https://doi.org/10.24199/j.mmv.1966.27.17
2 November 1966

PORT PHILLIP SURVEY 1957–1963.

ASCIDIACEA.

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SUMMARY.

An account is given of 38 species of ascidians in a collection from Port Phillip, Victoria. One of these is described as a new species *Ritterella asymmetrica.*

INTRODUCTION.

This paper deals with ascidians (subphylum Tunicata, class Ascidiacea) from Port Phillip collected during an ecological survey made by the National Museum of Victoria in collaboration with the Fisheries and Wildlife Department of Victoria. The treatment in the present paper is taxonomic, the ecological aspects being dealt with by other authors.

I wish to thank Miss J. Hope Macpherson of the National Museum of Victoria for providing the specimens and relevant information.

Positions 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 the position of the stations numbered 1–317 with the same grid superimposed to aid in location of the stations and for correlation with depth, &c.

Localities in the text are shown as Area number followed immediately by the Station number in brackets. Table A (back of volume) records station number, date, method of collecting (dive or dredge) and depth in fathoms.

LIST OF SPECIES.

Order ENTEROGONA Perrier, 1898.

Suborder APLOUSOBRANCHIATA Lahille, 1886.

Family POLYCLINIDAE Verrill, 1871.

Aplidium phortax (Michaelsen).
Synoicum papilliferum (Michaelsen)?
Synoicum arenaceum (Michaelsen).
Ritterella asymmetrica sp. n.

Family CLAVELINIDAE Forbes and Hanley, 1848.

Clavelina baudinensis Kott.
Podoclavella cylindrica (Quoy and Gaimard).
Polycitor giganteus (Herdman).
Sycozoa tenuicaulis (Herdman).
Sycozoa cerebriformis (Quoy and Gaimard).
Distaplia viridis Kott.
Distaplia stylifera (Kowalevsky)?
Cystodites dellechiajei (Della Valle).

Suborder PHLEBOBRANCHIATA Lahille, 1886.

Family CIONIDAE Lahille, 1887.

Ciona intestinalis (Linnaeus).

Family CORELLIDAE Lahille, 1887.

Corella eumyota Traustedt.

Family PEROPHORIDAE Giard, 1872.

Perophora hutchisoni Macdonald.

Family ASCIDIIDAE Adams, 1858.

Ascidia sydneiensis Stimpson.
Ascidia gemmata Sluiter.
Ascidiella aspersa (Müller).

Order PLEUROGONA Perrier, 1898.

Suborder STOLIDOBRANCHIATA Lahille 1886.

Family STYELIDAE Sluiter, 1895.

Botryllus gracilis Hartmeyer and Michaelsen.
Botryllus stewartensis Brewin.
Botrylloides magnicoecus (Hartmeyer)?
Symplegma viride Herdman.
Amphicarpa diptycha (Hartmeyer).
Polyandrocarpa lapidosa (Herdman).
Oculinaria lapidosa Grey.
Polycarpa pedunculata Heller
Styela etheridgii Herdman.
Styela plicata (Lesueur).
Asterocarpa cerea (Sluiter).

Family PYURIDAE Hartmeyer, 1908.

Pyura irregularis (Herdman).
Pyura pachydermatina (Herdman).
Pyura praeputialis (Heller).
Pyura fissa (Herdman).
Microcosmus spiniferus (Herdman).
Microcosmus australis Herdman.
Herdmania momus (Savigny).

Family MOLGULIDAE Lacaze-Duthiers, 1877.

Molgula sabulosa (Quoy and Gaimard).
Molgula janis Kott.

DESCRIPTION OF SPECIES.

FAMILY POLYCLINIDAE.

Aplidium phortax (Michaelsen).

Amaroucium phortax: Michaelsen, 1924, p. 389, figs. 20, 21.

MATERIAL.—Port Phillip Survey: Areas 18 (61); 55 (35); 56 (295); 59 (23–4).

Zooid.—The zooids agree closely with the description by Michaelsen (1924), particularly in the position of the pouch containing embryos, at the posterior end of the thorax (Fig. 1, A.). The specimens from Port Phillip have one or two embryos or larvae and Michaelsen noted one to three.

Larva (Fig. 1, B.). Kott (1963) described and figured larvae from Australian colonies that she identified as *A. phortax*, but these differ from larvae in specimens from Port Phillip as shown in Table I.

TABLE I.

