

INTERTIDAL ECOLOGY OF PORT PHILLIP BAY WITH SYSTEMATIC LIST OF PLANTS AND ANIMALS

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Abstract

The zonation is recorded at 14 stations within Port Phillip Bay. Any special features of a station are discussed in relation to the adjacent stations and the whole Bay. The intertidal plants and animals are listed systematically with references, distribution within the Bay and relevant comment.

1. INTERTIDAL ECOLOGY

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Introduction

This account is basically concerned with the distribution of intertidal plants and animals of Port Phillip Bay. The benthic flora and fauna have been dealt with in separate papers (Memoir 27 and present volume).

Following preliminary investigations, 14 stations were selected for detailed study in such a way that all regions and all major geological formations were represented. These localities are listed below and are shown in Figure 1.

For ease of comparison with Womersley (1966), in his paper on the subtidal algae, the bay is divided into the same regions. All regions except Central Bay are included.

The dates given are the dates of the main investigation of the area, but all stations have been visited on several occasions.

**Northern Bay**—Areas 1-14

Area 6: Station 16 Williamstown, 28 Aug. 69

**Corio Bay**—Areas 15-18, 25-30, 37-40

Area 16: Station 23 Kirk Pt. 2 Feb. 69

Area 25: Station 19 North Corio Bay, 17 Sept. 69

Area 26: Station 2 Limeburners Ck. 17 Sept. 69

Area 27: Station 17 Pt Wilson, 2 Feb. 70

Area 29: Station 22 Portarlington, 16 Oct. 69

**South-western Bay**—Areas 42, 49, 50

Area 42: Station 21 St. Leonards 16 Oct. 69

Area 49: Station 4 Swan Bay Jetty, 17 Sept. 69

**Eastern Bay**—Areas 23-24, 35-36, 47-48, 55

Area 23, Station 20, Ricketts Pt., 30 Sept. 69

Area 55: Station 15 Schnapper Pt. 25 May 70

Area 55: Station 13 Fossil Beach 25 May 70

**Southern Bay**—Areas 60-64, 67-70

Area 63: Station 24 Martha Pt. 25 May 70

**Port Phillip Heads**—Areas 58-59

Area 58: Station 10 Queenscliff, 12 Mar. 69

Area 58: Station 5 Pt. Nepean, 15 Jan. 70

Stations or groups of stations are considered separately below. The basic zonation is outlined in a table which, unless otherwise stated, is that of open rock platform. The letters U, M or L after a species refer to its position within the zone indicated. The position shown for a particular species is the level of maximum development and individuals of this species may be found well above and/or below this. Seasonal fluctuations in abundance occur for many algae and in some cases this has been noted.

**Northern Bay**

Area 6 (S16) Williamstown (Foreshore off Gloucester Reserve) 28 August 69

Area 6 (S16A) Williamstown (0.25 mi E. of 16).

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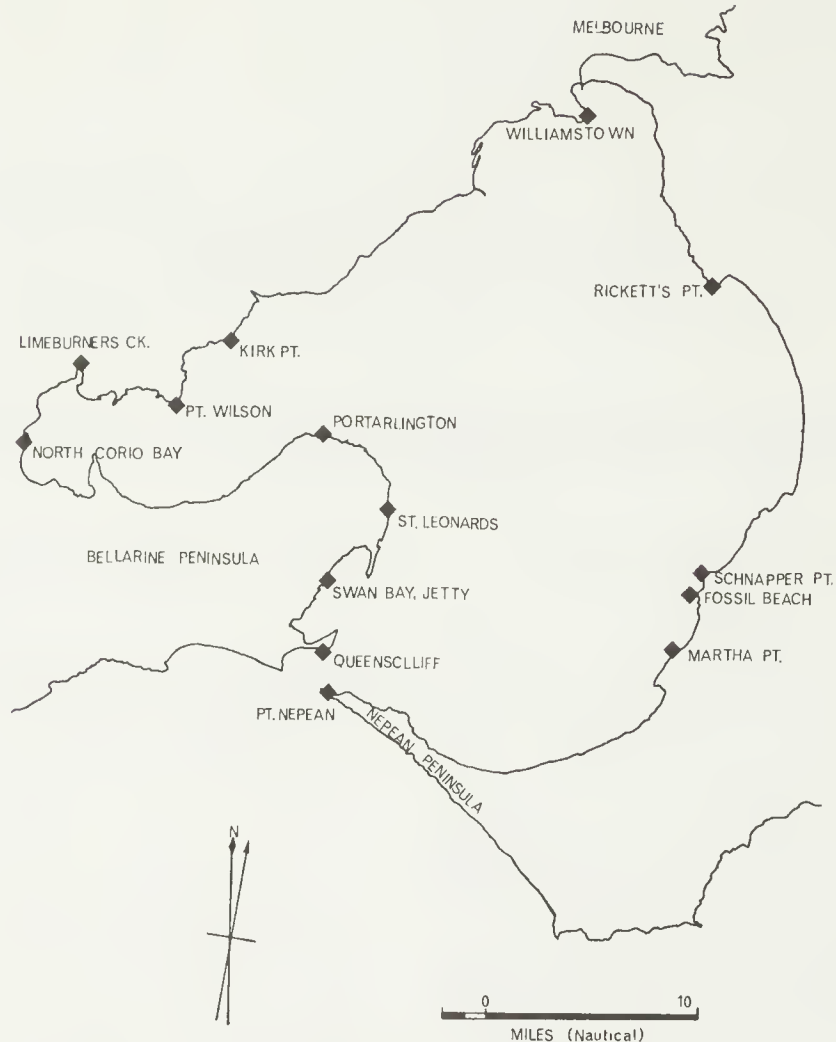


FIG. 1—Map of localities.

### Geology and Geomorphology

The whole of the foreshore has been altered by man and there is a sea wall along the back of the beach. Basalt boulders have been built up along the sea front and an artificial breakwater, also of basalt, has been built normal to the sea wall approximately half way along the reserve frontage. At station 16A there is a natural rock platform developed on Pleistocene basalt.

### Flora and Fauna

The basic pattern of zonation is shown in Table 1. The following species were not re-

corded even though a special search was made for them: *Austrocochlea constricta*, *Bembicium* and *Melarapha praetermissa*. The animals are mostly on steep rock faces e.g. *Galeolaria caespitosa* and *Mytilus planulatus*, or in crevices e.g. *Heliocidaris erythrogramma*, *Actinea tenebrosa*, *Pateriella calcar*, the orange sponge *Tethys australis*, and numerous small anemones. The algae are commonly on horizontal rock surfaces. Pools at station 16A contained the following algae: *Enteromorpha*, *Ulva lactuca*, *Corallina officinalis*, *Grateloupia filicina* and *Lithothamnion*. The brown algae *Caulocystis cephalornithos*, *Cystophora polycystidea*,

TABLE 1. NORTHERN BAY REGION, Williamstown (S 16, 16A)

ZONE	PLANTS	ANIMALS
LITTORAL FRINGE	<i>Salicornia quinqueflora</i> <sup>2</sup> <i>Bangia fuscopurpurea</i> <sup>1</sup> L	<i>Melarapha unifasciata</i> L (in crevices and small holes)
UPPER EULITTORAL	<i>Enteromorpha</i> M	<i>Siphonaria diemenensis</i> M <i>Cellana tramoserica</i> M <i>Austrocochlea adelaidae</i> <sup>3</sup> <i>A. odontis</i> <sup>3</sup> <i>Patelloida alticostata</i>
MID- EULITTORAL	<i>Porphyra</i> <sup>1</sup> U <i>Enteromorpha intestinalis</i> U <i>Ulva lactuca</i> <sup>1</sup> U <i>Gelidium pusillum</i> L	<i>Poneroplax costata</i> <i>Mytilus planulatus</i> L
LOWER EULITTORAL	<i>Hormosira banksii</i> <sup>2</sup> U <i>Centroceras clavulatum</i> U <i>Polysiphonia</i> <sup>1</sup> <i>Ulva lactuca</i> M <i>Caulerpa brownii</i> L	<i>Galeolaria caespitosa</i> U <i>Actinia tenebrosa</i> U <i>Pateriella calcar</i> <sup>3</sup>
UPPER SUB- LITTORAL	<i>C. geminata</i> <i>C. longifolia</i> f. <i>crispata</i> <i>C. remotifolia</i> <i>C. simpliciuscula</i> <i>Corallina officinalis</i> <i>Ecklonia radiata</i> <i>Lithothamnion</i> <i>Sargassum</i> spp.	U = Upper } part M = Middle } of L = Lower } zone <sup>1</sup> = Seasonally abundant <sup>2</sup> = On natural platform only (S.16A) <sup>3</sup> = In pools

*C. retorta*, *Colpomenia sinuosa*, *Sargassum* sp. and *Scytosiphon lomentaria*, were less abundant, and heavily covered with epiphytic colonial diatoms. *Zostera muelleri* occurs in shallow sandy pools and was also heavily epiphytized.

### Corio Bay (A)

Area 16 (S23) Kirk Point 2 February, 1970

Area 27 (S17) Point Wilson 2 February, 1970.

### Geology and Geomorphology

These two stations are representative of a number of isolated and small outcrops of Pleistocene basalt on the W. margin of the Bay. The outcrops form boulder beaches limited by sandy beach in the upper regions, and by sandy-clay sediments just below low tide level.

### Flora and Fauna

The outcrops are backed by a sandy beach with a high percentage of shell remains. This is

fringed on the landward side by *Atriplex cinerea* and behind this is a marsh area with *Salicornia quinqueflora* and *Arthrocnemum halocnemoides* as the most common species. Table 2 shows the basic zonation at these stations. The pattern is substantially modified by conditions of local shelter. The strong development of the algae *Centroceras clavulatum*, *Grateloupia filicina* var. *luxurians*, *Rhabdonia robusta*, *Rhodoglossum* and the excessive growth of *Ulva lactuca* probably indicates nutrient enrichment from the adjacent Melbourne and Metropolitan Board of Works sewerage farm. The same algal representatives occur together near a waste outfall pipe at Portarlington, Area 29 (S22).

Only those animals capable of withstanding the sheltered conditions and the sandy-clay substrate are present. On the rocky outcrops *Bembicum auratum* occurs in the upper eulittoral, grading into *Austrocochlea constricta* above the *Mytilus planulatus*-*Galeolaria caespitosa* band. On the *Galeolaria* and below it *Cominella*

TABLE 2. CORIO BAY REGION (A) Point Wilson and Kirk Point (S17, 23)

ZONE	PLANTS	ANIMALS
LITTORAL FRINGE		
UPPER EULITTORAL		<i>Bembicium auratum</i> U <i>Austrocochlea constricta</i> M
MID- EULITTORAL	<i>Ulva lactuca</i> U <i>Enteromorpha</i> U <i>Gelidium pusillum</i> L	<i>Mytilus planulatus</i> L
LOWER EULITTORAL	<i>Polysiphonia</i> <sup>1</sup> <i>Centroceras clavulatum</i> <i>Grateloupia filicina</i> <sup>1</sup> M <i>Caulerpa brownii</i> L	<i>Galeolaria caespitosa</i> U <i>Cominella eburnea</i> L <i>Cominella lineolata</i> L <i>Pyura praeputialis</i> L
UPPER SUB- LITTORAL	<i>Caulerpa remotifolia</i> U <i>C. longifolia</i> f. <i>crispata</i> U <i>Rhodoglossum</i> U	U = Upper } part M = Middle } of L = Lower } zone <sup>1</sup> = Seasonally abundant

*eburnea* and *C. lineolata* are common, while below this at low tide level scattered *Pyura praeputialis* are found. On sandy patches between the rocks the large speckled anemone *Oulactis muscosa* is common, as are the molluscs *Katelysia rhytophora* and *Parcanassa pauperata*. *Anadara trapezia* which was taken in numbers in Corio Bay region by the benthic survey is found to extend into the upper sublittoral and lower eulittoral zones on the sandy beaches to the north of Point Wilson and Kirk Point. They occur in large clumps of dead and living shells many clumps having up to a dozen live shells in them.

To the SE. of Point Wilson there are large beds of *Zostera*, with *Ulva lactuca* and *Caulerpa* species occurring on isolated rocks. On the sheltered inner margin of these beds *Acetabularia peniculus* is found growing on dead *Katelysia scalarina* shells.

### Corio Bay (B)

Area 25 (S19) Corio Bay North 17 September, 1969.

#### Geology and Geomorphology

The shoreline is in Tertiary limestone, marls and sands. These have eroded to form low cliffs approximately 20 ft. high with a narrow boulder beach derived from the bedrock. The cliff breaks away in large blocks up to six ft. across, which are broken down and sorted by the sea.

#### Flora and Fauna

The numerous boulders afford protection for the intertidal animals and although the environment has a limited fauna in species, the number of individuals is large. The general distribution of species is shown in Table 3. There are no *Melarapha* although large boulders at the base of the cliff should provide a suitable habitat. Under stones in the mid- and lower eulittoral are *Cominella lineolata* and *Paragrapsus gaimardii*; also occasionally *Lepsiella vinosa*, *Vela cumantus australis*, *Pateriella brevispina*, and *Tosia australis* are found. *Anadara trapezia* is present in small numbers. Algae growing in the lower eulittoral and upper sublittoral zones are covered with epiphytic diatoms.

### Corio Bay (C)

Area 29 (S22) Portarlington 16 October, 1969.

#### Geology and Geomorphology

The bedrock is lower Tertiary basalt and there is a small, almost horizontal, wave cut platform (Jutson 1931). The platform lies in the mid- and lower-eulittoral, and there is a sharp drop into the sub-littoral.

#### Flora and Fauna

The general pattern of zonation is shown in Table 4. In sandy patches in the upper sublittoral *Zostera muelleri* occurs heavily epiphytized by *Ulva lactuca* and *Punctaria latifolia* with some *Acrosorium uncinatum*. Near the

drain outlet at the W. end of the reef *Centroceras clavulatum*, *Grateloupia filicina* var. *luxurians*, *Rhabdonia robusta* and *Rhodoglossum* occur with the increased growth of *Ulva*

*lactuca* c.f. Kirk Point and Point Wilson. Many of the larger brown algae in the upper sublittoral zone are covered by Ectocarpaceae and colonial diatoms.

TABLE 3. CORIO BAY REGION (B), Corio Bay North (S19)

ZONE	PLANTS	ANIMALS
UPPER EULITTORAL	<i>Enteromorpha</i> L	
MID-EULITTORAL	<i>Ulva lactuca</i> M <i>Enteromorpha</i> M <i>Porphyra</i> <i>Caloglossa leprieurii</i> M <i>Gelidium pusillum</i> M	<i>Bembicium auratum</i> U <i>Austrocochlea constricta</i> M <i>Notoacmea septiformis</i> L <i>Chthamalus antennatus</i> L <i>Mytilus planulatus</i> L
LOWER EULITTORAL	<i>Chaetomorpha darwinii</i> U <i>Codium fragile</i> M <i>Petalonia fascia</i> M <i>Scytosiphon lomentaria</i> M	<i>Galeolaria caespitosa</i> U
UPPER SUB-LITTORAL	<i>Caulerpa remotifolia</i> <i>C. simpliciuscula</i> <i>Sargassum</i> <i>Zostera muelleri</i> <sup>1</sup>	<i>Andara trapezia</i> <sup>1</sup> L U = Upper } part M = Middle } of L = Lower } zone <sup>1</sup> = Sandy patches between boulders.

