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PORT PHILLIP SURVEY 1957–1963.

VEGETATION.

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Summary

A brief historical account is given of the botanical collections, followed by discussion of the vascular flora and mosses living within the marine influence. This encompasses terrestrial and salt-marsh vegetation and submarine angiosperms. Lists of species and appropriate literature references are appended.

Introduction

Except for some historical references, the present account is concerned only with indigenous vascular plants and mosses that occur either in the water or along the bounding coastline of Port Phillip—a lineal distance of approximately 152 miles. The marine algae form the subject of a separate paper by a specialist in this group. If Bay-side vegetation be limited to those plants growing only within the influence of salt water (including high tides and driven spray), then the vascular flora would barely exceed 120 species; but a strip of land one mile wide all around the shore would embrace representatives of at least 550 species.

COLLECTORS AND INVESTIGATORS

No plant had been seen by white men on the terrain that is now Victoria before George Bass landed at Wilson Promontory in January, 1798, and James Grant visited Western Port in March, 1801, but there is a lack of evidence that either party collected botanical specimens. However, within four months of John Murray's discovery of Port Phillip Bay, on 5th January, 1802, Captain Matthew Flinders also sailed through The Heads accompanied by a botanical genius, Robert Brown.

During the week that H.M.S. INVESTIGATOR surveyed the southern parts of Port Phillip, Brown made the second recorded collection of Victorian plants. For the first collection credit must go to the French botanist, M. Leschenault de la Tour, who spent several days at Western Port with Captain Emmanuel Hamelin's party on LE NATURALISTE at the beginning of April, 1802, thus forestalling the discoveries of the Englishmen in Port Phillip by only a few days. Leschenault was impressed by the fertile appearance of the Western Port coasts, but said: "The number of plants which I gathered is not great." Robert Brown ascended Arthur's Seat (27th April, 1802), and examined the vegetation of Point Nepean peninsula, but was not present when Flinders and three crewmen climbed Station Peak (You Yangs) on May 1st. Brown returned to Port Phillip for another week's botanizing early in 1804, and he left for Hobart on the LADY NELSON (27th January) with the last party of evacuees from

Lieutenant David Collins's unsuccessful attempt to establish a settlement near Sorrento. It was unfortunate that Brown's only two sojourns on Victorian soil—both brief—should have been during summer and late autumn when floral activity was at a minimum; but among his trophies on the latter occasion was the showy Blue Pincushion (*Brunonia australis*) in a new monotypic genus bearing the Latinized form of the great collector's name. While the full extent of these earliest Victorian plant collections remains unknown, there is evidence that Brown either gathered from or noted about 100 species at Port Phillip; the type material of eighteen new species was involved, and his actual specimens of no less than 23 Port Phillip species are housed in the National Herbarium of Victoria (at South Yarra).

Neither surveyor Charles Grimes, who discovered the Yarra River (January, 1803), nor Hamilton Hume and William Hovell, who trekked overland from near Albury to Corio Bay (November–December, 1824), made any plant collections. But Ronald Gunn collected during "a short visit to the south coast of New Holland in March, 1835" and in 1842 he published some observations on the flora of Geelong district—based on 100 species, of which only the genera are listed completely. This, apparently, was the first reference published in Australia to the plant-life of the Port Phillip region. James Backhouse, a visiting Quaker missionary, spent ten days in and around Melbourne during November, 1837; his narrative (published in 1843) certainly refers to several trees noted near the Yarra River mouth, but his contribution to early Victorian botany was negligible.

In the early 1840's Charles Joseph LaTrobe, Superintendent of the Port Phillip District and founder of Melbourne's Royal Botanic Gardens, interested himself in the local flora. Specimens of at least fourteen species, that he gathered on the heathlands between Melbourne and Brighton, are now represented in the Neuchatel Herbarium, western Switzerland. Also, between 1840 and 1855 an early Melbourne settler, F. M. Adamson, sent plant specimens to Sir William Hooker at Kew, England; some were from the shores of Port Phillip. In 1851 Daniel Bunce published a list of 201 species of the Victorian flora, including many from Port Melbourne, Brighton and other parts of the Bay.

