 \text{ mg l}^{-1}$ . At concentrations above this ammonia becomes toxic. (Waite & Gregory 1969, Waite & Mitchell 1972, Ho 1975). It was known at the beginning of the century that the growth is stimulated by pollution, both artificial and natural (Cotton 1910). There is a good deal of natural pollution in the form of organic matter from rotting vegetation and from bird droppings at the western end of the Fleet and this could be a stimulating agent for the growth of Ulva lactuca populations. The fact that large populations occur close to the shore, as e.g. at Berry Knapp, might suggest that drainage from adjacent farm land could also be assisting the growth. Such growths of Ulva, and other green weeds perhaps stimulated in the same way, could be detrimental to the survival of the Zostera beds here.\*

\* It should be realised that the suggested origins of elevated nitrogen levels are speculative. Ed.

The intertidal region of the western Fleet has yet to be studied in detail for its algae. Some parts which have been examined show the presence of species associated with somewhat brackish conditions:

Cladophora brownii  
Monostroma oxyspermum  
Pseudoclonium submarinum  
Ulothrix subflaccida

Cladophora brownii is known elsewhere at only one site in Cornwall and one in County Wicklow in Ireland. Hoek (1963) includes this species in Cladophora aegagropila. This latter species is known in Britain only from the Shetland Isles and from one or two sites in the north of Scotland, so that however the species is accepted, Cladophora brownii is a very rare plant.

While most of the algae occurring in the Fleet can be found elsewhere, quite a few are rare plants and the associations they form in the Fleet are unusual, especially those in the western basin. The whole of this basin on which many birds depend, could be a very sensitive area. There are a few signs that changes are taking place which may eventually affect the whole system and these need to be watched. In particular the chemical composition of the water needs surveillance.