TABLE 4. CORIO BAY REGION (C), Portarlington (S22)

ZONE	PLANTS	ANIMALS
SUPRA-LITTORAL	<i>Bangia fuscopurpurea</i> <sup>1</sup> L	
UPPER EULITTORAL	<i>Enteromorpha</i> M	<i>Bembicium melanostomum</i> U <i>B. nanum</i> (rare) <i>Austrocochlea constricta</i> M
MID-EULITTORAL	<i>Porphyra</i> <sup>1</sup> M <i>Enteromorpha intestinalis</i> M	<i>Chthamalus antennatus</i> U (on pipeline base) <i>Siphonaria diemenensis</i> M <i>Patelloida alticostata</i> M <i>Notoacmea septiformis</i> M <i>Mytilus planulatus</i> L
LOWER EULITTORAL	<i>Hormosira banksii</i> U <i>Centroceras clavulatum</i> M <i>Ulva lactuca</i> M <i>Chaetomorpha aerea</i> <sup>2</sup> M <i>Corallina officinalis</i> M	<i>Galeolaria caespitosa</i> U <i>Montfortula rugosa</i> U <i>Lepsiella vinosa</i> U
UPPER SUB-LITTORAL	<i>Grateloupia filicina</i> <sup>2</sup> U <i>Rhodoglossum</i> <sup>2</sup> U <i>Caulerpa remotifolia</i> M <i>C. simpliciuscula</i> M <i>Caulocystis cephalornithos</i> M <i>Cystophora polycystidea</i> <i>Ecklonia radiata</i> <i>Sargassum</i> spp.	U = Upper } part M = Middle } of L = Lower } zone <sup>1</sup> = Seasonally abundant <sup>2</sup> = Abundant near pipe outlet

### South-Western Bay

Area 42 (S21) St. Leonards 16 October, 1969.

#### Geology and Geomorphology

The bedrock is Pliocene ferruginous sandstone, which forms a narrow platform just above low tide mark.

#### Flora and Fauna

The platform lies offshore, and behind this are beds of *Zostera muelleri*, and then a band of shingle between the *Zostera* and the sandy beach. At about mid-tide level the shingles are covered with *Enteromorpha intestinalis*, and at lower levels with *Laurencia*, *Ceramium* and *Polysiphonia*. Occasionally *Caulocystis uvifera* occurs on large rocks. *Acetabularia peniculus* is recorded on dead shells of *Katelysia scalarina*. The *Zostera* beds are dense, and appeared to be accumulating sediments, being some 6-12 in higher than surrounding bare areas. The *Zostera* is covered with epiphytes: *Enteromorpha*, *Ulva lactuca*, *Champia affinis*, and less commonly with *Acrosorium uncinatum* and *Polysiphonia*.

The fauna of the *Zostera* beds includes *Actinia australis*, *Cnidopus veratra*, *Philyra*

*laevis*, *Katelysia scalarina*, *Austrocochlea constricta* (small) *Cominella lineolata* and *Parcanassa pauperata*.

The platform lies in the lower eulittoral and below, and the distribution of species is summarized in Table 5. Along the W. coastline the change from open coast species to the more typical bay species is quite abrupt, Figure 2, and this corresponds with a marked change in substrate and degree of wave action.

### Eastern Bay (A)

Area 23 (S20). Ricketts Point. 30 September 1969.

#### Geology and Geomorphology

Ricketts Point consists of lateritized Tertiary marine sediments, the ironstone point forming an intertidal platform. On the higher parts, coarse gravel to sand are present.

#### Flora and Fauna

The basic zonation pattern is shown in Table 6. It should be noted that:

1. The littoral fringe is almost bare. There are no rock stacks, and no *Melarapha*.
2. The demarcation between the lower eulittoral and the upper sublittoral is not particularly clear.

TABLE 5. SOUTH-WESTERN BAY REGION, St. Leonards (S21)

ZONE	PLANTS	ANIMALS
LITTORAL FRINGE		
UPPER EULITTORAL		<i>Austrocochlea constricta</i> L (on inshore pebbles)
MID-EULITTORAL	<i>Enteromorpha intestinalis</i> L	
LOWER EULITTORAL	<i>Hormosira banksii</i> U <i>Ulva lactuca</i> U <i>Laurencia</i> M <i>Caulerpa brownii</i> L	<i>Austrocochlea odontis</i> <i>Cominella lineolata</i>
UPPER SUB-LITTORAL	<i>Caulerpa remotifolia</i> U <i>Cystophora retorta</i> U <i>C. subfarcinata</i> <i>Caulocystis cephalornithos</i> <sup>1</sup> <i>C. uvifera</i> <i>Sargassum decipiens</i>	<i>Halicarcinus rostratus</i> U = Upper } part M = Middle } of L = Lower } zone <sup>1</sup> = Local Shelter <sup>2</sup> = Amongst algae

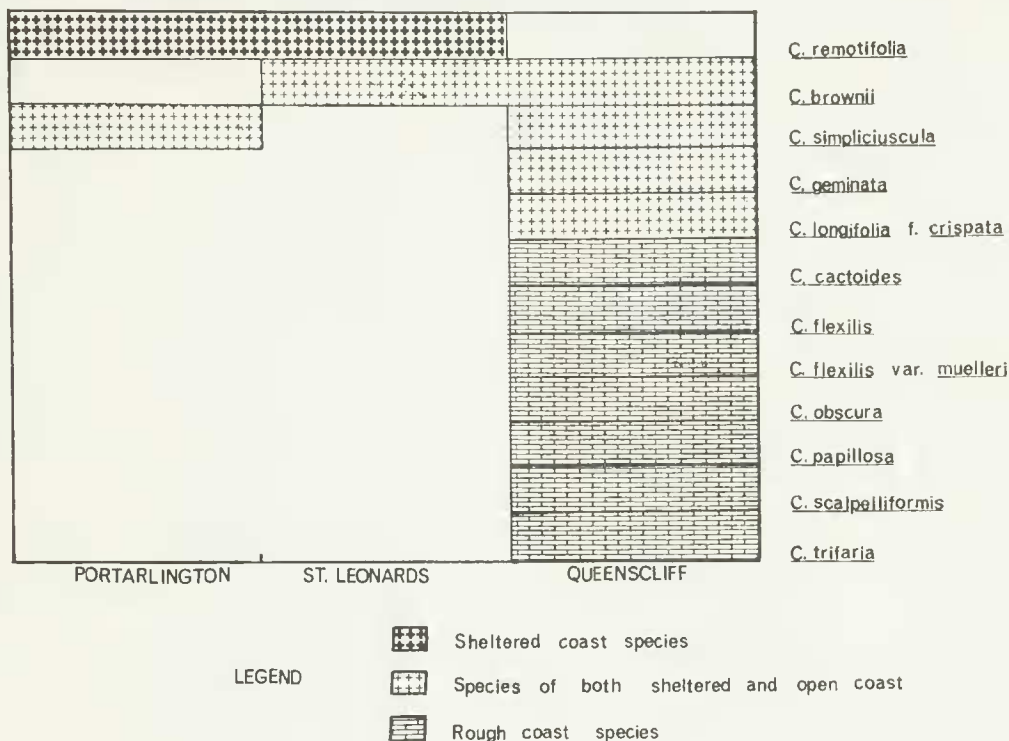


FIG. 2.—Distribution of *Caulerpa* spp. on the W. coast of Port Phillip.

3. Where *Ibla* occurs, it forms colonies adjacent to *Galeolaria*; it does not shelter amongst the worm tubes as on open coast.
4. In the upper sublittoral the Fucales *Caulocystis cephalornithos*, *Cystophora moniliformis*, *C. retorta*, *C. subfarcinata* and *Sargassum* occur only as isolated plants, never in a dense band. They are frequently covered with Ectocarpaceae and colonial diatoms.

In shallow pools in the mid-eulittoral *Ulva lactuca*, *Corallina officinalis*, *Lithothamnion* and *Austrocochlea constricta* are common. In pools at lower levels *Corallina officinalis* and *Lithothamnion* are dominant with *Chaetomorpha aerea*, Ectocarpaceae, *Polysiphonia*, colonial diatoms, the molluscs *Notoacmea petterdi*, *Montfortula rugosa* and the crab *Paragrapsus gaimardii*. Pools towards the outer edge contain *Ischnoradsia evanida*. In pools in the lower eulittoral *Austrocochlea odontis*, *Cominella lineolata*, *Subninella undulata*, *Poneroplax cos-*

*tata* and *Pateriella calcar* are common. *Cnidopus veratra* occurs at all levels.

In sandy patches between the tongues of the platform *Zostera muelleri* occurs with epiphytic *Cladophora* and *Punctaria latifolia* or *Ulva lactuca* and *Porphyra* at slightly higher levels. The associated animals in these areas are the anemone *Cnidopus veratra*, and molluscs *Austrocochlea odontis* with a few *Austrocochlea constricta* and *Parcanassa pauperata*. No bivalves are recorded.

In sandy pools on the inner part of the platform there are scattered plants of *Ulva lactuca*, the molluscs *Zeacumantus diemenensis*, *Parcanassa pauperata* and a few *Austrocochlea constricta*.

The beach N. of Ricketts Point is of very fine sand in which the dominant species is *Donacilla angusta*. There are scattered holes probably of soldier crabs, *Mictyris platycheles*. A freshwater drain on the E. edge has a dense population of *Salinator fragilis*.

TABLE 6. EASTERN BAY REGION (A), Ricketts Point (S20)

ZONE	PLANTS	ANIMALS
LITTORAL FRINGE	<i>Salicornia quinqueflora</i> U (occasional in small patches of ironstone gravel and sand)	
UPPER EULITTORAL	<i>Enteromorpha</i> <sup>1</sup> M	<i>Bembicium auratum</i> U (very abundant) <i>Cominella lineolata</i> L <i>Austrocochlea constricta</i> L
MID-EULITTORAL	<i>Porphyra</i> <sup>1</sup> M <i>Ulva lactuca</i> <sup>1</sup> M <i>Gelidium pusillum</i> L	<i>Cellana tramoserica</i> M <i>Patelloida alticostata</i> M <i>Mytilus planulatus</i> <sup>3, 4</sup> L
LOWER EULITTORAL	<i>Hormosira banksii</i> U <i>Laurencia</i> <sup>4</sup> L <i>Corallina officinalis</i> <sup>2</sup> L <i>Caulerpa brownii</i> <sup>4</sup> L	<i>Galeolaria caespitosa</i> U <i>Ibla quadrivalvis</i> <sup>2</sup> U <i>Lepsiella vinosa</i> U <i>Subnina undulata</i> L
UPPER SUB-LITTORAL	<i>Codium fragile</i> <sup>3</sup> U <i>Ulva lactuca</i> <sup>2, 3</sup> <i>Caulocystis cephalornithos</i> <sup>3, 4</sup> <i>Cystophora moniliformis</i> <sup>3, 4</sup> <i>C. retorta</i> <sup>4</sup> <i>C. subfarinata</i> <sup>4</sup> <i>Dictyota dichotoma</i> <sup>2</sup> <i>Sargassum</i> <sup>3, 4</sup> <i>Scytosiphon lomentaria</i> <sup>1, 2</sup> <i>Polysiphonia</i> <sup>3</sup> <i>Porphyra</i> <sup>1, 3</sup>	<i>Patierella brevispina</i> <sup>2</sup> <i>Coscinasterias calamaria</i> <sup>2</sup> U = Upper } part M = Middle } of L = Lower } zone 1 = Seasonally abundant 2 = West side the platform 3 = South of platform 4 = East of platform

**Eastern Bay (B)**

Area 55 (S15) Mornington (Schnapper Point) 25 May, 1970.

Area 55 (S13) Mornington (Fossil Beach) 25 May, 1970.

*Geology and Geomorphology*

Schnapper Point is a resistant headland of Pliocene laterite. Below the cliff there is only slight platform development, and most of the intertidal area is composed of isolated boulders. At Fossil Beach, which is approximately two miles S. of Schnapper Point, laterite is underlain by Miocene marine siltstone which forms the intertidal zone.

*Flora and Fauna*

The basic zonation is shown in Table 7. *Hormosira banksii*, which is characteristic of the lower eulittoral zone throughout the bay, is not recorded. This appears to be due to lack of suitable substrate. The general discussion of this area is included with that of Martha Point Area 63 (S24).

**Southern Bay**

Area 63 (S24) Martha Point 25 May 1970.

*Geology and Geomorphology*

The bedrock is upper Palaeozoic granodiorite with well-developed intertidal platforms (Jutson 1940).

*Flora and Fauna*

The zonation is summarized in Table 8. It is basically similar to that at the Mornington Stations (Eastern bay (B)) but the following important differences occur:

1. The presence of *Lichina confinis* in the spray zone and in the upper eulittoral. This is indicative of an increase in the amount of wave action.
2. *Rivularia firma* was found in the mid-eulittoral. This species is otherwise recorded only for the two stations at the Heads.
3. *Hormosira banksii* in the uppermost part of the lower eulittoral.



TABLE 7. EASTERN BAY REGION (B), Mornington, Schnapper Point and Fossil Beach (S15, 13)

ZONE	PLANTS	ANIMALS
LITTORAL FRINGE		<i>Melarapha unifasciata</i> <i>Melarapha praetermissa</i>
UPPER EULITTORAL		<i>Bembicium auratum</i> <sup>1</sup> U <i>Bembicium nanum</i> U <i>Austrocochlea concamerata</i> <sup>1</sup> U <i>Patelloida latistrigata</i> <sup>1</sup> M <i>Clamaesiphio columna</i> L
MID- EULITTORAL	<i>Ulva lactuca</i> M	<i>Austrocochlea constricta</i> M <i>Cellana tramoserica</i> M <i>Siphonaria diemenensis</i> M <i>Actinia tenebrosa</i> <i>Galeolaria caespitosa</i> L
LOWER EULITTORAL	<i>Ulva lactuca</i> U <i>Corallina officinalis</i> M <i>Lithothamnion</i> <i>Laurencia</i> <sup>2</sup> <i>Caulerpa brownii</i> L <i>C. flexilis</i> <sup>3</sup> L	<i>Mytilus planulatus</i> U <i>Patelloida alticostata</i> U <i>Poneroplax costata</i> M <i>Subnina undulata</i> L
UPPER SUB- LITTORAL	<i>C. geminata</i> <i>C. scalpelliformis</i> <sup>3</sup> <i>C. remotifolia</i> <sup>2</sup> <i>C. simpliciuscula</i> <i>Amphiroa beauvoisii</i> <i>Ecklonia radiata</i> <i>Caulocystis uvifera</i> <i>Cystophora moniliformis</i> <sup>3</sup> <i>C. retorta</i> <sup>3</sup> <i>C. subfarcinata</i> <sup>3</sup> <i>C. torulosa</i> <sup>3</sup>	<i>Notohalotis ruber</i> U U = Upper } part M = Middle } of L = Lower } zone <sup>1</sup> = Local shelter <sup>2</sup> = Schnapper Point only <sup>3</sup> = Fossil Beach only

- Ecklonia radiata* occurs only with local shelter (as at the Heads region) and not generally in the upper sublittoral as it does throughout the more sheltered parts of the bay.
- Bembicium nanum* has completely replaced the bay species *B. auratum*. At Schnapper Point both species are present but *B. nanum* only occurs at the outer edge of the S. end of the platform.
- Mytilus planulatus* only occurs in sheltered positions.
- Ibla quadrivalvis* is abundant in crevices, and in the shelter of *Galeolaria* as on open coast.