Up until 1852, virtually all botanical (and other) collections had been taken out of the Colony to museums overseas; but the arrival from Adelaide, in August that year, of Dr. Ferdinand J. H. Mueller ushered in a new era for phytological research. Bringing with him a large private herbarium of European and South Australian collectings, also a useful reference library, young Mueller received the appointment of first Colonial Botonist on 26th January, 1853. Thereafter he threw himself into a survey of the country's flora with such zeal and efficiency that, within a decade, little remained anywhere for succeeding botanists to discover.

By 1861 this phenomenal man had built up in Melbourne a herbarium of 160,000 specimens that was long to remain the largest by far in the southern hemisphere. During 1862 appeared the first (and only complete) volume of his elaborate, illustrated PLANTS INDIGENOUS TO THE COLONY OF VICTORIA; a few species were quoted as from Port Phillip. In April, 1863, after just ten years in the Victorian Public Service, Mueller claimed that "the botanical investigation of the territory of our colony is now nearly completed"; and of course his investigation included most

of the species now known to occupy the coasts of Port Phillip. Up to the 1880's, botanical inquiry in Victoria became almost synonymous with Mueller's own activity in field and herbarium.

Of the very few other workers during the 25 year period 1853–78, mention may be made of Samuel Hannaford who brought out (1856) a catalogue of the Colony's commoner plants, and of Fanny A. Charsley whose 58 lithographic plates of Melbourne wildflowers in colour (1867) contained several undoubtedly coastal species, three being exclusively so.

G. H. Adcock's "Census of indigenous plants of the Geelong District" (1897), was probably the best attempt, until then, at a local flora in the Colony—with the possible exception of D. Sullivan's "Native Plants of the Grampians and Vicinity" which ran as a series through volumes 2 and 3 (1882–83) of the SOUTHERN SCIENCE RECORD, but which listed only ORCHIDACEAE among the monocotyledons. Dr. C. S. Sutton broke new ground in 1911 and 1912 by publishing the first ecological account of a major plant formation on the Bay-side: his "Notes on the Sandringham Flora" gave a detailed and informative account of Greater Melbourne's heath formation, with complete list of constituent species. In 1916 appeared Sutton's complementary and equally valuable contribution, "A Sketch of the Keilor Plains Flora"; this covered the basaltic terrain bounding the western side of the Bay. Both papers were published through the VICTORIAN NATURALIST, and drew attention to the alarming rate at which these tracts of vegetation were then disappearing. A warning of what was to come had already been sounded 30 years before by an anonymous writer in the SOUTHERN SCIENCE RECORD (Vol. 2, June, 1882):

> "Ominous signs of advancing settlement present themselves daily. Great notice-boards announcing sales of large areas, surveyors' pegs, landmarks and snobbishly-worded notices regarding trespassers, all justify the conviction that the once famous Brighton heath-grounds will shortly become a thing of the past. The collector will therefore do well to keep what specimens he finds, . . . in a few years these districts will be to the collector as a sealed book."

T. S. Hart's close acquaintance with the plant-life of Port Phillip is evident in several other papers to the Victorian Naturalist, notably on the protective value of coastal plants (1914) and a survey of the original extent of Yellow Box, *Eucalyptus melliodora*, near Melbourne (1939). In Professor A. J. Ewart's long-awaited FLORA OF VICTORIA (1931) sundry species are ascribed to the sandy heathlands and basalt plains adjoining Port Phillip. The latest and most advanced treatment of the vascular vegetation has been Dr. R. T. Patton's series of four important ecological studies—Cheltenham flora, coastal sand dunes, basalt plains and salt marsh—published between 1933 and 1942.

Meanwhile, the marine algae were not being neglected. The eminent phycologist, Professor W. H. Harvey of Trinity College, Dublin, spent four months in Victoria between August, 1854, and January, 1855, his chief collecting places on Port Phillip being at Brighton, Geelong and Queenscliff. These localities appear among others in the five volumes of his monumental PHYCOLOGIA AUSTRALICA ((1858–1863). S. Hannaford also collected some algae at Queenscliff and around Geelong between 1857 and 1863. During this period Mr. H. Watts provided observations and details of new species for Harvey's works and continued to investigate Port Phillip seaweeds into the 1880's, giving a number of algal lectures to the Victorian Field Naturalists' Club of which he was an early president.

Dr. J. Bracebridge Wilson who organized the collection of marine specimens for the biological survey of Port Phillip, from its inception in 1888 until his death in 1895, was an assiduous algologist; his dried material at Melbourne Herbarium spans the period 1879–95, and most of it came from near The Heads. Wilson's chief literary contribution was a "Catalogue of Algae collected at or near Port Phillip Heads and Western Port" (1892). Phycological researches were further advanced by H. T. Tisdall (1898 and 1900) and Profesor A. H. S. Lucas (1919 and 1931), while H. B. S. Womersley (1956, &c.) has more lately published numerous articles in which the seaweed flora of Port Phillip is involved.

R. A. Bastow gathered bryophytes and lichens—now in Melbourne Herbarium—from the Bay-side coasts at the turn of last century (1892–1905), while Dr. Ethel McLennan and Sophie Ducker have done pioneering work (1956) among the smaller soil fungi of heathlands.

MAJOR PLANT COMMUNITIES

Plates I–II.

The geological formations of the Port Phillip shore-line are varied, including as they do beach sand, dunes, calcareous eolianite cliffs, fluviatile sand (sometimes impregnated with iron and consolidated, forming bluffs where eroded by the sea), granite headlands, stony basalt plains and depositions of river alluvium. The rainfall varies from less than 17 inches per annum near Little River in the central-western sector of the Bay to 30 inches at Dromana in the south-east. Such diversity in climate and soil-types is reflected in the physiognomy and composition of the flora from place to place: there is grassland, woodland or open forest, heath, salt-marsh, also smaller aquatic, rheophytic, dune and cliff communities.

By far the two most extensive formations were the heath on deep fluviatile sand, stretching along the whole eastern coast from the mouth of the Yarra to Sorrento, and the grassland of the drier western basalt plains (between Newport and Geelong). Both have been discussed in detail by Patton (1933 and 1935).

The typical open heath, of ericoid shrubs in many plant families, blended often with a woodland in which the prevailing tree was a stunted form of *Eucalyptus viminalis* (the variety *racemosa*, principal food-plant of koalas near the coast). *E. ovata* was frequent on wet flats, accompanied by *E. camaldulensis* with increasing clay content in soils marginal to the heathland; extensive swampy areas, as at Carrum, were dominated by dense thickets of the paperbark, *Melaleuca ericifolia*, with associate aquatic herbs. There is evidence that the tea-tree, *Leptospermum laevigatum* (Pl. 1, fig. 1), an attractive and characteristic coastline tree all along the eastern side of Port Phillip, has been invading some areas of open heathland and reducing the species composition. In association with *Banksia integrifolia*, *Acacia longifolia* (var.), *Styphelia parviflora* and *Myoporum insulare*, it may frequently form a closed canopy, overhung by such creepers as *Tetragonia implexicoma* and *Clematis microphylla* and providing bower-like habitats for a few tender shade-loving species (including corticolous bryophytes and lichens, also fungi).

The heath proper was extremely rich in species, notably in the orchid, wattle, pea and epacrid groups, its facies at flowering time (July to October) recalling the colourful display of a West Australian sand-plain. Unfortunately this very attractive belt of vegetation, so interesting to the botanist, has been all but exterminated through suburban housing, draining of swamps and agricultural developments. The few inadequate and pathetic selvages that remain are being inexorably ruined by aggressive weeds that thrive on disturbed ground (e.g., alien species of *Briza, Ehrharta, Watsonia, Phytolacca, Oxalis, Salpichroa, Coprosma, Senecio* and *Chrysanthemoides*).

The basalt grasslands on the western side have also been profoundly altered through grazing, building operations and the influx of numerous weeds, (e.g., *Avena, Bromus, Diplotaxis, Trifolium, Lycium, Arctotheca, Cynara, Tragopogon* and many other members of Compositae). This tract of grassland was quite deficient in shrubs and very much poorer in species than the heath, to which it formed a striking contrast—the two formations were separated by salt-marsh and riparian scrub at the mouth of the Yarra.