If we consider all the stations on the E. coastline of the Bay, then Fossil Beach and

Martha Point can be regarded as transitional between the rough open coast at the Heads and the more typical inner bay region. The following species are not listed for the bay proper but are found at the transition stations and the Heads; the lichen *Lichina confinis*, the algae *Rivularia firma*, *Caulerpa flexilis*, *C. scalpelliformis* and *Cystophora torulosa*, and the mollusc *Bembicium nanum*.

Figure 3 indicates the occurrence of *Caulerpa* species on the E. coastline. *Caulerpa remotifolia* is the only *Caulerpa* that can be regarded as a truly calm water species, and this is completely replaced ecologically by *Caulerpa scalpelliformis* at Fossil Beach. By comparison the change on the W. coast is abrupt (Fig. 2).

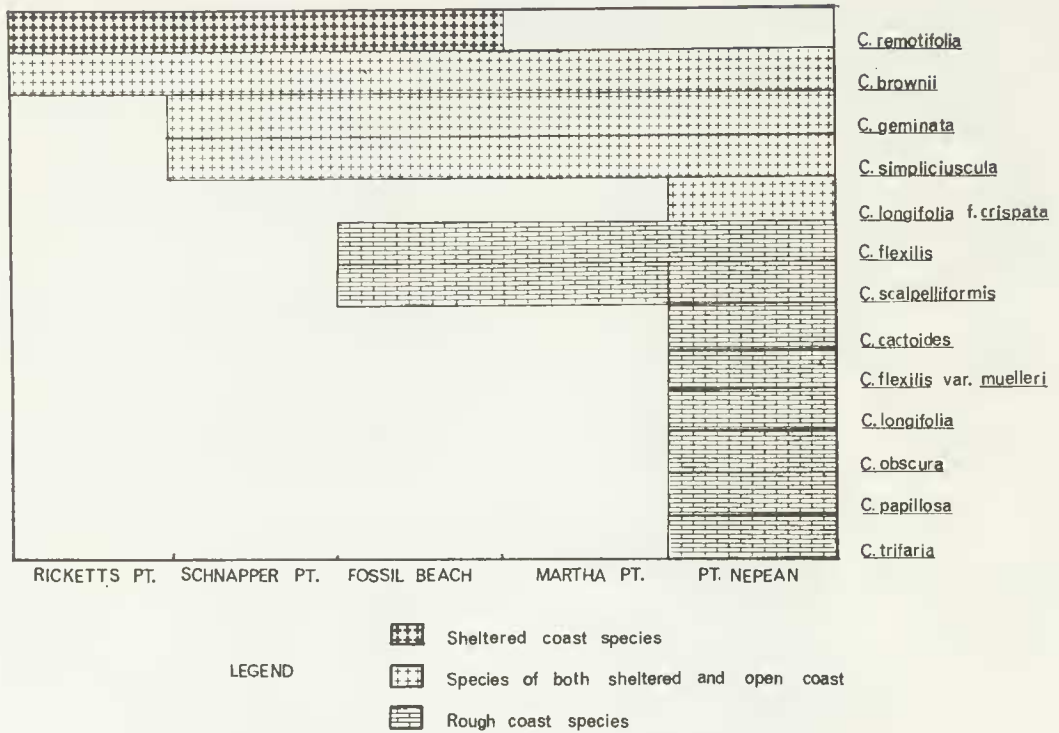
FIG. 3.—Distribution of *Caulerpa* spp. on the E. coast of Port Phillip.

TABLE 8. SOUTHERN BAY REGION, Martha Point (S24)

ZONE	PLANTS	ANIMALS
LITTORAL FRINGE	<i>Lichina confinis</i>	<i>Melarapha unifasciata</i> <i>Melarapha praetermissa</i> <i>Melarapha paludinella</i>
UPPER EULITTORAL	<i>Chaetomorpha aerea</i> (Shallow pools) <i>Gracilaria verrucosa</i> (Shallow pools)	<i>Bembicium nanum</i> U <i>Melanerita melanotragus</i> <sup>1</sup> U <i>Austrocochlea concamerata</i> <sup>1</sup> U <i>Austrocochlea constricta</i> L
MID-EULITTORAL	<i>Enteromorpha</i> <i>Ulva lactuca</i> M <i>Rivularia firma</i> M	<i>Chamaesipho columna</i> M <i>Cellana tramoserica</i> U <i>Siphonaria diemenensis</i> <i>Ibla quadrivalvis</i> <sup>1</sup> <i>Mytilus planulatus</i> <sup>1</sup> <i>Galeolaria caespitosa</i>
LOWER EULITTORAL	<i>Hormosira banksii</i> U <i>Caulerpa brownii</i> L	<i>Patelloida alticostata</i> U <i>Poneroplax costata</i> M <i>Subnina undulata</i> L
UPPER SUB-LITTORAL	<i>C. geminata</i> <i>C. scalpelliformis</i> <i>C. simpliciuscula</i> <i>Ecklonia radiata</i> <sup>1</sup> <i>Cystophora moniliformis</i> <i>C. reitoria</i> <i>C. subfarcinata</i> <i>C. torulosa</i>	<i>Notohalotis ruber</i> U U = Upper } part M = Middle } of L = Lower } zone <sup>1</sup> = Local shelter

### Port Phillip Heads

Area 58 (S5). Pt. Nepean. 15 January 1970.  
Area 58 (S10). Queenscliff. 12 March 1969.

#### Geology and Geomorphology

The country rock is Pleistocene calcareous aeolianite which forms low cliffs and is eroded into broad shore platforms broken by channels (Bowler 1966). Bird (1964) believes that the platforms have been shaped partly by wave abrasion and partly by solution. At Pt. Nepean the platforms extend over 400 ft seawards with a fall of less than two feet, and then drop off abruptly. The upper zones are represented on only a few isolated outcrops since the platform is for the most part covered by sand on the inner margin.

#### Flora and Fauna

Wave action at the Heads is at a maximum for Port Phillip and appears to be equivalent to 'moderate exposure' of Bennett and Pope (1960).

The flora and fauna on the surface of the platform is fairly typical of much of the central Victorian coast. The pattern for Pt. Nepean is shown in Table 9. A similar pattern occurs at Queenscliff, but with a reduction in the intensity of wind and wave action the sub-littoral fringe virtually disappears. A variety of habitats is provided in the pools and channels, and beneath overhanging rock ledges. This development is marked on the aeolianite, but is not found elsewhere in the bay. Of the 68 species of algae recorded for the Heads region, and not recorded at any other localities, 38 (56%) are restricted to rock pools. Some species, e.g. *Ecklonia radiata*, common in the upper sub-littoral within the bay occur only in pools or with extreme local shelter at the Heads.

Many of the species present are characteristic of rough coasts, e.g. *Apjohnia laetevirens*, *Dicetyosphaeria sericea*, *Caulerpa cactoides*, *C. cliftoni*, *C. flexilis*, *C. obscura*, *C. scalpelliformis*, *Codium galeatum*, *C. pomoides*, *Cystophora siliquosa*, *Durvillea potatorum*, *Macrocytis angustifolia*, *Padina fraseri*, *Petrospongium rugosum*, *Phyllospora comosa*, *Splachnidium rugosum*, *Xiphophora chondrophylla*, *Ballia callitricha*, *B. scoparia*, *Gelidium australe*,

*G. glandulaefolium*, *Laurencia elata*, *Pterocladia capillacea*. *Amphibolis antarctica* is found in pools where sand covers a rocky substrate. *Zostera* is restricted to sheltered sandy pools. *Cladophora rugulosa* is common at Pt. Nepean in shallow mid-eulittoral pools. *Lenormandia prolifera* is characteristic of sandy pools and channels in the lower eulittoral and below.

Like the algae, the fauna of the heads region is more typical of the open coast than the remainder of the bay. *Austrocochlea concamerata* and *Melanerita melanotragus* colonize sheltered areas of the upper eulittoral such as crevices and overhangs. Below this there are *Modiolus pulex* and *Brachidontes rostratus* in patches but they do not form the extensive sheets of many open coasts. *Pyura praeputialis* occurs in the lower eulittoral but in crevices reaches higher levels.

#### Extreme Shelter

Area 26 (S2). Limeburners Bay. 17 September 1969.

Area 49 (S4). Swan Bay Jetty. 17 September 1969.

These two stations represent extreme shelter within Port Phillip and are therefore considered together. The station at Swan Bay Jetty is described in detail.

#### Geology and Geomorphology

The country rock comprises sands, clays, limestone and lignites. The shore is fringed with calcareous sands and dune limestone; the coastal elevation is only a few feet above sea-level in some areas. The floor is a sandy clay derived from these sediments, with a high percentage of shell remains. Around the margin of the Bay there is accumulation of dead and decaying plant material, particularly of *Zostera*, and  $H_2S$  is formed.

Swan Bay is protected on its E. margin from the main area of the bay by Swan Island, Duck Island and Edwards Point, which runs S. from the E. shore of the Bellarine Peninsula.

#### Flora and Fauna

On the W. shore the bay is bordered by a well-developed salt marsh with *Arthrocnemum halocnemoides*, *Salicornia quinqueflora*, and

TABLE 9. PORT PHILLIP HEADS REGION, Point Nepean (S5)

ZONE	PLANTS	ANIMALS
LITTORAL FRINGE	<i>Lichina confinis</i>	<i>Melarapha unifasciata</i> <i>Melarapha praetermissa</i> <i>Melarapha paludinella</i>
UPPER EULITTORAL	<i>Bangia fuscopurpurea</i> <sup>1</sup>	<i>Bembicium nanum</i> U <i>Melanerita melanotragus</i> <sup>2</sup> <i>Austrocochlea concamerata</i> <sup>2</sup> <i>Chamaesipho columna</i> M <i>Modiolus pulex</i> <sup>2</sup> M <i>Clithamalus antennatus</i> <i>Siphonaria diemenensis</i> L <i>Austrocochlea constricta</i> L <i>Brachidontes rostratus</i> L
MID-EULITTORAL	<i>Bryopsis</i> <sup>1</sup> <i>Enteromorpha</i> <sup>1</sup> U <i>Porphyra</i> <sup>1</sup> U <i>Rivularia</i> M <i>Petrospongium rugosum</i> <sup>1</sup> L <i>Splachnidium rugosum</i> <sup>1</sup> L <i>Ulva lactuca</i> <sup>1</sup>	<i>Patelloida latistrigata</i> U <i>Cominella lineolata</i> U <i>Cellana tramoserica</i> M <i>Patelloida alticostata</i> L <i>Galeolaria caespitosa</i> <sup>2</sup> L <i>Actinia tenebrosa</i> <sup>2</sup> L
LOWER EULITTORAL	<i>Corallina officinalis</i> <i>Hormosira banksii</i> U <i>Gelidium pusillum</i> U <i>Ulva lactuca</i> <i>Caulerpa brownii</i> L <i>Cladostephus verticillatus</i> <sup>1, 3</sup> <i>Cystophora torulosa</i> L <i>Laurencia heteroclada</i> L <i>Padina fraseri</i> L	<i>Pyura praeputialis</i> <sup>2</sup> <i>Poneroplax albida</i> <i>Poneroplax costata</i>
SUB-LITTORAL FRINGE	<i>Durvillea potatorum</i> <i>Ballia scoparia</i> <i>Chaetomorpha darwinii</i> <i>Halopteris gracilescens</i> <i>Lithothamnion</i> <i>Xiphophora chondrophylla</i>	<i>Dicathais textilosa</i> <i>Notohalotis ruber</i> <i>Scutus antipodes</i>
UPPER SUB-LITTORAL	<i>Ecklonia radiata</i> <sup>2</sup> <i>Macrocystis angustifolia</i> <i>Phyllospora comosa</i> <i>Amphibolis antarctica</i> <sup>2, 3</sup>	U = Upper } part M = Middle } of L = Lower } zone <sup>1</sup> = Seasonally abundant <sup>2</sup> = Local shelter <sup>3</sup> = Sand overlying rocky substrate

*Suaeda australis* as dominant species. *Salicornia* plants are found on small isolated muddy outcrops along the edge of the bay and amongst them are *Salinator fragilis*, *Velacumantus australis*, *Austrocochlea constricta porcata* and *Bembicium melanostomum*. This merges with *Zostera muelleri* which extends through the eulittoral and into the sublittoral zone. Associated with the *Zostera* are two other marine angiosperms *Ruppia maritima* and occasionally *Lepilaena cylindrocarpa*. These sea grasses are established in loose sediments and form the

substrate for a number of algae including *Enteromorpha*, *Ulva lactuca*, *Ceramium*, *Gracilaria*, *Polysiphonia*, numerous diatoms and dinoflagellates, and *Phaeocystis giraudii*. In deeper water *Zostera* has associated with it a fauna of amphipods and *Assimineia brazieri* with *Katylisia scalarina* amongst the roots. Near the causeway on the E. side of the bay the dominant species amongst the *Zostera* is *Katylisia rhytiphora*. Under calm conditions debris and shell remains become a substrate for algal growth; *Acetabularia peniculus* is commonly

found attached to dead *Katelysia scalarina* shells.

Animals are sparse, the most abundant and obvious species being *Zeacumantus diemenensis*, some *Austrocochlea contracta*, a few ascidians, *Microcosmos australis*, and a few parchment tubes of *Chaetopteris* sp. protruding from the sand, but no worms were collected. Dead shells of *Katelysia* and *Homalina* are abundant. Stagnant pools which form in the marsh area during winter and spring are characterized by a dense growth of *Enteromorpha*.

In Limeburners Bay at Station 4, the spit running into the bay from the foreshore in front of Geelong Grammar School differs from Swan Bay in two aspects. Firstly the marsh area is separated from the intertidal region by a beach of loosely compacted silty sand with a high proportion of marine skeletal material. Secondly dense beds of sea grass are not developed in the sublittoral.

Algae are poorly represented; the following species were found attached to occasional rocks or posts: *Enteromorpha*, *Ulva lactuca*, *Colpomenia sinuosa*, and *Scytosiphon lomentaria*. On posts *Caloglossa leprieurii* occurs near mid-tide. In the upper zones the dominant and only obvious animal was *Bembicium melanostomum*, which then graded into abundant *Eubittium lawleyanum* and finally at low tide *Velacumantus australis*. Hiding among the pebbles and the algae are the crabs *Philyra laevis* and *Paragrapsus gaimardii*.

### Discussion

The flora and fauna of the intertidal zones of Port Phillip can be used to divide the bay into two main biological areas, (1) the open coast area of Port Phillip Heads, and (2) the bay proper. This division is not clear cut on the E. margin of the bay.

The major difference between the intertidal zones of the bay and of the Heads is the reduced number of species found within the bay. However, although fewer species occur, the actual population density remains much the same. Most of the bay species also occur at the Heads but the reverse is not true. A number of animals e.g. *Patellanax peroni*, *Scutus antipodes*, *Siphonaria funiculata*, are restricted to

the open coast. A list of algae found only at the Heads but not in the bay is given in the description of stations 5 and 10, Port Phillip Heads. While a number of species occur throughout the whole bay, others appear to tolerate the conditions of the bay to a limited degree. *Montfortula rugosa* occurs to the S. of Clifton Springs (W. coast) and Schnapper Point (E. coast); *Kellia australis* and *Poneroplax albida* occur on the E. coastline S. of Ricketts Pt. and at the Heads.

In some cases one particular species may be ecologically replaced by another. The green alga *Caulerpa scalpelliformis* occurs at the Heads and on the E. coastline S. of Schnapper Pt., but is completely replaced elsewhere in the bay by the densely pinnate form of *Caulerpa remotifolia*. The mollusc *Bembicium nanum* occurs as far N. as Portarlington (W. coast) and Schnapper Pt. (E. coast) and is then replaced by either *Bembicium auratum* or *B. melanostomum*.

A number of species occur throughout the bay but occupy different ecological niches under the differing environmental conditions. *Meturaplax retrojecta* is intertidal on open coast but occurs at 1.5-3 fm within the bay. *Ibla quadrivalvis* requires the shelter of *Galeolaria caespitosa* at Martha Pt. (E. coast) and the Heads, but within more sheltered parts of the bay occurs in rock crevices adjacent to the *Galeolaria*. Some algae, e.g. *Ecklonia radiata*, which are sublittoral within the bay are restricted to deep pools and other positions of local shelter at the Heads.

Biological zonation within the bay is not as well developed as at the Heads, and with increase in shelter both the sub-littoral fringe and the littoral fringe (spray zone) disappear. Some difficulty is experienced in recognizing zones within the bay area, and this is in part due to the poor development of rocky platforms, and the narrow tidal range (1 m. or less for most of the bay, c.f. approx. 1.7 m at the Heads). With the increase in shelter the algae become more important as zone indicators. However, algae within the bay show marked seasonal fluctuations whereas at the Heads there is a relatively stable cover of *Hornosira banksii* and *Cystophora* species in the lower zones.

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## 2. SYSTEMATIC LIST OF INTERTIDAL ANIMALS

By J. HOPE BLACK

The list is of the commoner intertidal animals, and not a definitive record of all species found in the littoral zone. It is biased towards species occupying a rocky substrate, as these reflect ecologic changes more clearly than those from sandy or muddy bottoms. No attempt is made to include the large number of species that live in rock pools and in the sub-littoral.

References have been kept to a minimum as most of the species have been discussed by the various authors in the systematic papers published in this and the previous survey volume. Distribution within the bay is listed and brief remarks made on their ecology.

The additional locality numbers in this section are stations worked but not included on the chart or discussed in Section 1 (Intertidal Ecology) of this paper.

**Porifera**

It has not been possible to obtain identifications of sponges, but fortunately they are not an important component of the intertidal ecology. Most species are benthic, although several, including *Sycon* and *Tythya corticata* inhabit intertidal pools.

**Coelenterata**

*Hydrozoa*. A number of species is found in pools and in the sublittoral, but the group has

not been studied in any detail since Bayle worked the material collected by the Royal Society Survey of 1888-95. Recently Mrs J. Watson has made extensive collections which she is now studying. Her results will show to what extent the distribution of this group has changed within the bay.

## ACTINIARIA

**Actinia australiensis** Carlgren, 1950

*Actinia australiensis* Carlgren 1950 Corallimorpharia, Actinaria and Zoantharia from N.S.W. and S. Qd. *Ark. Zool.* 1 (10): 131-146.

Survey area 27 (S17), 29 (S22), 40 (S6), 42 (S21).

A small brown anemone found under stones in the mid- and lower-eulittoral of rock platforms. In Port Phillip it is often found amongst the *Galeolaria*.

**Actinia tenebrosa** Farquhar, 1898

*Actinia tenebrosa* Farquhar, H., 1898. Preliminary account of some New Zealand Actinaria. *Journ. Linn. Soc. Lond. (Zool.)* 26: 535.

Survey area 55 (S13) (S15), 58 (S5) (S10).

Very common on rock platforms in the mid- and lower-eulittoral in areas of moderate exposure. At Daveys Bay on the flat sandstone platform it occurs in large numbers.

**Oulactis muscosa** (Drayton, 1848)

*Metridium muscosum* Drayton J., 1848 in J. D. Dana *Wilkes U.S. Exped. Zoophytes*, p. 153.

Survey area 9 (S12).

This brown speckled anemone occurs in the lower eulittoral on rock platforms usually living in cracks and holes where sand and skeletal material has accumulated.

**Cnidopus veratra** (Drayton, 1848)

*Actinia veratra* Drayton 1848 in J. D. Dana *Wilkes U.S. Exped. Zoophytes*, p. 129.

Survey area 23 (S20).

This green anemone is found in shallow pools and crevices in the lower eulittoral.

**Cerianthus** sp.

Survey area 9 (S12).

Burrowing anemone found on sandy mud flats in areas of extreme shelter. A lower eulittoral species in Port Phillip but occurs 5-10 fm in the warmer N.S.W. waters.

## ANNELIDA POLYCHAETA

**Galeolaria caespitosa** Lamarck, 1818

Survey area 6 (S16), 23 (S20), 25 (S19), 27 (S17), 37 (S1), 40 (S6), 48 (S14), 55 (S13) (S15), 58 (S5) (S10), 63 (S24).

*Galeolaria* occurs as a band at the top of the lower eulittoral on open coasts which afford some shelter. In localities of extreme exposure it is only found where rock stacks or boulders protect it from the full force of the sea. In the bay it is found as a fringe on boulders, favouring the exposed sides.

## CRUSTACEA CIRREPEDIA

**Ibla quadrivalvis** Cuvier, 1817

*Ibla quadrivalvis*, Cuvier 1817.

Survey area 23 (S20), 40 (S6), 48 (S14), 63 (S24).

A common species living among *Galeolaria* tubes on open coasts, but in the shelter of the bay it forms separate colonies usually in depressions and fissures adjacent to the *Galeolaria*.

**Chthamalus antennatus** (Darwin, 1854)

*Chthamalus antennatus* Pope E. C., 1965. A review of Australian and some Indomalayan Chthamalidae. *Proc. Linn. Soc. N.S.W.* 90: 45.

Survey area 58 (S5).

Occurs in the upper eulittoral of open rock platforms in Port Phillip; it does not occur N. of the Nepean Bay Bar.

**Chamaesipho columna** (Spengler, 1790)

*Chamaesipho columna* Pope E. C., 1965: 64.

Survey area 25 (S19), 48 (S14), 55 (S13), 58 (S5), 63 (S24), 69 (S11).

Occurs in the upper eulittoral on rock platforms of open coasts, within the bay it is confined to the S. half, but penetrates into Corio Bay North.

**Elminius modestus** Darwin, 1854

*Elminius modestus* Pope E. C. Cirripedia, Port Phillip Survey *Mem. natn. Mus. Vict.* 27: 181.

Survey area 63 (S24).

This species occurs from low tide to high water neaps, depending on the configuration of the locality and the degree of exposure.

**Tetraclita purpureascens** (Wood, 1815)

*Lepas purpureascens* Wood, 1815. *Gen. Conch.*

Survey area 58 (S10).

Occurs on rock platforms 'in places sheltered from the sun' (Bennett and Pope 1953: 133). Its occurrence is similar at S10.

## ISOPODA

**Paridotea munda** Hale, 1924

*Paridotea munda* Naylor E., 1966. *Isopoda*, Port Phillip Survey. *Mem. natn. Mus. Vict.* 27: 183.

Survey area 42 (S21).

**Paridotea ungulata** (Pallas, 1881)

*Paridotea ungulata* Naylor E., 1966: 183.

Survey area 5.

**Crabzys longicaudatus** (Spence Bate, 1888)

*Crabzys longicaudatus* Naylor E. 1966 *ibid.* p. 183.

Survey area 5.

## BRACHYURA

Griffin, D. J. G., and Yaldwin, J. C., *Brachyura*, this volume.

**Elabia (Phylxia) intermedia** Miers, 1886

Survey area 42 (S21).

**Philyra laevis** Bell, 1885

Survey area 26 (S2), 58 (S3).

This small pebble crab is found on *Zostera* beds from the sublittoral down to several fathoms.

**Halicarcinus ovatus** Stimpson, 1858

Survey area 10 (intertidal) 42 (S21).

Two species of *Halicarcinus* are common 1-7 fm in Port Phillip Bay, but only this species has been taken in the eulittoral.

**Naxia aurita** (Latreille, 1825)

Survey area 6 (S16), 40 (intertidal), 42 (intertidal), 58 (S10).

In areas of extreme shelter.

**Notomithrax minor** (Filhol, 1885)

Survey areas 42 (intertidal), 55 (S. side Schnapper Point, intertidal).

**Carcinus maenus** Linnaeus, 1758

Survey area 5 (intertidal), 69 (S11).

This introduced European species is common in association with *Zostera* beds throughout the bay.

**Nectocarcinus integrifrons** (Latreille, 1825)

Survey area 42 (intertidal).

**Ovalipes australiensis** Stephenson and Rees, 1968

Survey area 9 (S12), 69 (S11), 63 (intertidal Safety Beach).

This swimming crab occurs on *Zostera* beds or sand patches adjacent to them.

**Actaea peronii** (H. Milne Edwards, 1824)

Survey area 59 (S25).

**Pilumnus acer** Rathbun, 1923

Survey area 59 (intertidal).

**Pilumnus monilifer** Haswell, 1881

Survey area 5 (intertidal).

**Pilumnopeus serratifrons** (Kinahan, 1856)

Survey area 27 (S17).

**Litochiera bispinosa** Kinahan, 1856

Survey area 42 (intertidal).

This and the above four species are found under stones in the mid- and lower-eulittoral.

**Cyclograptus audouinii** (H. Milne Edwards, 1837)

Survey area 14 (intertidal, Beaumaris).

**Paragrapsus quadridentatus** (H. Milne Edwards, 1837)

Survey area 55 (S13).

**Paragrapsus gaimardii** (H. Milne Edwards, 1837)

Survey area 23 (S20), 26 (S2) (S9), 55 (S13).

A common species living under stones in the mid- and lower eulittoral.

**Mictyris platycheles** (H. Milne Edwards, 1852)

Survey area 5 (intertidal) 23 (S20).

This soldier crab occurs on firm sandy beaches, and when present is usually very abundant.

## MOLLUSCA

Macpherson, J. Hope, and Gabriel, C. J., 1962. *Marine Molluscs of Victoria*, p. 19.

Macpherson, J. Hope, 1966. Mollusca. Port Phillip Survey, *Mem. natn. Mus. Vict.* 27: 201-263.

## AMPHINEURA

**Poneroplax albida** (Blainville, 1825)

Survey area 23 (S20), 58 (S5).

Occurs with *P. costata* in the lower eulittoral.

It appears to be less adapted to sheltered conditions, and has been taken only on the E. side of the bay.

**Poneroplax costata** (Blainville, 1885)

Survey area 6 (S16), 23 (S20), 40 (S6), 48 (S14), 55 (S13) (S15), 58 (S5), 63 (S24).

In the lower eulittoral below the *Galeolaria*.

**Kopionella matthewsi** (Iredale, 1920)

Survey area 55.

Under stones in the sub-littoral.

**Meturoplax retrojecta** (Pilsbury, 1894)

This species is a common crypt-dweller of the lower eulittoral of open coasts, but within Port Phillip it was only taken on reefs at 1.5-3 fm below low tide.

**Ischnochiton elongatus** (Blainville, 1825)

Survey area 55.

There are several species of Ischnochitonidae living under stones in the sublittoral.

**Ischnoradsia evanida** (Sowerby, 1840)

Survey area 23 (S20), 55 (intertidal), (S13).

Occurs under stones in the sublittoral of the E. coast of the bay.

## GASTROPODA

**Notohaliotis ruber** (Leach, 1814)

Survey area 55 (S13) (S15), 63 (S24).

This species was common in the sublittoral until commercial fishing by skin divers denuded the population. A number of small specimens up to 2.5 in. (6 cm) in diameter were recorded for the above localities.

**Montfortula rugosa** (Quoy and Gaimard, 1834)

Survey area 40 (S6). 55 (intertidal), 58 (S5) (S7).

An open coast lower eulittoral species which only occurs in the S. half of the bay.

**Scutus antipodes** (Montfort, 1810)

Survey area 58, 59.

Only occurs in the region of the Heads where suitable stones afford it shelter.

**Cellana tramoserica** (Sowerby, 1825)

Survey areas 6 (S16), 7 (S18), 23 (S20), 48 (S14), 55 (S13) (S15), 58 (S5) (S7) (S10), 63 (S24).

A common mid-littoral species which is able to adapt itself to a wide range of conditions, and so occurs on most platforms both within and outside the bay.

**Patellanax peroni** (Blainville, 1825)

Survey area 58 (S10).

An open coast lower eulittoral species which does not penetrate the Nepean bay bar.



**Patelloida alticostata** Angas, 1856

Survey areas 6 (S16), 7 (S18), 23 (S20), 48 (S14), 55 (S13) (S15), 58 (S5) (S7) (S10), 63 (S24).

Occupies a similar situation to *Cellana* with a similar range.

**Patelloida latistrigata** (Angas, 1865)

Survey area 55 (S13) (S15).

Another open coast species that penetrates the bay as far as area 55.

**Notoacmea petterdi** (Tenison Wood, 1876)

Survey areas 23 (S20), 58 (S10).

Open coast species found on exposed rock surfaces.

**Notoacmea granosa** (Macpherson, 1954)

Survey areas 55 (S13), 25 (S19).

An open coast species which was recorded by the survey only for the E. coast.

**Notoacmea mayi** May, 1923

Survey area 55 (S13).

Also an open coast species which penetrates the bay to Mornington on the E. coast.

**Notoacmea scabrilirata** (Angas, 1865)

Survey area 58 intertidal.

Lives under stones in the mid- and lower-eulittoral.

**Cantharidus pulcherrimus** (Wood, 1828)

Survey area 58 (S7) (S10).

This species is confined to the Heads region of the bay, living amongst algae.

**Phasianotrochus eximius** (Perry, 1811)

Survey area 58 (S7).

Like the previous species this is an inhabitant of the intertidal algal beds.

**Phasianotrochus rutilus** (A. Adams, 1851)

Survey area 58 (S5).

This is a common species in Western Port Bay, but it is rare even in the Heads region of the bay.

**Thalotia conica** (Gray, 1827)

Survey area 58 (S7) (S10).

Another of the algal dwellers which is confined to the Heads region.

**Austrocochlea constricta** (Lamarck, 1822)

Survey areas 7 (S18), 23 (S20), 26 (S9) *porcata*, 27 (S17), 37 (S1), 48 (S14), 49 (S4) *porcata*, 55 (S13) (S15), 63 (S24).

This species is common in the upper culittoral of open rock platforms, and is widely distributed on the platforms within the bay. It also occurs in areas of extreme shelter where it is found on areas of sandy mud such as *Zostera* beds, and at the base of mangrove trees. Specimens in the latter type of habitat are smaller and have been given the varietal name *porcata* (A. Adams, 1851).

**Austrocochlea concamerata** (Wood, 1828)

Survey areas 55 (S13) (S15), 63 (S24).

An open coast upper eulittoral species which is found in crevices or under overhangs which afford shelter.

**Austrocochlea adelaidae** (Phillippi, 1849)

Survey areas 6 (S16), 58 (S7) (S10).

This and the next species occur in algal pools from the mid- to lower-eulittoral.

**Austrocochlea odontis** (Wood, 1828)

Survey areas 6 (S16), 23 (S20), 26 (S9), 58 (S5).

**Subnina undulata** (Solander, 1786)

Survey areas 23 (S20), 55 (S13) (S15), 58 (S5) (S7) (S10), 63 (S24).