Small occurrences of mangrove (*Avicennia marina*) accompanied the halophytic vegetation under tidal influence in Swan Bay and at the mouth of Kororoit Creek (near Seaholme), but *Avicennia* was virtually destroyed at the latter place by a thick deposit of oil discharged into the Bay about June, 1950—see comments by Willis (1951), and Fawcett (1951). Dominants of the saline marsh (pl. I, fig. 2) are chiefly members of the *Chenopodiaceae* (viz., succulent species of *Arthrocnemum, Salicornia* and *Suaeda*), but *Disphyma* (pl. II, fig. 1), *Frankenia, Wilsonia* and *Selliera* may each form extensive almost pure societies. This formation keeps remarkably free of weeds, *Atriplex hastata* being one of the few successful alien intruders. Patton has dealt with the coastal salt-marsh "in extenso" (1942), and also with the sand dune flora (1935)—a pioneer community of relatively few hardy species and some weeds (e.g., *Lagurus, Melilotus, Arctotis*). Marram Grass (*Ammophila arenaria*) has been deliberately planted on some unstable dunes to prevent sand drift.

Even more limited is the strand flora on beach sand within the influence of high tides. Only about seven species are concerned in this zone, the most interesting component being probably Coast Spinifex or Silver Grass (*Spinifex hirsutus*) (Pl. II, fig. 2) which sends its robust cord-like rhizomes for yards across the bare sand. Sea Wheat-grass, *Agropyron junceum*, is an introduction that occasionally serves to stabilize sand washed by high tides; it has been noted at Beaumaris, Seaholme, St. Leonards and Queenscliff. *Atriplex cinerea* and two species of *Cakile* (Sea Rocket) have a remarkable capacity for rapid colonization of loose beach sand.

The cliffy sections of the Bay exhibit a varied assortment of shrubs and herbs, some being confined to such habitats as are within reach of blown spray, e.g., *Alyxia buxifolia* and *Calocephalus brownii*. (Pl. II, fig. 2.) Many plants encroach onto sea-cliffs from the surrounding formations, notably heathland; and it is sometimes difficult to decide whether a particular species is to be regarded as an intruder or a natural component of the cliff flora. Some eucalypts and acacias are undoubtedly intruders, although they may reach the cliff-edge—perhaps through natural erosion

by the sea. Probably the rarest among Port Phillip's cliff-dwellers is *Lasiopetalum baueri*, of which only two old bushes are now known to survive (at Red Bluff, Sandringham).

SUBMARINE FLOWERING PLANTS

Of peculiar interest are the four species of phanerogams, all rhizomic monocotyledons, that grow permanently submerged in shallow sea-water. They comprise the two grass-wracks (*Zostera muelleri* and *Z. tasmanica*), sea-wrack (*Halophila ovalis*) and sea nymph (*Cymodocea antarctica*) which range widely along Australian shores. *Zostera muelleri* has been recorded from temperate waters of all States and also New Zealand, *Z. tasmanica* from South Australia, Victoria, Tasmania and New Zealand. *Halophila* is much more widespread, being known from all States, extending to tropical northern coasts and occurring also beyond Australia in parts of the Indian and western Pacific Oceans. *Cymodocea*, by contrast, is restricted to southern coasts of every State except Queensland. Mixed with various algae, detached fragments of these marine plants are often piled up on adjacent beaches during storms. In Port Phillip such drift material may often consist entirely of grass-wrack. (*Zostera*.)

The two *Zostera* species are grass-like plants with very narrow, flaccid, ribbony leaves, 1·5—5·0 mm. wide and from under 1 foot to nearly 3 feet long. *Z. muelleri* (leaves less than 1 foot long and 2 mm. wide) is commoner in the Bay than *Z. tasmanica;* but distributions overlap, and together these populations are dominant over a surprisingly large area of sandy shallows. From the accompanying map Chart 3 (back of volume), carefully prepared by Miss J. Hope Macpherson, their chief concentrations will be seen to extend around the north and south shores of Corio Bay, throughout the whole of Swan Bay and from thence northward to Indented Head, with detached occurrences off Mud Island, Rye, the Werribee River estuary and Altona. The whole eastern shoreline has only a few small, isolated and inconsequential beds of *Zostera*; but, at a conservative estimate, the total area of Port Phillip covered by grass-wrack would be at least 47 square miles.

Intimately associated as they are with inshore fisheries, the submarine "meadows" of *Zostera* are ecologically and economically important. E. J. Ferguson Wood (1959) has suggested that *Zostera* requires good illumination and does not thrive in turbid water. Consequently, it occurs mainly in shallows, from low water line to about 5 feet, and it may even be exposed to the air for a few hours during exceptionally low tides. About $1\frac{1}{2}$ miles east of Indented Head, however, grass-wrack beds extend out beyond the 5-fathom line to where the sea-floor begins to slope more abruptly toward 10 fathoms (at $1\frac{7}{8}$ miles). This occurrence, at depths exceeding 30 feet, must mark the absolute limit of low-illumination tolerance. After flowering has finished, at the end of summer, practically all foliage is shed; so, *Zostera* flats may appear to be quite bare during autumn and winter, although the subterranean rhizomes persist. Black swans are known to cause serious denudation of *Zostera* communities by tearing up the rhizomes over large areas (q.v. Wood, 1959). Owing to a complete lack of any previous information on the size and distribution

of these grass-wrack beds, it is not possible to say whether the extent of present occurrences indicates a recession, an expansion or a virtually static situation.

Halophila, with its oval or oblong leaf-blades (to 3 inches long) in pairs at each node of the rhizome, presents a very different picture. Generally speaking, it is submerged in deeper water than *Zostera* and will tolerate illuminations as low as 5—10% of the light intensity in surface layers. In Port Phillip *Halophila* occupies only a small fraction of the area covered by *Zostera*, occurring chiefly as narrow selvages along the outward fringe of *Caulerpa* (green algae) and *Zostera* beds; but this pattern may merely reflect an inability of *Halophila* to compete successfully with the other genera in shallower water.

Distribution of sea-wrack is practically confined to the western side of the Bay—from a belt $\frac{1}{2}$ mile offshore and parallel to the eastern coast of Bellarine Peninsula to a longer zone 3–4 miles off the mouth of Werribee River, Corio Bay supporting several smaller occurrences. The range of *Halophila* is indicated on the map by finer, denser dotting.

Cymodocea is distinguished by its hard. wiry, naked stems (6–24 inches long) that carry a terminal cluster of shiny, distichous, broadly linear and truncated leaves, each 1–2 inches long. The reproductive mechanism is obscure but highly intriguing. Minute male and female flowers lie concealed within separate leaf-bases, and the pollen is extruded into sea-water as thread-like or vermiform cells, some of which reach the exserted filiform stigmas of female flowers. Bracts surrounding the latter enlarge in fruit to form a rigid cup (about 10 mm. wide) with four curved and comb-like lobes that serve effectively to anchor the embryo plant. Sea nymph, although usually growing on sand or mud beyond low water mark, may also favour rock pools in shallower water. Frequently the stems and foliage are encrusted with epiphytic growths of polyzoa and various algae. This plant is confined to the southern waters in Port Phillip, near The Heads, and the few areas that support it are too small to be mapped. However, in the Bunbury–Busselton area (West Australia) *Cymodocea* becomes a dominant marine plant in large beds, whence it is washed ashore to form pure drifts up to 6 feet wide and deep on the beaches of Geographe Bay.

Submarine flowering plants were collected during the course of the biological survey of Port Phillip Bay from the following localities. These are recorded as Areas with the station number in brackets immediately following:—

Zostera sp. Areas 5 (167–168); 6 (118); 10 (15); 16 (142–143); 26 (126–300); 27 (139); 28 (140); 39 (42–46, 313); 40 (101); 42 (264–5, 281, 288); 43 (263–303); 50 (229, 230, 233, 238, 267); 51 (250); 58 (89, 90–1, 150); 59 (214, 226); 60 (230–268); 61 (239); 66 (291); 68 (155, 158).

Halophila ovalis Areas 10 (14); 18 (62, 186, 307); 26 (300); 28 (141, 315); 39 (45); 40 (101); 42 (265); 50 (229, 267).

Cymodocea antarctica. Areas 43 (263); 50 (266); 58 (150–2); 59 (214); 66 (291).

Position of Areas and stations are shown on Charts 1 and 2 (back of volume).

Chart 1 is a bathymetric chart plotted from Admiralty Chart 1171 Port Phillip, with the numbered Area grid superimposed.

Chart 2 shows position of the stations numbered 1–317, with the same grid super-imposed to aid in location of the stations and for correlation with depth, &c. Table A (back of volume) records station number, date, area, method of collecting (dive or dredge) and depth in fathoms.

LIST OF VASCULAR SPECIES GROWING WITHIN THE INFLUENCE OF SALT WATER OR SPRAY.

(Arrangement is systematic, following the scheme of Engler & Prantl, 1887–1902.)