Occurs in crevices and pools in the lower eulittoral.

**Micrastraea aurea** (Jonas, 1844)

Survey areas 27 (S17), 58 (S10).

This species is common in many situations below low tide to approximately 7 fm. It was taken in the sublittoral at the above stations.

**Melanerita melanotragus** (A. E. Smith, 1884)

Survey area 55 (S13), 63 (S24).

Occurs in crevices and under overhangs in the upper eulittoral of open coasts. In Port Phillip it is one of the open coast species that penetrates up the E. coast.

**Melarapha unifasciata** (Gray, 1826)

Survey areas 6 (S16), 25 (S19), 48 (S14), 55 (S13) (S15), 58 (S5) (S10), 63 (S24).

This and the next species are common on vertical rock stacks in the infra-littoral fringe. This species tends to occur a little higher than the following one.

**Melarapha praetermissa** (May, 1908)

Survey areas 48 (S14), 55 (S13) (S15), 58 (S10), 63 (S24).

**Melarapha paludinella** (Reeve, 1857)

Survey area 63 (S24).

This very small species occurs on open coast rock platform in the upper eulittoral amongst the barnacle *Chamaesipho columna*. Its situation is similar at Martha Point (S24).

**Bembicium nanum** (Lamarck, 1822)

Survey areas 48 (S14), 55 (S13) (S15), 58 (S10), 63 (S24).

This is an open coast species and penetrates the bay to S. of Schnapper Point.

**Bembicium auratum** (Quoy and Gaimard, 1834)

Survey areas 23 (S20), 27 (S17), 37 (S1), 40 (S6), 48 (S14), 55 (S13) (S15).

Occurs in areas of partial shelter where it replaces the above species.

**Bembicium melanostomum** (Gmelin, 1791)

Survey areas 25 (S18), 26 (S2), 49 (S4).

Occurs in area of extreme shelter attached to any hard substrata including mangrove stems and roots.

**Velacumantus australis** (Quoy and Gaimard, 1834)

Survey areas 25 (S19), 26 (S2) (S9), 49 (S4).

A common species in sandy mud situations.

**Zeacumantus diemenensis** (Quoy and Gaimard, 1834)

Survey areas 23 (S20), 26 (S9), 49 (S4). Found on open sandy mud.

**Eubittium lawleyanum** (Crosse, 1863)

Survey area 26 (S2).

A sublittoral species found only in extreme shelter.

**Cymatiella verrucosa** (Reeve, 1844)

Survey area 58 (S7).

This and the following species are inhabitants of open rock platforms where some shelter such as algal growth is available.

**Cymatiella lesueuri** Iredale, 1929

Survey area 58 (S7).

**Lepsiella vinosa** (Lamarck, 1822)

Survey areas 6 (S16), 23 (S20), 25 (S19), 40 (S6), 58 (S7) (S10), 63 (S24).

Common in the mid- and lower-eulittoral in association with mussels and *Galeolaria* on which it feeds.

**Lepsiella reticulata** (Blainville, 1832)

Survey area 58 (S7).

An open coast species.

**Dicathais textilosa** (Lamarck, 1822)

Survey area 58 (S5) (S7) (S10).

Living in sheltered positions such as crevices and overhangs in the lower eulittoral to several fathoms.

**Cominella eburnea** (Reeve, 1846)

Survey areas 40 (S6), 6 (S16).

Occurs in sheltered situations in the mid-eulittoral often completely replacing the more open coast species *C. lineolata*.

**Cominella lineolata** (Lamarck, 1809)

Survey areas 7 (S18), 23 (S20), 25 (S19), 40 (S6), 55 (S13) (S15), 58 (S5) (S7) (S10), 63 (S24).

A widespread species on rock platforms, common in open positions, but penetrates into even well-sheltered bays and inlets.

**Parcanassa pauperata** (Lamarck, 1822)

Survey areas 23 (S20), 26 (S9), 37 (S1). A shelter-loving species.

**Tavaniotha optata** (Gould, 1860)

Survey area 69 (S11).

Occurs in areas of sand and muddy sand from the sublittoral to 9 fm.

**Floreoconus anemone** (Lamarck, 1810)

Survey area 58 (S10).

Occurs under stones in the lower eulittoral in areas of medium shelter.

**Salinator fragilis** (Lamarck, 1822)

Survey areas 2 (S8), 23 (S20), 40 (S6), 49 (S4).

On sandy mud areas usually in the vicinity of freshwater runnels.

**Siphonaria diemenensis** (Quoy and Gaimard, 1834)

Survey areas 6 (S16), 40 (S6), 48 (S14), 55 (S13) (S15), 58 (S5) (S7) (S10), 63 (S24).

Common on the upper eulittoral of rock platforms both within the bay and on the open coast.

**Siphonaria tasmanica** (Tenison Woods, 1876)

Survey area 58 (S10).

In similar situations to the above species, but only found in the Heads region.

**Siphonaria funiculata** Reeve, 1856

Survey area 58 (S10).

Confined to the S. of the bay.

**Siphonaria baconi** Reeve, 1856

Survey area 58 (S5) (S7).

On the sheltered side of Point Nepean this species is common on flat rock surfaces in the mid-eulittoral.

**Onchidella patelloides** (Quoy and Gaimard, 1832)

Survey area 58 (S10).

An open coast rock platform species.

## BIVALVIA

**Anadara trapezia** (Deshayes, 1840)

Survey areas 25 (S18), 26 (S9), 27 (S17).

Occurs in the lower eulittoral on the silty clays and silty sands of the N. shore of Corio Bay.

**Modiolus pulex** (Lamarek, 1819)

Survey area 58 (S5) (S10).

An open coast mid-eulittoral species.

**Brachidontes rostratus** (Dunker, 1857)

Survey area 58 (S5) (S10).

Forms extensive beds in the mid-eulittoral on open coast platforms.

**Mytilus planulatus** (Lamarek, 1819)

Survey areas 2 (S8), 6 (S16), 9 (S12), 23 (S20), 25 (S19), 37 (S1), 40 (S6), 48 (S14), 55 (S13) (S15), 63 (S24), 69 (S11).

Occurs from the lower eulittoral to 10 fathoms in sheltered waters.

**Kellia australis** (Lamarek, 1818)

Survey area 63 (S24).

Lives in the shelter of *Galeolaria* and mussels on open coasts.

**Electroma georgiana** (Quoy and Gaimard, 1835)

Survey areas 69 (S11), 27 (S17).

Found within the bay from the sublittoral to 10 fm wherever algae and such like are available for attachment.

**Katelysia scalarina** (Lamarek, 1818)

Survey area 49 (S4), 69 (S11).

Occurs on sand from the sublittoral to several fathoms.

**Katelysia rhytiphora** Lamy, 1937

Survey areas 26 (S9), 37 (S1), 49 (S4).

Occurs in association with *Zostera*.

**Donacilla angusta** (Reeve, 1854)

Survey areas 23 (S20), 69 (S11).

Living in sand in areas of shelter.

**Homalina deltoidalis** (Lamarek, 1818)

Survey areas 27 (S17), 37 (S1).

Occurs in the sublittoral to 7 fm in areas of extreme shelter.

## ECHINODERMATA

**Pateriella calcar** (Lamarek, 1816)

Survey areas 23 (20), 48 (S14), 58 (S10).

Common in rock pools and under stones from the mid-eulittoral to several fathoms.

**Pateriella brevispina** (H. L. Clark, 1923)

Survey area 23 (S20), 58 (S10).

In similar situations to the above species.

**Pateriella gunni** (Gray, 1840)

Survey area 58 (S10).

This and the previous species are often considered to be conspecific, but recent work separates them.

**Tosia australis** Gray, 1840

Survey areas 25 (S19), 58 (S10).

Under stones in the lower littoral to several fathoms.

**Cosmosterias calamaria** (Gray, 1840)

Survey area 23 (S20).

A shallow benthic species which from time to time invades the upper sub-littoral.

**Heliocidaris erythrogramma** (Val., 1846)

Survey area 58 (S10).

This common sea urchin of the Port Phillip intertidal occurs in rock pools in the lower eulittoral and under ledges to several fathoms.

## ASCIDIACEA

**Pyura praeputialis** (Heller, 1878)

Survey areas 40 (S6), 58 (S5).

Occurs in the sublittoral but in some areas of shelter such as gutters, may extend up into the lower eulittoral.

**Pyura pachydermatina** (Herdman, 1881)

Survey area 58 (S5) (S10).

Attached to rocks, often under overhangs, in the sub-littoral down to several fathoms.

**Microcosmos australis** Herdman, 1899

Survey areas 9 (S12), 49 (S4).

Occurs on sand and clayey sand in areas of shelter from the sub-littoral down to several fathoms.

## 3. FLORA OF THE INTERTIDAL REGION

By R. J. KING and SOPHIE C. DUCKER

**Introduction**

The algae and flowering plants collected during field trips to the 14 intertidal stations are listed. This list is by no means exhaustive, notable omissions being microscopic epiphytic algae.

Unless specifically stated all algae occur in the intertidal regions or the adjacent upper sub-littoral.

The distribution within the bay is given according to the region and followed by the area number with the station number in brackets (see above). Short ecological notes, and further distribution records taken from specimens in the Herbarium of the Botany School, University of Melbourne (MELU), are included. Several

species which were not recorded for the intertidal zone, but which are common components of the drift have been included in this list.

For each species the full original quotation is cited but not the basionym. Recent monographs dealing with species which occur in Port Phillip Bay are given.

## Phylum CHLOROPHYTA

## Order ULVALES

## Family ULVACEAE

**Enteromorpha** Link

A number of species of *Enteromorpha* is common throughout the bay, in the eulittoral and upper sub-littoral zones.

*Enteromorpha intestinalis* (Linnaeus) Link 1820: 5. Bliding 1963: 139, Fig. 87.

N. bay area 6 (S16). Corio Bay area 29 (S22). SW. bay area 42 (S21).

Upper- and mid-eulittoral; also recorded for Altona.

**Ulva** Thuret

*Ulva lactuca* auct. (Non Linnaeus). Papenfuss 1960: 306. Bliding 1968: 537, Figs. 1-5.

N. bay area 6 (S16). Corio Bay areas 16 (S23), 25 (S19), 26 (S2), 27 (S17), 29 (S22). SW. bay areas 42 (S21), 49 (S4). E. bay areas 23 (S20), 55 (S13, S15). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Widely distributed and common upper eulittoral to sub-littoral. Often epiphytic, particularly on *Zostera*. The species of *Ulva* with the dissected and ribbon-like thallus which Womersley (1966) has noted from the vicinity of the Heads was collected at Portarlington and Queenscliff.

*Ulva spathulata* Papenfuss 1960: 309, Pl. 3, fig. 15.

Port Phillip Heads area 58 (S10).

Epiphytic on *Cladostephus verticillatus*.

## Order CLADOPHORALES

## Family CLADOPHORACEAE

**Chaetomorpha** Kützting

*Chaetomorpha aerea* (Dillwyn) Kützting 1849: 379.

Corio Bay area 29 (S22). E. bay area 23 (S20). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Occasional in mid- and lower-eulittoral pools; at Portarlington dense growth in the lower eulittoral.

*Chaetomorpha darwinii* (J. D. Hooker) Kützting 1849: 380. Kornmann 1969: 335, Figs. 1-13.

Corio Bay area 25 (S19). Port Phillip Heads area 58 (S5, S10).

Usually epiphytic on *Halopteris* spp., *Cladostephus verticillatus*, and *Gelidium australe* in the lower eulittoral and upper sub-littoral; also in lower eulittoral pools.

*Chaetomorpha* sp.

Corio Bay area 26 (S2).

Intermingled strands in upper eulittoral.

### **Cladophora** Kützting

*Cladophora* species are recorded throughout the bay but these have not all been identified.

*Cladophora fascicularis* (Mertens in C. Agardh) Kützting 1843: 268. Sakai 1964: 25, Fig. 8, Pl. 4 (1).

Port Phillip Heads area 58 (S10).

Lower eulittoral channels and sub-littoral fringe. Also recorded for Altona, Werribee and Sandringham.

*Cladophora repens* (J. Agardh) Harvey 1851: Pl. 236.

Port Phillip Heads area 58 (S10).

Upper eulittoral outer edge of the reef.

*Cladophora rugulosa* Martens 1866: 112; Sakai 1964: 67, Figs. 31-32, Pl. 15 (1).

Port Phillip Heads area 58 (S5).

Shallow inner sandy pools in mid-eulittoral. Also recorded for Beaumaris and Mt Martha.

### Order SIPHONOCLODALES

#### Family SIPHONOCLODACEAE

### **Apjohnia** Harvey

*Apjohnia lactevirens* Harvey 1855b: 335. Dawes 1969: 78, Fig. 1.

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral pools. This species is restricted to pools on rough coasts.

#### Family VALONIACEAE

### **Dictyosphaeria** Decaisne

*Dictyosphaeria sericea* Harvey 1855a: 565.

Port Phillip Heads area 58 (S5, S10).

On vertical and steep faces in the upper zones of lower eulittoral pools; also in channels open to the lower eulittoral. This species does not occur within the sheltered waters of the bay.

### Order CODIALES

#### Family BRYOPSISIDACEAE

### **Bryopsis** Lamouroux

*Bryopsis gemellipara* J. Agardh 1887: 25.

Port Phillip Heads area 58 (S10).

Epiphytic on *Gelidium australe* in lower eulittoral pools.

*Bryopsis hypnoides* Lamouroux 1809: 333.

N. bay area 6 (S16). Corio Bay areas 16 (S23), 25 (S19). E. bay area 55 (S13, S15).

Lower eulittoral and occasionally above.

*Bryopsis plumosa* (Hudson) C. Agardh 1823: 448.

Recorded for Port Phillip Bay. In the W. H. Harvey herbarium (TCD) specimens from Brighton Beach (570F) and Geelong (570G) are under this name. Womersley (1966) records *B. plumosa* from N. bay area 10 (103).

We have found it difficult to differentiate between *B. plumosa* and *B. hypnoides*, and have assigned to *B. hypnoides* only plants where the monoeocious character was established (Feldmann 1957).

*Bryopsis vestita* J. Agardh 1878: 3.

Port Phillip Heads area 58 (S10).

Dense patches in upper eulittoral zone.

#### Family CODIACEAE

### **Codium** Stackhouse

*Codium australicum* Silva in Silva and Womersley 1956: 280, Fig. 13, Pl. 2 (2).

Recorded from Pt Nepean in lower eulittoral pools.

*Codium capitulatum* Silva et Womersley 1956: 263, Fig. 2, Pl. 1 (1).

Port Phillip Heads area 58 (S5).

On vertical and shaded faces in lower eulittoral pools.

*Codium duthiae* Silva in Silva and Womersley 1956: 275, Fig. 10, Pl. 1 (2).

Port Phillip Heads area 58 (S5, S10). Mid- and lower-eulittoral pools.

*Codium fragile* (Suringar) Hariot 1889: 32. Silva and Womersley 1956: 282, Fig. 14d.

N. bay area 6 (S16). Corio Bay areas 25 (S19), 27 (S17). E. bay area 23 (S20). Port Phillip Heads area 58 (S5, S10).

All levels from mid-eulittoral to upper sub-littoral, and in mid- and lower-eulittoral pools: sub-littoral plants are often covered by epiphytic

Ceramiales. At the Heads this species is common in the mid-eulittoral in rough positions.

*Codium galeatum* J. Agardh 1887: 42, Pl. 1, fig. 1.  
Silva and Womersley 1956: 273, Fig. 9.

Port Phillip Heads area 58 (S5).

Deep lower eulittoral pools; a rough coast species not found within the bay. *Hymenocladia sanguinea* is characteristically epiphytic on *C. galeatum*.

*Codium lucasii* Setchell in Lucas 1935: 200, Fig. 3;  
Silva and Womersley 1956: 265, Fig. 3.

Port Phillip Heads area 58 (S10).

Under ledges in lower eulittoral pools and on sides of lower eulittoral channels. Also recorded for Pt Nepean.

*Codium muelleri* Kützinger 1856: 34. Silva and Womersley 1956: 278, Fig. 12.

Recorded for Pt Nepean.

*Codium perrinae* Lucas 1935: 203, Fig. 4. Silva and Womersley 1956: 267, Fig. 4.

Port Phillip Heads area 58 (S10).

Under ledges in lower eulittoral pools.

*Codium pomoides* J. Agardh 1894: 100; Silva and Womersley 1956: 271, Fig. 7.

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral pools, under ledges and in crevices. Common in the Heads region but not found within the shelter of the bay.

#### Order CAULERPALES

#### Family CAULERPACEAE

#### *Caulerpa* Lamouroux

*Caulerpa brownii* (C. Agardh) Endlicher 1843: 16.

N. bay area 6 (S16). Corio Bay area 27 (S17). SW. bay area 42 (S21). E. bay areas 23 (S20), 55 (S13, S15). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Lower eulittoral, the sub-littoral fringe (at the Heads), and most commonly in the upper sub-littoral; also in lower eulittoral pools and channels.

*Caulerpa cactoides* (Turner) C. Agardh 1823: 439.

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral pools and channels often associated with *Amphibolis antarctica*. This is an open coast species not recorded within the bay.

*Caulerpa flexilis* Lamouroux 1813: 283, Pl. 7, fig. 3.

E. bay area 55 (S13). Port Phillip Heads area 58 (S5, S10).

Lower eulittoral, sub-littoral fringe and upper sub-littoral on rock platform; also lower eulittoral pools.

*Caulerpa flexilis* var. *muelleri* (Sonder) Womersley 1956: 367.

Port Phillip Heads area 58 (S5, S10).

Mid- and lower-eulittoral pools.

*Caulerpa geminata* Harvey 1855a: 564.

Corio Bay area 27 (S17). E. bay area 55 (S13, S15). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Common in the upper sub-littoral, but occasionally in the lower eulittoral, the sub-littoral fringe (at the Heads), and in lower eulittoral pools. Also recorded for Williamstown, Beaumaris, Werribee and Geelong. Womersley (1966) discusses the various ecological forms of *C. geminata* occurring within the bay.

*Caulerpa longifolia* C. Agardh 1823: 437.

Port Phillip Heads area 58 (S5).

Lower eulittoral pools; uncommon.

*Caulerpa longifolia* f. *crispata* (Harvey) Womersley 1950: 147.

N. bay area 6 (S16). Corio Bay areas 16 (S23), 27 (S17). Port Phillip Heads area 58 (S5, S10).

Lower eulittoral pools and channels, and upper sub-littoral. While f. *crispata* is common both within the bay and at the Heads, the typical form appears to be confined to open coast.

*Caulerpa obscura* Sonder 1845: 50.

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral pools on vertical and overhung rock faces; characteristic of such conditions on rough coast and not found within the bay.

*Caulerpa papillosa* J. Agardh 1872b: 42.

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral pools, occasional in the lower eulittoral. This species has not been recorded within the bay,

*Caulerpa remotifolia* Sonder 1852: 660.

N. bay area 6 (S16). Corio Bay areas 16 (S23), 25 (S19), 26 (S2), 29 (S22). SW. bay area 42 (S21). E. bay area 55 (S15).

Common in lower eulittoral and upper sub-littoral. Also recorded for Altona and Swan Bay. All specimens collected were very densely pinnate.

*Caulerpa scalpelliformis* (R. Brown in Turner) C. Agardh 1823: 437.

E. bay area 55 (S13). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Upper sub-littoral but also lower eulittoral pools.

*Caulerpa simpliciuscula* (Turner) C. Agardh 1823: 439.

N. bay area 6 (S16). Corio Bay areas 25 (S19), 27 (S17), 29 (S22). E. bay area 55 (S13, S15). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10). Common within the bay in the sub-littoral; mid- and lower-eulittoral pools in rough conditions.

*Caulerpa trifaria* Harvey 1863: Pl. 261.

Port Phillip Heads area 58 (S10).

Lower eulittoral pools, often associated with *Amphibolis antarctica*.

#### Family UDOTEACEAE

#### **Chlorodesmis** Harvey et Bailey

*Chlorodesmis baculifera* (J. Agardh) Ducker 1966: 245; 1965: 151, Figs. 1-4, as *C. bulbosa*.

Recorded from Pt Nepean lower eulittoral pool.

#### Order DASYCLADALES

#### Family DASYCLADACEAE

#### **Acetabularia** Lamouroux

*Acetabularia peniculus* (R. Brown in Turner) Solms-Laubach 1895: 27, Pl. 2, figs. 2, 6-7.

Corio Bay area 27 (S17). SW. bay areas 42 (S21), 49 (S4).

Lower eulittoral and upper sub-littoral, commonly growing on dead shells of *Katylesia scalarina*. Very common at Swan Bay Jetty; also recorded for W. Rosebud and Blairgowrie.

#### Phylum PHAEOPHYTA

#### Order ECTOCARPALES

#### Family ECTOCARPACEAE

#### **Acinetospora** Bornet

*Acinetospora crinita* (Carmichael ex Harvey in J. D. Hooker) Kornmann 1953: 223, Figs. 1-14.

Mornington, Beaumaris, Geelong, Queenscliff.

Epiphytic and epilithic; distributed throughout the mid- and lower-eulittoral in sheltered pools.

#### **Ectocarpus** Lyngbye

*Ectocarpus fasciculatus* Harvey 1841: 40; Russell 1966: 268, Figs. 1-2.

Mornington, Queenscliff.

Epiphytic and epilithic in littoral zone pools; considerable seasonal variation in abundance.

*Ectocarpus siliculosus* (Dillwyn) Lyngbye 1819: 131; Russell 1966: 275, Figs. 3-4.

Mornington, Geelong.

Epiphytic (probably also epilithic); rare.

#### **Feldmannia** Hamel

*Feldmannia globifera* (Kützing) Hamel 1939: XVII, fig. 61 (g); Cardinal 1964: 57, Figs. 31-32.

Mornington, Queenscliff.

Epilithic and epiphytic; common in littoral zone rock pools but also in the sub-littoral fringe.

*Feldmannia lebelii* (Areschoug ex Crouan frat.) Hamel 1939: XVII.

Queenscliff.

Epiphytic; common in littoral zone pools.

#### **Giffordia** Batters

*Giffordia fuscata* (Zanardini ex Meneghini) Kuckuck 1961: 140, Figs. 11-16.

Mornington, Beaumaris.

Epilithic; uncommon in the upper sub-littoral zone.

*Giffordia granulosa* (J. E. Smith) Hamel 1939: XV, fig. 61 (e); Cardinal 1964: 39, Figs. 19-20.

Mornington, Queenscliff.

Usually epiphytic in the mid- and lower-eulittoral and sub-littoral fringe; much seasonal variation in occurrence.

*Giffordia intermedia* (Rosenvinge) Lund 1959: 48, Fig. 5.

Mornington.

Epilithic and epiphytic in the lower eulittoral and the sub-littoral fringe; uncommon.

*Giffordia irregularis* (Kützing) Joly 1965: 72, Figs. 111-119.

A species complex; taxonomy, etc., under investigation.

Mornington, Swan Bay, Beaumaris, Geelong, Queenscliff.

Epiphytic and epilithic; common in the littoral zone in pools and damp places, also in the sub-littoral fringe.

*Giffordia mitchellae* (Harvey) Hamel 1939: XIV, fig. 61 (c, d). Cardinal 1964: 45, Fig. 23.

Mornington, Queenscliff, Beaumaris.

Epilithic and epiphytic; common in the littoral zone pools and sheltered damp positions.

*Giffordia saudriana* (Zanardini) Hamel 1939: XIV. Cardinal 1964: 37, Fig. 18.

Mornington, Werribee.

Epiphytic, epilithic; uncommon, in the upper sub-littoral zone.

#### **Kuckuckia** Hamel

*Kuckuckia spinosa* (Kützing) Kuckuck 1958: 172, Figs. 1-4.

Mornington.

Epiphytic and epilithic; uncommon in the upper sub-littoral zone.

#### **Pilayella** Bory

*Pilayella littoralis* (Linnaeus) Kjellman 1872: 99.

Mornington, Beaumaris.

Epiphytic and epilithic; common in the lower eulittoral and the upper sub-littoral.

#### **Sorocarpus** N. Pringsheim

*Sorocarpus micromorus* (Bory) Silva 1950: 256.

Mornington.

Epiphytic and epilithic; rare in the upper sub-littoral zone.

#### Order SPHACELARIALES

##### Family SPHACELARIACEAE

#### **Sphacelaria** Lyngbye

*Sphacelaria* sp.

Port Phillip Heads area 58 (S10).

Shallow lower- and mid-eulittoral pools.

#### Family STYPOCAULACEAE

#### **Halopteris** Kützing

*Halopteris funicularis* (Montagne) Sauvageau 1904: 393. Lindauer et al. 1961: 167, Fig. 20.

Recorded for Queenscliff.

*Halopteris gracilescens* (J. Agardh) Womersley 1967: 202.

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral pools and channels.

*Halopteris pseudospicata* Sauvageau 1904: 408.

Port Phillip Heads area 58 (S10).

Lower eulittoral and below. Also recorded for Ricketts Pt.

#### Family CLADOSTEPHACEAE

#### **Cladostephus** C. Agardh

*Cladostephus verticillatus* (Lightfoot) C. Agardh 1817: XXV. Lindauer et al. 1961: 175, Fig. 24.

Corio Bay area 29 (S22). Port Phillip Heads area 58 (S5, S10).

Occasional in the lower eulittoral, frequent in lower eulittoral pools. Also recorded for Ricketts Pt.

#### Order CUTLERIALES

##### Family CUTLERIACEAE

#### **Cutleria** Greville

*Cutleria multifida* (J. E. Smith) Greville 1830: 60, Pl. 10.

E. bay area 55 (S15).

Young plants in upper sub-littoral on vertical concrete sea wall within shelter of the Mornington Jetty. Often a significant component of drift at Werribee.

#### Order DICTYOTALES

##### Family DICTYOTACEAE

#### **Dictyota** Lamouroux

*Dictyota alternifida* J. Agardh 1894: 80.

Recorded from Queenscliff and Pt Nepean.

*Dictyota apiculata* J. Agardh 1894: 67.

Port Phillip Heads area 58 (S10).

Lower eulittoral pools.

*Dictyota dichotoma* (Hudson) Lamouroux 1809: 331.

N. bay area 6 (S16). E. bay areas 23 (S20), 55 (S13, S15). S. bay area 63 (S24).

Occasional in the lower eulittoral and upper sub-littoral; sometimes forming a dense cover, e.g. at Ricketts Pt. Also recorded for Queenscliff and Werribee.

#### **Dilophus** J. Agardh

*Dilophus fastigiatus* (Sonder) J. Agardh 1880: 107.

Recorded for Half Moon Bay in the upper sub-littoral.

#### **Lobospira** Areschoug

*Lobospira bisenspidata* Areschoug 1854: 364.

Port Phillip Heads area 58 (S10).

Lower eulittoral pools and channels.

#### **Pachydietyon** J. Agardh

*Pachydietyon paniculatum* (J. Agardh) J. Agardh 1894: 84.

SW. bay area 42 (S21). Port Phillip Heads area 58 (S5, S10).



Upper sub-littoral zone, often epiphytic on *Amphibolis antarctica*, *Caulocystis cephalornithos* and *Phyllospora comosa*.

Family ZONARIEAE

**Dictyopteris** Lamouroux

*Dictyopteris muelleri* (Sonder) Reinbold 1899: 43.

Port Phillip Heads area 58 (S5, S10).

Common in lower eulittoral pools and channels from October to February; occasional in the sub-littoral fringe. Also recorded for Williamstown, Geelong and Ricketts Pt.

**Padina** Adanson

*Padina fraseri* (Greville) Greville 1830, synop. XLIV. Gaillard 1968: 21, Pls. 1-2.

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral; also in littoral zone pools.

**Taonia** J. Agardh

*Taonia australasica* J. Agardh 1894: 30.

Common in drift at Pt. Wilson and Corio Bay during January and February 1970.

**Zonaria** C. Agardh

This genus is well represented in the bay but specific identification is impossible since many collections are only represented by young, infertile specimens.

*Zonaria sinclarii* J. D. Hooker et Harvey 1845: 530.

N. bay area 6 (S16). Port Phillip Heads area 58 (S5).

Occasional in the lower eulittoral.

*Zonaria turneriana* J. Agardh 1870: 438.

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral pools.

Order CHORDARIALES

Family MYRIONEMATACEAE

**Myrionema** Greville

*Myrionema strangulans* Greville 1827: Pl. 300.

Corio Bay area 29 (S22). SW. bay area 42 (S21). Port Phillip Heads area 58 (S5).

Epiphytic and restricted to *Ulva*; common October-February.

Family CORYNOPHLAEACEAE

**Corynophlaea** Kützing

*Corynophlaea cystophorae* J. Agardh 1880: 22, Pl. 1 (1).

Port Phillip Heads area 58 (S5).

Epiphytic on *Cystophora moniliformis* in lower eulittoral pools.

**Leathesia** Gray

*Leathesia difformis* (Linnaeus) Areschoug 1846: 376.

Port Phillip Heads area 58 (S5).

Associated with *Amphibolis* in lower eulittoral pools; also in the upper sub-littoral zone.

**Petrospongium** Nägeli

*Petrospongium rugosum* (Okamura) Setchell et Gardner 1924: 12. MacLennan 1956: 1, Fig. 1.

Port Phillip Heads area 58 (S10).

Outer edge in the mid-eulittoral, slightly above *Hormosira banksii*. Also recorded for Point Nepean.

Family CHORDARIACEAE

**Myriogloia** Kuckuck

*Myriogloia sciurus* (Harvey) Kuckuck 1929: 62, Fig. 81.

Port Phillip Heads area 58 (S10).

Mid-eulittoral, growing through sand.

**Polycerea** J. Agardh

*Polycerea nigrescens* (Harvey ex Kützing) Kylin 1940: 36, Fig. 20 (A, B), Pl. 7, fig. 16.

Port Phillip Heads area 58 (S5)

Epiphytic on *Amphibolis antarctica*.

**Tinocladia** Kylin

*Tinocladia australis* (Harvey) Kylin 1940: 34, Pl. 6, fig. 14.

Port Phillip Heads area 58 (S10).

On rock platform, mid-eulittoral.

Family SPLACHNIDIACEAE

**Splachnidium** Greville

*Splachnidium rugosum* (Linnaeus) Greville 1830, synop. XXXVI. Price and Ducker 1966: 261, Figs. 1-3.

Port Phillip Heads area 58 (S5, S10). Occasionally in the mid-eulittoral.