A. Submerged in sea water (4 species).

Zostera muelleri Irmisch ex Aschers.
Zostera tasmanica G. Martens ex Aschers.
Cymodocea antarctica (Labill.) Endl.
Halophila ovalis (R.Br.) Hook f.

B. Strand vegetation, on beach sand (7 species):

Spinifex hirsutus Labill.
Carex pumila Thunb.
Atriplex cinerea Poir.
Salsola kali L.
Tetragonia tetragonioides (Pallas) O. Kuntze
Cakile edentula (Bigel) Hook. subsp. *californica* (Heller) Hult.
Cakile maritima Scop. subsp. *integrifolia* (Hornem.) Hyland.

C. Salt-marsh and saline mud flats (43 species).

Ruppia maritima L.
Lepilaena preissii (Lehm.) F. Muell.
Lepilaena cylindrocarpa (Körnicke) Benth.
Triglochin striata Ruiz & Pav.
Triglochin mucronata R. Br.
Triglochin minutissima F. Muell.
Puccinellia stricta (Hook. f.) C. Blom.
Distichlis distichophylla (Labill.) Fassett
Zoisia macrantha Desv.
Sporobolus virginicus (L.) Kunth.
Scirpus cernuus Vahl.
Schoenus nitens (R.Br.) Poir.
Gahnia filum (Labill.) F. Muell.
Centrolepis polygna (R.Br.) Hieron.
Juncus maritimus Lam.
Juncus bufonius L.
Hemichroa pentandra R. Br.
Chenopodium glaucum L.
Atriplex paludosa R. Br.
Arthrocnemum arbuscnlum (R. Br.) Moq.
Arthrocnemum halocnemoides Nees. var. *pergranulatum* J. M. Black. J. M. Black.
Salicornia australasica (Moq.) Hj. Eichler
Salicornia blackiana Ulbrich.
Suaeda australis (R. Br.) Moq.
Disphyma australe (Soland.) J. M. Black.
Sagina apetala L.
Spergularia media (L.) C. Presl.
Plagianthus spicatus (Hook.) Benth.
Frankenia pauciflora DC.
Hydrocotyle medicaginoides Turcz.
Samolus repens (Forst. & Forst. f.) Pers.
Limonium australe (R.Br.) Kuntze
Sebaea albidiflora F. Muell.
Wilsonia humilis R. Br.
Wilsonia rotundifolia Hook.
Wilsonia backhousei Hook. f.
Avicennia marina (Forst.) Vierh. var. *resinifera* (Forst.) Backh.
Mimulus repens R. Br.
Pratia platycalyx (F. Muell.) Benth.
Selliera radicans Cav.
Brachycome graminea (Labill.) F. Muell.
Cotula vulgaris Levyns var. *australasica* J. H. Wilhs.
Angianthus preissianus (Steetz) Benth.