A common species on exposed Victorian coast but never recorded within the shelter of the bay.

Family NOTHEIACEAE

**Notheia** Harvey et Bailey

*Notheia anomala* Harvey et Bailey 1851: 371. Nizamuddin and Womersley 1960: 673.

Corio Bay area 29 (S22). Port Phillip Heads area 58 (S5, S10).

Epiphytic on *Hormosira banksii* fringing lower eulittoral pools; uncommon within the Bay even though *Hormosira* is widely distributed.

Order SPOROCHNALES  
Family SPOROCHNACEAE  
**Nereia** Zanardini

*Nereia australis* (Harvey) Harvey 1860: 289, Pl. 188.  
Common in the drift at Williamstown and Werribee.

**Perithalia** J. Agardh

*Perithalia caudata* (Labillardière) Womersley 1967: 239.

Port Phillip Heads area 58 (S10).

Uncommon in crevices in the upper sub-littoral zone and the sub-littoral fringe.

Order DICTYOSIPHONALES  
Family PUNCTARIACEAE

**Colpomenia** (Endlicher) Derbès et Solier

*Colpomenia peregrina* (Sauvageau) Hamel 1937: 201.

Port Phillip Heads area 58 (S10).

Epiphytic on *Caulocystis uvifera*. Also recorded for Werribee.

*Colpomenia sinuosa* (Martens ex Roth) Derbès et Solier 1851: 95. Lindauer et al. 1961: 261, Pl. 4 (b).

N. bay area 6 (S16). Corio Bay areas 25 (S19), 26 (S2), 29 (S22). SW. bay area 42 (S21). E. bay area 23 (S20). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Lower eulittoral and below, usually epiphytic on *Sargassum*, *Cystophora* or *Caulocystis* species. Also recorded for Canadian Bay and Werribee.

**Petalonia** Derbès et Solier

*Petalonia fascia* (O. E. Müller) Kuntze 1898: 419. Wynne 1969: 17, Figs. 6-8, Pls. 6-13.

Corio Bay area 25 (S19). E. bay areas 23 (S20), 55 (S15).

Epiphytic on *Zostera* in the upper sub-littoral zone and in shallow littoral pools.

**Punctaria** Greville

*Punctaria latifolia* Greville 1830: 52.

Corio Bay area 29 (S22). E. bay area 23 (S20).

Epiphytic on *Zostera*.

**Scytosiphon** C. Agardh

*Scytosiphon lomentaria* (Lyngbye) Link. Wynne 1969: 32, Pls. 14-17.

We have been unable to ascertain the date and place of publication.

N. bay area 6 (S16). Corio Bay areas 25 (S19), 26 (S2), 29 (S22). E. bay area 23 (S20).

Mainly in mid- and lower-eulittoral pools; occasionally lower-eulittoral zone and below on the platform.

Order LAMINARIALES

Family LESSONIACEAE

**Macrocystis** C. Agardh

*Macrocystis angustifolia* Bory 1826: 10. Womersley 1954a: 119, Pls. 2, 5-6.

Port Phillip Heads area 58 (S5, S10).

Characteristic of the upper sub-littoral zone; also in deep lower-littoral pools and occasional young plants in the sub-littoral fringe.

Family ALARIACEAE

**Ecklonia** Hornemann

*Ecklonia radiata* (C. Agardh) J. Agardh 1848: 146. Lindauer et al. 1961: 278, Pl. 7.

N. bay area 6 (S16). Corio Bay area 29 (S22). E. bay area 55 (S13, S15). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10). Upper sub-littoral zone within the bay, but at the Heads mainly in deep littoral pools. Also recorded for Ricketts Point and Altona.

Order FUCALES

Family DURVILLEACEAE

**Durvillea** Bory

*Durvillea potatorum* (Labillardière) Areschoug 1854: 343.

Port Phillip Heads area 58 (S5).

Characteristic of the sub-littoral fringe. Common outside the Heads region but not found within the bay.

Family HORMOSIRACEAE

**Hormosira** (Endlicher) Meneghini

*Hormosira banksii* (Turner) Decaisne 1842: 331. Lindauer et al. 1961: 320, Pls. 16, 25.

N. bay area 6 (S16). Corio Bay area 29 (S22). SW. bay area 42 (S21). E. bay area 23 (S20). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10). Characteristic of the lower eulittoral, although common in pools with epiphytic *Notheia anomala*. Apparently absent from the W. side of the bay.

## Family FUCACEAE

**Xiphophora** Montagne

*Xiphophora chondrophylla* (R. Brown ex Turner) Montagne ex Harvey 1855c: 215. Nizamuddin 1964: 1, Figs. 1, 3, 5-8.

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral and sub-littoral fringe; also in lower eulittoral pools.

## Family SEIROCOCCACEAE

**Phyllospora** C. Agardh

*Phyllospora comosa* (Labillardière) C. Agardh 1839: 311, Pl. 28, fig. 11. Nizamuddin 1968: 81, Figs. 1-18, Pl. 1.

Port Phillip Heads area 58 (S5, S10).

Common in the upper sub-littoral at the Heads; not recorded within the bay. Occasionally young plants occur in deep pools, and in the sub-littoral fringe.

## Family CYSTOSEIRACEAE

**Acrocarpia** Areschoug

*Acrocarpia paniculata* (Turner) Areschoug 1854: 336. Womersley 1964: 98, Fig. 42, Pl. 14 (2).

Port Phillip Heads area 58 (S10).

Confined to deep lower eulittoral pools on the outer edge of the reef.

**Caulocystis** Areschoug

*Caulocystis cephalornithos* (Labillardière) Areschoug 1854: 335. Womersley 1964: 102, Figs. 46-47, Pl. 16.

N. bay area 6 (S16). Corio Bay area 29 (S22). SW. bay area 42 (S21). E. bay area 23 (S20). Port Phillip Heads area 58 (S5, S10). Lower eulittoral pools, occasionally in the lower eulittoral and upper sub-littoral zones.

*Caulocystis uvifera* (C. Agardh) Areschoug 1854: 335. Womersley 1964: 101, Fig. 45, Pl. 15 (2).

Corio Bay area 27 (S17). SW. bay area 42 (S21). E. bay area 55 (S15). Port Phillip Heads area 58 (S10).

Lower eulittoral to upper sub-littoral, particularly with local shelter.

**Cystophora** J. Agardh

*Cystophora congesta* Womersley et Nizamuddin in Womersley 1964: 86, Fig. 30, Pl. 9 (2).

N. bay area 6 (S16). Port Phillip Heads area 58 (S10).

Lower eulittoral pools, and sub-littoral fringe.

*Cystophora moniliformis* (Esper) Womersley et Nizamuddin in Womersley 1964: 71, Fig. 6, Pl. 3 (1).

E. bay areas 23 (S20), 55 (S13). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Common in the sub-littoral fringe at the Heads, mainly upper sub-littoral within the bay; also in lower eulittoral pools.

*Cystophora polycystidea* Areschoug ex J. Agardh 1848: 240. Womersley 1964: 73, Figs. 10-11, Pl. 4 (2).

N. bay area 6 (S16). Corio Bay areas 27 (S17), 29 (S22).

Almost always in the upper sub-littoral zone, but occasionally in larger pools; also recorded for Werribee.

*Cystophora retorta* (Mertens) J. Agardh. 1848: 243. Womersley 1964: 92, Figs. 34-35, Pl. 11 (1-2).

N. Bay area 6 (S16). SW. bay area 42 (S21). E. bay areas 23 (S20), 55 (S13). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Characteristically in lower eulittoral pools, but also lower eulittoral channels, the sub-littoral fringe and the upper sub-littoral; also recorded for Werribee.

*Cystophora siliquosa* J. Agardh 1870: 445. Womersley 1964: 93, Fig. 36, Pl. 12 (1).

Port Phillip Heads area 58 (S5, S10).

Lower eulittoral zone and below; characteristic of the sub-littoral fringe under conditions of local shelter. Not recorded within the bay.

*Cystophora subfarinata* (Mertens) J. Agardh 1848: 240; Womersley 1964: 95, Figs. 38-40, Pl. 13.

SW. bay area 42 (S21). E. bay areas 23 (S20), 55 (S13). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Lower eulittoral and below; also in lower eulittoral pools.

*Cystophora torulosa* (R. Brown ex Turner) J. Agardh 1848: 243; Womersley 1964: 85, Figs. 28-29, Pl. 9 (1).

E. bay area 55 (S13). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Characteristic of the lower eulittoral at the Heads; upper sub-littoral within the bay.

Family SARGASSACEAE  
**Sargassum** C. Agardh

A number of species of this genus is common throughout the bay but is usually represented only by basal parts of the thallus. These are often common in the upper sub-littoral but never dominant.

*Sargassum decipiens* (R. Brown ex Turner) J. Agardh 1872b: 63. Womersley 1954b: 348, Fig. 1 (e-f), Pl. 4 (1).

Corio Bay area 29 (S22). SW. bay area 42 (S21). Port Phillip Heads area 58 (S5, S10).

Lower eulittoral and below; occasionally in lower eulittoral pools.

Phylum RHODOPHYTA  
 Order BANGIALES  
 Family BANGIACEAE  
**Bangia** Lyngbye

*Bangia fuscopurpurea* (Dillwyn) Lyngbye 1819: 83. Sommerfeld and Nichols 1970: 640, Figs. 1-28.

N. bay area 6 (S16). Corio Bay area 29 (S22). Port Phillip Heads area 58 (S10).

Upper eulittoral and into the littoral fringe.

**Porphyra** C. Agardh

*Porphyra* sp.

N. bay area 6 (S16). Corio Bay areas 25 (S19), 29 (S22). E. bay area 23 (S20). Small plants common in the mid-eulittoral, large plants in lower eulittoral and the upper sub-littoral; it is possible that these are two different species. Seasonally abundant June-December.

Order NEMALIALES  
 Family HELMINTHOCLADIACEAE  
**Helminthocladia** J. Agardh

*Helminthocladia australis* Harvey 1863, Pl. 272. Womersley 1965b: 470, Figs. 46-53, Pl. 5.

Port Phillip Heads area 58 (S10).  
 Mid-eulittoral pool.

*Helminthocladia dotyi* Womersley 1965b: 465, Figs. 23-31, Pl. 3 (2).

Port Phillip Heads area 58 (S5).  
 Common in patches, lower eulittoral.

**Helminthora** J. Agardh

*Helminthora australis* J. Agardh ex Levring 1953: 497, Figs. 27-30; Womersley 1965b: 461, Figs. 17-22, Pls. 2 (2), 3 (1).

Port Phillip Heads area 58 (S10).

Epiphytic on *Amphibolis antarctica*, in lower eulittoral pools and the upper sub-littoral.

**Liagora** Lamouroux

*Liagora harveyiana* Zeh 1912: 270; Womersley 1965b: 480, Figs. 63-69, Pl. 7 (1).

Port Phillip Heads area 58 (S5, S10).  
 Lower eulittoral and in pools.

*Liagora wilsoniana* Zeh 1912: 269; Womersley 1965b: 483, Figs. 70-75, Pl. 7 (2).

Port Phillip Heads area 58 (S5).  
 Lower eulittoral zone.

**Nemalion** Targioni-Tozzetti

*Nemalion elminthoides* (Velley) Batters 1902: 59. Womersley 1965b: 455, Figs. 1-9, Pl. 1.

Port Phillip Heads area 58 (S10).

Upper eulittoral zone attached to jetty piles.  
 Also recorded from Pt. Nepean and Mt. Eliza.

Family CHAETANGIACEAE  
**Galaxaura** Lamouroux

*Galaxaura marginata* (Ellis et Solander) Lamouroux 1816: 264 (Syn. *G. laxa* Kjellman 1900: 71).

Port Phillip Heads area 58 (S5).

Rare in pools in the sub-littoral fringe. Also recorded from lower-eulittoral pools.

Order GELIDIALES  
 Family GELIDIACEAE  
**Gelidium** Lamouroux

*Gelidium australe* J. Agardh 1872a: 30.

Port Phillip Heads area 58 (S5, S10).

Sub-littoral fringe and also lower-eulittoral pools.

*Gelidium glandulaefolium* J. D. Hooker et Harvey 1847: 406.

Port Phillip Heads area 58 (S5).

Lower-eulittoral zone in crevices.

*Gelidium pusillum* (Stackhouse) Le Jolis 1963: 139. N. bay area 6 (S16), Corio Bay areas 25 (S19), 27 (S17). E. bay area 23 (S20), Port Phillip Heads area 58 (S5, S10).

Mainly confined to the lower eulittoral but with isolated occurrences in the mid-eulittoral, particularly in crevices; often associated with *Galeolaria caespitosa*.

**Pterocladia** J. Agardh

*Pterocladia capillacea* (Gmelin) Bornet et Thuret 1876: 57.

Port Phillip Heads area 58 (S5).  
 Sub-littoral fringe.

## Order CRYPTONEMIALES

## Family SQUAMARIACEAE

**Ethelia** Weber-van Bosse

*Ethelia australis* (Sonder) Weber-van Bosse 1921: 300.

Recorded from Queenscliff.

## Family CORALLINACEAE

**Amphiroa** Lamouroux

*Amphiroa beauvoisii* Lamouroux 1816: 299; Hamel and Lemoine 1953: 42, Pl. 5 (1, 7).

E. bay area 55 (S15). Port Phillip Heads area 58 (S5).

Upper sub-littoral zone and culittoral zone pools.

**Corallina** Linnaeus

*Corallina officinalis* Linnaeus 1758: 805 (see Johansen 1969: 63). Johansen 1970, p. 79, Figs. 1, 3, 5-6, 9, 11.

N. bay area 6 (S16). Corio Bay area 29 (S22). E. bay areas 23 (S20), 55 (S13, S15). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Common in the lower eulittoral, sub-littoral fringe (at the Heads) and the upper sub-littoral, where occasionally dominant. Also lower culittoral pools.

**Haliptylon** (Decaisne) Johansen

*Haliptylon subulata* (Ellis et Solander) Johansen 1970, p. 79, Figs. 10, 12.

Port Phillip Heads area 58 (S5, S10).

Lower culittoral pools and channels, and the lower-culittoral zone.

**Jania** Lamouroux

*Jania fastigiata* Harvey 1847: 107.

Port Phillip Heads area 58 (S5, S10).

Shallow littoral pools; also the lower-culittoral zone and the sub-littoral fringe.

**Lithothamnion** Philippi

*Lithothamnion muelleri* Lenormand in Rosanoff 1866: 101, Pl. 6, figs. 8-11; see Foslie and Printz 1929: 43, Pl. 7 (1-10).

Epiphytic on *Amphibolis antarctica*.

*Lithothamnion* sp.

N. bay area 6 (S16). E. bay areas 23 (S20), 55 (S13, S15). S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

In pools and on the platform, lower eulittoral and below; often forming an almost complete cover in the upper sub-littoral where associated with *Corallina officinalis*.

**Metagoniolithon** Weber-van Bosse

*Metagoniolithon charoides* (Lamouroux) Weber-van Bosse 1904: 102, Pl. 15 (11).

Port Phillip Heads area 58 (S10).

Occasional in lower-culittoral pools.

*Metagoniolithon stelligerum* (Lamarck) Weber-van Bosse 1904: 103, Pl. 15 (9 and 13).

Port Phillip Heads area 58 (S5, S10).

Epiphytic on *Amphibolis antarctica* in lower-culittoral pools.