D. Dunes and sea-cliffs (68 species).

Pteridium esculentum (Forst.f.Nakai).
Poa poiformis (Labill.) Druce
Festuca littoralis Labill.
Dichelachne crinita (L.f.) Hook. f.
Agrostis billardieri R. Br.
Danthonia geniculata J. M. Black.
Stipa elegantissima Labill.
Stipa teretifolia Steud.
Stipa compacta D. K. Hughes
Stipa elatior (Benth.) D. K. Hughes
Scirpus nodosus Rottb.
Cladium junceum R. Br.
Lepidosperma gladiatum Labill.
Lomandra longifolia Labill.
Dianella revoluta R. Br.
Acianthus reniformis (R. Br.) Schlechter.
Caladenia latifolia R. Br.
Pterostylis cucullata R. Br.
Casuarina stricta Dryand. in Ait.
Banksia integrifolia L.f.
Amyema preissii (Miq.) van Tiegh.
Muehlenbeckia adpressa (Labill.) Meissn.
Rhagodia baccata (Labill.) Moq.
Enchylaena tomentosa R. Br.
Tetragonia implexicoma (Miq.) Hook. f.
Carpobrotus rossii (Haw.) N.E.Br.
Spergularia rubra (L.) J. & C. Presl
Clematis microphylla DC.
Hymenolobus procumbens (L.) Nutt. ex J. M. Black.
Crassula sieberiana (Schult. & Schult. f.) Druce.
Bursaria spinosa Cav.
Acaena anserinifolia (Forst. & Forst. f.) Druce.
Acacia longifolia (Andr.) Willd. var. *sophorae* (Labill.) F. Muell.
Acacia retinodes Schlechtendal var. *oraria* J. M. Black.
Pultenaea tenuifolia R. Br.
Lotus australis Andr.
Swainsona lessertiifolia DC.
Kennedia prostrata R. Br. in Ait. f.
Geranium pilosum sens, lat. (non certe Forst. f.).
Pelargonium australe Willd.
Oxalis corniculata L.
Zygophyllum billardieri DC.
Correa alba Andr.
Adriana klotzschii (F. Muell.) Muell.-Arg.
Adriana quadripartita (Labill.) Gaudich.
Stackhousia spathulata Sieber ex Spreng.
Lasiopetalum baueri Steetz in Lehm.
Pimelea serpyllifolia R. Br.
Melaleuca pubescens Schauer in Walp.
Leptospermum laevigatum (J. Gaertn.) F. Muell.
Apium prostratum Labill.
Styphelia parviflora (Andr.) Lindl.
Alyxia buxifolia R. Br.
Dichondra repens Forst. & Forst. f.
Solanum laciniatum Ait.
Myoporum insulare R. Br.
Lobelia alata Labill.
Olearia axillaris (DC.) Benth.
Olearia ramulosa (Labill.) Benth.
Olearia glutinosa (Lindl.) Benth.
Brachycome parvula Hook. f.
Calocephalus brownii (Cass.) F. Muell.
Cassinia spectabilis (Labill.) R. Br.
Helichrysum paralium (N. T. Burbidge) W. M. Curtis
Helichrysum leucopsidium DC.
Senecio lautus Forst. f. ex. Willd.
Senecio odoratus Hornem.
Sonchus megalocarpus (Hook. f.) J. M. Black

A few species occur on cliffs just outside the Port Phillip Heads, but have not been noted in the Bay proper, viz: *Threlkeldia diffusa* R. Br. *Pultenaea canaliculata* F. Muell., *Beyeria leschenaultii* (DC.) Baill., *Pomaderris oraria* F. Muell. ex Reiss., *Senecio orarius* J. M. Black.

MOSSES.

The moss-flora of Port Phillip shoreline is relatively poor in species, all being common and widely distributed plants elsewhere; but published references to these occurrences are very meagre, if they exist at all. The eastern coast, with its cliffy terrain, surviving thickets of *Leptospermum* and other small trees, supports a far greater percentage of bryophytes than the flatter, drier, exposed western shore. Every moss in the following list

of 29 species has been identified by the author whose locality records are also indicated. More intensive work, especially in the vicinity of the Heads, will doubtless bring to light additional records.

Brachymenium preissianum (Hampe) Jaeg.—Sorrento.
Breutelia affinis (Hook.) Mitt.—Frankston, Edwards Point (Swan Bay).
Bryum argenteum Hedw. Port Melbourne, Sandringham and Beaumaris
Bryum billardieri Schwaegr.—Sandringham, Beaumaris, Frankston, Martha Point, Rosebud, Sorrento, Mud Islands, Edwards Point.
Bryum chrysoneuron C. Muell.—Port Melbourne.
Bryum capillare Hedw.—Rosebud, Sorrento.
Bryum dichotomum Hedw.—Port Melbourne, Sandringham, Beaumaris.
Campylopus introflexus (Hedw.) Brid.—Sandringham, Beaumaris, Frankston.
Campylopus clavatus (R. Br.) Hook. f. & Wils.—Edwards Point.
Ceratodon purpureus (Hedw.) Brid.—Sandringham, Beaumaris, Martha Point, Sorrento, Mud Islands, Edwards Point.
Desmatodon convolutus (Brid.) Grout.—Sandringham, Martha Point.
Fissidens pungens C. Muell. & Hampe (var.)—Sandringham, Beaumaris.
Fissidens taylori C. Muell.—Sandringham, Beaumaris.
Fissidens vittatus Hook. f. & Wils.—Martha Point.
Gigaspermum repens (Hook.) Lindb.—Sandringham.
Gymnostomum calcareum Nees, Hornsch. & Sturm.—Sorrento.
Pleuridium nervosum (Hook.) Par.—Sandringham, Beaumaris.
Polytrichum juniperinum Hedw.—Edwards Point.
Pottia davalliana (Sm.) C. Jens.—Queenscliff.
Rhacopilum convolutaceum (C. Muell.) Mitt.—Frankston, Rosebud, Sorrento.
Rhynchostegium tenuifolium (Hedw.) Jaeg.— Sandringham, Beaumaris, Rosebud.
Sematophyllum homomallum (Hampe) Broth.—on tree-trunks at Sandringham, Beaumaris, Frankston, Rosebud, Edwards Point.
Thuidium furfurosum (Hook. f. & Wils) Jaeg.—Sandringham, Beaumaris, Frankston, Rosebud Sorrento, Edwards Point.
Tortella calycina (Schwaegr.) Dixon—Sandringham, Beaumaris, Martha Point, Rosebud, Sorrento, Mud Islands, Edwards Point.
Tortula muralis Hedw.—on cement-works, bricks, &c., at Brighton, Sandringham, Beaumaris, Rosebud.
Tortula papillosa Wils. ex Spruce—on tree-trunks at Sandringham, Beaumaris, Sorrento, Mud Islands.
Tortula princeps (C. Muell.) DeNot.—Rosebud, Sorrento, Edwards Point.
Triquetrella papillata (Hook. f. & Wils.) Broth.—Brighton, Sandringham, Beaumaris, Martha Point, Rosebud, Edwards Point.
Zygodon minutus C. Muell. & Hampe.—on tree-trunks at Sandringham, Beaumaris, Frankston, Sorrento, Mud Islands.

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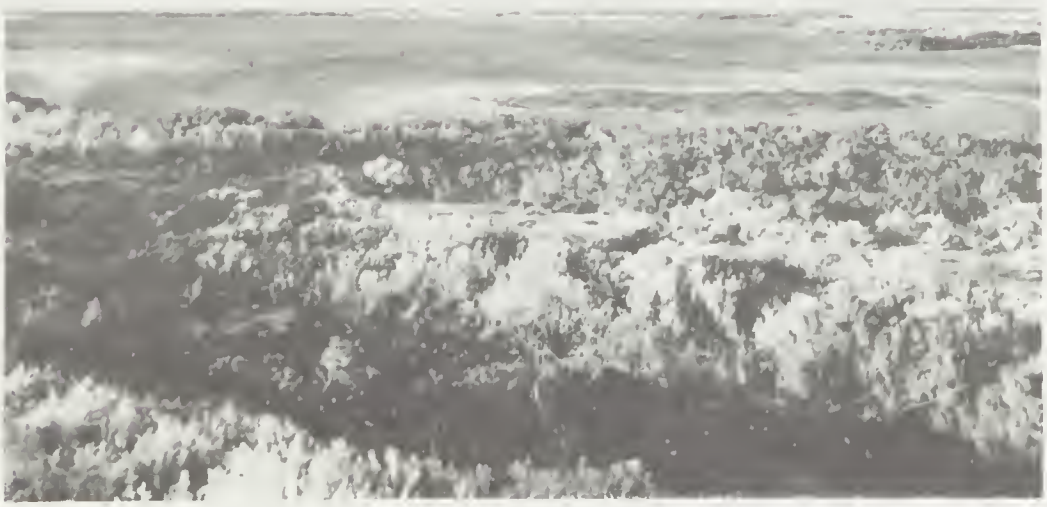
PLATE I.

[*Photo.*: H. T. Reeves.

Fig. 1. *Leptospermum laevigatum* (Coast Tea-tree). Typical old trees and associated shrubs, in the sets near Beaumaris cliffs.



[*Photo.*: Helen Aston, Jan., 1958.

Fig. 2. Zones of salt-marsh vegetation on Mud Island:
Foreground—*Atriplex cinerea* (edge of beach sand).
Centre—*Arthrocnemum arbusculum*.
Middle distance (forming "island")—*Salicornia* spp.

PLATE II.

[*Photo.* H. T. Reeves.

Fig. 1. *Disphyma australe* (Rounded Noon-flower) in full bloom on salt-marsh near mouth of Yarra River.

[*Photo.*: H. T. Reeves.

Fig. 2. *Calocephalus brownii* (Cushion-brush) on sand dunes at Sorrento (*Spinifex hirsutus* at extreme right, *Helichrysum paralium* in background).