## Family CRYPTONEMIAEAE

**Grateloupia** C. Agardh

*Grateloupia filicina* var. *luxurians* A. et E. S. Gepp 1906: 259.

This variety of *Grateloupia filicina* (Lamouroux) C. Agardh 1822: 223 is abundant near sewerage outlets. A similar observation has been made in England (Farnham and Irvine 1968).

N. bay area 6 (S16). Corio Bay areas 16 (S23), 27 (S17), 29 (S22). Port Phillip Heads area 58 (S10).

Common in the lower eulittoral and upper-sub-littoral but at Queenscliff restricted to lower-culittoral pools. Also recorded for Ricketts Pt and Newport.

## Order GIGARTINALES

## Family GRACILARIACEAE

**Gracilaria** Greville

*Gracilaria verrucosa* (Hudson) Papenfuss 1950: 195.

Corio Bay area 27 (S17). SW. bay area 49 (S4). S. bay area 63 (S24).

Found in lower culittoral and below, also in shallow rock pools.

## Family PLOCAMIACEAE

**Plocanium** Lamouroux

*Plocanium augustum* (J. Agardh) J. D. Hooker et Harvey 1847: 404.

Port Phillip Heads area 58 (S5).

Occasional in lower-culittoral pools, and in the upper sub-littoral. Also recorded for Ricketts Pt.

*Plocanium leptophyllum* Kützing 1849: 885.

Port Phillip Heads area 58 (S5, S10).

Occasional in lower-eulittoral pools.

## Family RHABDONIACEAE

**Rhabdonia** Harvey

*Rhabdonia robusta* (Greville) J. Agardh 1851: 355.

Corio Bay areas 27 (S17), 29 (S22).

Found in the lower eulittoral and upper sub-littoral; also recorded for Ricketts Pt.

*Rhabdonia verticillata* Harvey 1863: Pl. 299.

Corio Bay area 27 (S17).

Occurs infrequently in the upper sub-littoral zone.

## Family HYPNEACEAE

**Hypnea** Lamouroux

*Hypnea* sp.

Corio Bay area 27 (S17).

Uncommon in the upper sub-littoral.

## Family MYCHODEACEAE

**Mychodea** Harvey

*Mychodea hamata* Harvey 1860: 323.

Port Phillip Heads area 58 (S10).

Pools and channels in the lower eulittoral.

## Family DICRANEMACEAE

**Dicranema** Sonder

*Dicranema grevillei* Sonder 1845: 56.

Port Phillip Heads area 58 (S5, S10).

Epiphytic on *Amphibolis antarctica*.

## Family ACROTYLACEAE

**Acrotylus** J. Agardh

*Acrotylus australis* J. Agardh 1849: 87.

Corio Bay area 29 (S2). Port Phillip Heads 58 (S10).

Uncommon in the lower eulittoral and upper sub-littoral.

## Family GIGARTINACEAE

**Gigartina** Stackhouse

*Gigartina brachiata* Harvey 1860: 325.

Corio Bay area 27 (S17).

Rare in upper sub-littoral.

**Rhodoglossum** J. Agardh

Both *Rhodoglossum foliiferum* (Harvey) J. Agardh 1876: 186 and *Rhodoglossum proliferum* J. Agardh 1885: 27 are recorded for Port Phillip Bay. Specimens collected on this survey are not easily assigned to either species, the limits of which are obscure and may even overlap.

Corio Bay areas 27 (S17), 29 (S22).

Common in upper sub-littoral and lower-eulittoral zones, particularly near waste outfall pipes. Also recorded for Altona and Werribee.

## Order RHODYMENIALES

## Family RHODYMENIACEAE

**Botryocladia** (J. Agardh) Kylin

*Botryocladia obovata* (Sonder) Kylin 1931: 18.

Port Phillip Heads area 58 (S5, S10).

Although common in the sub-littoral zone within the bay this species is restricted at the Heads to lower-eulittoral pools and channels.

**Gloioderma** J. Agardh

*Gloioderma wilsoni* (J. Agardh) De Toni 1900: 496 as *G. wilsoni*.

Port Phillip Heads area 58 (S5).

Rare in lower eulittoral pools.

**Hymenocladia** J. Agardh

*Hymenocladia sanguinea* (Harvey) Sparling 1957: 370, Pl. 58 (a-e).

Characteristically epiphytic on *Codium galeatum* in the Port Phillip Heads region.

## Family LOMENTARIACEAE

**Champia** Desveaux

*Champia affinis* (J. D. Hooker et Harvey) J. Agardh 1876: 304.

SW. bay area 42 (S21).

Epiphytic on *Zostera* in the lower eulittoral.

*Champia tasmanica* Harvey 1844a: 407, Pl. 19.

Port Phillip Heads area 58 (S10).

Occasional in lower-eulittoral pools.

## Order CERAMIALES

## Family CERAMIACEAE

**Amoenothamnion** Wollaston

*Amoenothamnion planktonicum* Wollaston 1968: 377, Fig. 35 (D-Q), Pl. 10.

Port Phillip Heads area 58 (S10).

Lower-eulittoral pools.

**Antithamnion** Nägeli

*Antithamnion hanowioides* (Sonder) De Toni 1903: 1398. Wollaston 1968: 295, Fig. 19.

Port Phillip Heads area 58 (S10).

Lower-eulittoral pools.

**Ballia** Harvey

*Ballia callitricha* (C. Agardh) Kützing 1843: 293. Wollaston 1968: 308, Fig. 21 (A-I).

Port Phillip Heads area 58 (S5).

Sub-littoral fringe and the upper sub-littoral zone; also recorded from Queenscliff.

*Ballia scoparia* (J. D. Hooker et Harvey) Harvey  
1860: 333. Wollaston 1968: 317, Fig. 23 (A-L).

Port Phillip Heads area 58 (S5, S10).

Common in the sub-littoral fringe and the upper sub-littoral zone; occasional in lower-eulittoral pools.

#### **Bornetia** Thuret

*Bornetia* sp.

Port Phillip Heads area 58 (S10).

Lower-eulittoral pools.

#### **Callithamnion** Lyngbye

Although *Callithamnion* species occur throughout the bay, none was recorded in this survey.

#### **Centroceras** Kützing

*Centroceras clavulatum* (C. Agardh) Montagne  
1846: 140. Hommersand 1963: 241, Figs. 29-30a.

N. bay area 6 (S16). Corio Bay areas 16 (S23), 27 (S17), 29 (S22). Port Phillip Heads area 58 (S10).

Occurs throughout the bay as a conspicuous component of the lower eulittoral.

#### **Ceramium** Roth

*Ceramium* spp.

Corio Bay area 27 (S17). SW. bay areas 42 (S21), 49 (S4). E. bay area 23 (S20). Port Phillip Heads area 58 (S10).

Lower eulittoral and below.

#### **Crouania** J. Agardh

*Crouania* sp.

Port Phillip Heads area 58 (S10).

Uncommon in the sub-littoral fringe.

#### **Griffithsia** C. Agardh

Several unidentified species of *Griffithsia* are recorded for Port Phillip.

*Griffithsia teges* Harvey 1855a: 559.

Recorded for Newport and Point Nepean. Occasionally in drift in the N. bay.

#### **Haloplegma** Montagne

*Haloplegma preissii* (Harvey) Sonder 1846: 171.

Recorded for Queenscliff.

#### **Lophothamnion** J. Agardh

*Lophothamnion comatum* J. Agardh 1892: 43.

Port Phillip Heads area 58 (S5).

Common in shallow littoral pools.

#### **Corynospora** J. Agardh

*Corynospora griffithsioides* (Sonder) Kylin 1956: 583.

Corio Bay area 27 (S17).

Occasional in the upper sub-littoral; also recorded for Werribee.

#### **Ptilocladia** Sonder

*Ptilocladia pulchra* Sonder 1845: 53.

Recorded for Queenscliff and Point Nepean.

#### Family DELESSERIACEAE

##### **Acrosorium** Zanardini in Kützing

*Acrosorium uncinatum* (Turner) Kylin 1924: 78, Fig. 61.

Corio Bay area 29 (S22). SW. bay area 42 (S21). Port Phillip Heads area 58 (S10).

Commonly epiphytic, particularly on *Zostera*; also a conspicuous component of drift on the W. margin of the bay.

##### **Caloglossa** (Harvey) J. Agardh

*Caloglossa lepreurii* (Montagne) J. Agardh 1876: 499. Papenfuss 1961: 8, Figs. 1-30.

Corio Bay areas 25 (S19), 26 (S2).

Occurs in the mid- and lower-eulittoral mixed with *Galeolaria caespitosa*. This species is generally regarded as characteristic of salt marsh, commonly attached to mangrove pneumatophores, e.g. as at Tooradin, Western Port Bay, Vic.

##### **Phytomphora** J. Agardh

*Phytomphora amansioides* (Sonder) Womersley 1965a: 436.

Port Phillip Heads area 58 (S10).

Occasional, epiphytic in the sub-littoral fringe.

#### Family DASYACEAE

##### **Dasya** C. Agardh

*Dasya capillaris* J. D. Hooker et Harvey in Harvey 1847: 60, Pl. 19.

Corio Bay area 27 (S17). SW. bay area 42 (S21).

Upper sub-littoral zone; also recorded from Swan Bay.

*Dasya villosa* Harvey 1844b: 433.

Often found in drift throughout the bay.

#### Family RHODOMELACEAE

##### **Brongniartella** Bory

*Brongniartella australis* (C. Agardh) Schmitz 1893: 218.

Recorded in the upper sublittoral at Altona and Werribee; also in drift.

**Coeloclonium** J. Agardh

*Coeloclonium opuntioides* (Harvey) J. Agardh 1876: 640.

Common in drift at St. Leonards, Queens-cliff and Pt Neapean.

**Dictyomenia** Greville

*Dictyomenia tridens* (Martens ex Turner) Greville, 1830; synop. LI.

Corio Bay area 27 (S17).

Epizooic on *Pyura* in the lower-eulittoral zone.

**Laurencia** Lamouroux

*Laurencia botryoides* (Turner) Gaillon 1828: 363.

Port Phillip Heads area 58 (S5).

Occasional plants throughout the lower eulittoral.

*Laurencia elata* (C. Agardh) Harvey 1847: 81, Pl. 33 (b).

Port Phillip Heads area 58 (S5, S10).

Occurs mainly in the sub-littoral fringe, but also in lower eulittoral pools.

*Laurencia heteroclada* Harvey 1855a: 544. Cribb 1958: 175, Pl. 10, figs. 1-11, Pl. 13, fig. 4.

SW. bay area 42 (S21). E. bay area 55 (S13). Port Phillip Heads area 58 (S5, S10).

Lower-eulittoral zone; also in the sub-littoral fringe and pools. Young *Laurencia* plants which are possibly *L. heteroclada* are found throughout the bay.

*Laurencia tasmanica* J. D. Hooker et Harvey in Harvey 1847: 84.

Corio Bay area 29 (S22). SW. bay area 42 (S21). Lower eulittoral.

**Lenormandia** Sonder

*Lenormandia prolifera* (C. Agardh) J. Agardh 1863: 1103.

Port Phillip Heads area 58 (S5, S10).

Sandy lower-eulittoral pools and channels.

**Lophurella** Schmitz

*Lophurella pericladus* (Sonder) Schmitz in Schmitz and Falkenberg 1897: 441.

Corio Bay area 29 (S22). Port Phillip Heads area 58 (S5, S10).

Lower eulittoral and below.

**Polysiphonia** Greville

*Polysiphonia* spp.

N. bay area 6 (S16). Corio Bay areas 16 (S23), 27 (S17), 29 (S22). SW. bay areas 42 (S21), 49 (S4). E. bay area 23 (S20). Port Phillip Heads area 58 (S10).

Common in association with *Centroceras clavulatum* in the lower eulittoral.

*Polysiphonia blandi* Harvey 1862: Pl. 184.

Port Phillip Heads area 58 (S10).

Lower eulittoral, at higher levels on outer edge of the platform.

**Protokützingia** Falkenberg

*Protokützingia australasica* (Montagne) Falkenberg in Schmitz and Falkenberg 1897: 469.

Corio Bay area 29 (S22).

Uncommon in the upper sub-littoral and lower eulittoral.

Phylum CYANOPHYTA

Order NOSTOCALES

Family OSCILLATORIACEAE

**Lyngbya** C. Agardh ex Gomont

*Lyngbya* sp.

Corio Bay area 27 (S17).

Covering rocks in upper eulittoral.

Family RIVULARIACEAE

**Calothrix** C. Agardh

*Calothrix confervicola* (Roth) C. Agardh 1824: 70.

Epiphytic on *Myriogloia sciurus*.

**Rivularia** C. Agardh

*Rivularia firma* Womersley 1946: 130, Fig. 2 (a,b).

S. bay area 63 (S24).

Uncommon in the mid-eulittoral. Also recorded for Pt Neapean.

Phylum CHRYSOPHYTA

Order PRYMNESIALES

Family PHAEOCYSTACEAE

**Phaeocystis** Lagerheim

*Phaeocystis giraudii* (Derbès et Solier) Lagerheim 1893: 32.

SW. bay area 49 (S4).

Colonies epiphytic and free floating in *Zostera* beds, during winter months.



## LICHENS

**Lichina** C. Agardh

*Lichina confinis* (Müller) C. Agardh 1820: 105.

S. bay area 63 (S24). Port Phillip Heads area 58 (S5, S10).

Littoral fringe but also in the upper eulittoral under sheltered conditions.

## ANGIOSPERMAE (Flowering Plants)

## MONOCOTYLEDONEAE

## Family ZOSTERACEAE

*The Sea Grasses of the World* Den Hartog (1970), covers most of the taxa listed below.

**Zostera** Linnaeus

*Zostera muelleri* Irmisch ex Ascherson 1867: 168.

N. bay area 6 (S16). Corio Bay areas 25 (S19), 27 (S17), 29 (S22). SW. bay areas 42 (S21), 49 (S4). E. bay area 23 (S20). Port Phillip Heads area 58 (S10).

Common in lower eulittoral and upper sublittoral on flat, sandy or muddy areas; also in shallow sandy or muddy pools. Often densely covered with epiphytes.

## Family RUPPIACEAE

**Ruppia** Linnaeus

*Ruppia maritima* Linnaeus 1753: 127.

SW. bay area 49 (S4).

In upper sub-littoral associated with *Zostera* and *Lepilaena cylindrocarpa*.

## Family ZANNICHELLIACEAE

**Amphibolis** C. Agardh

*Amphibolis antarctica* (Labillardière) Sonder et Ascherson ex Ascherson 1867: 164.

Port Phillip Heads area 58 (S5, S10).

Occurs in shallow, sandy lower-eulittoral pools and channels, and in the sub-littoral zone. This species is not recorded in the sheltered waters of the bay.

**Lepilaena** Drummond ex Harvey

*Lepilaena cylindrocarpa* (Körnicke ex Walpers) Benth 1878: 180.

SW. bay area 49 (S4).

## DICOTYLEDONEAE

## Family CHENOPODIACEAE

**Salicornia** Linnaeus

*Salicornia quinqueflora* Bunge ex Ungern-Sternberg 1866: 59.

(Syn. *S. australis* Solander ex Benth 1870: 205).

N. bay area 6 (S16). Corio Bay area 27 (S17). SW. bay area 49 (S4). E. bay area 23 (S20).

This typical salt marsh plant seems to be capable of existence in small pockets of soil in the top of the upper-eulittoral zone.

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