	Kott (1963).	Port Phillip.
Length of trunk, mm	0·55 — 0·65	mean 0·9
Median papillae	absent	present

It appears that the Port Phillip specimens are not of the species described by Kott as *A. phortax*, but I believe that they do represent Michaelsen's species. In both cases the zooids agree quite well with the original account of *A. phortax*, which, unfortunately, did not include an adequate description of the larva. The ratio of depth to length of the larvae figured by Michaelsen, however, seems to agree better with the Port Phillip specimens than with Kott's specimens.

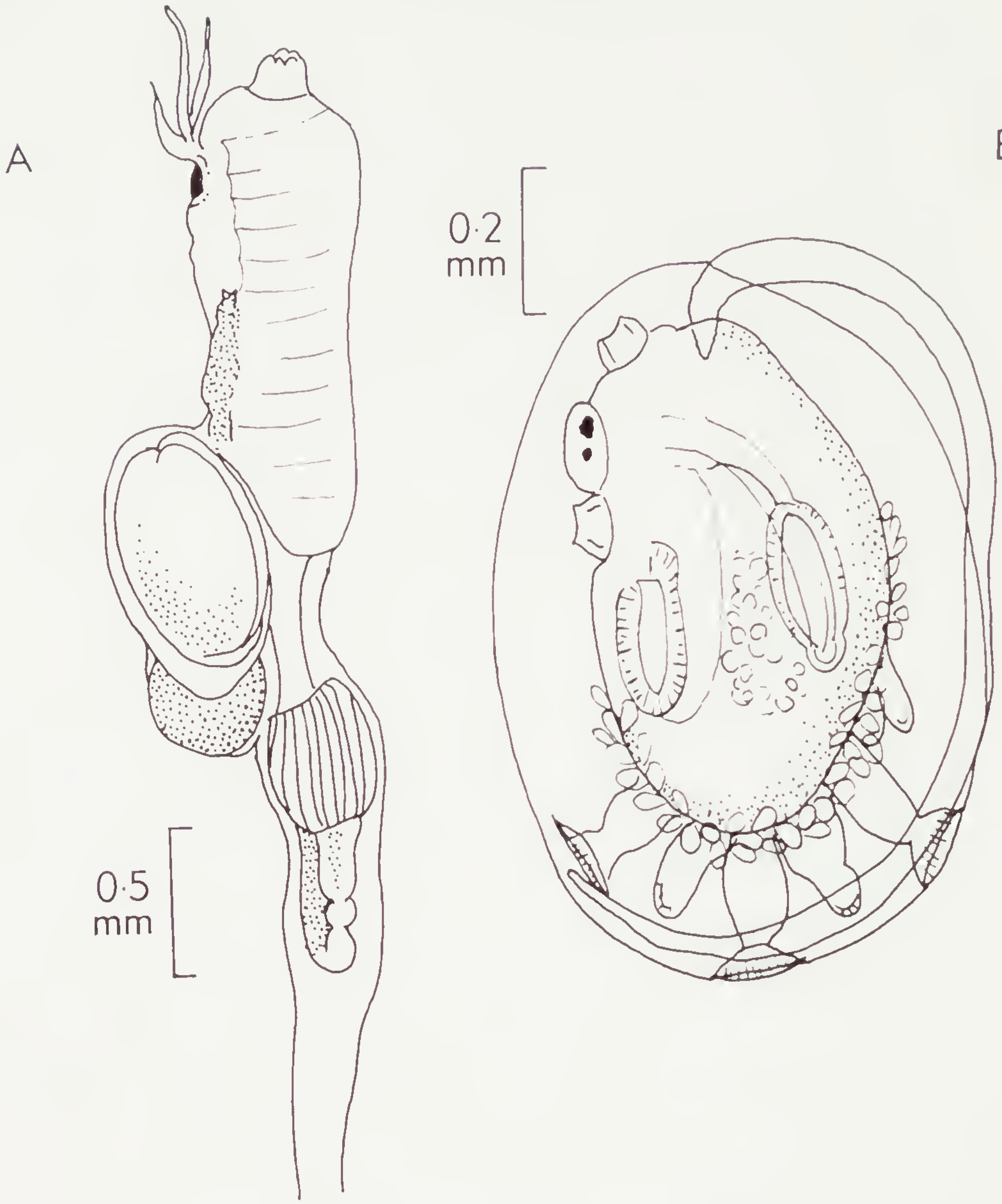

FIG. 1. *Aplidium phortax*. A, zooid. B, larva.

Synoicum papilliferum Michaelsen?

Synoicum papilliferum: Michaelsen, 1930, p. 530, fig. 7.

MATERIAL.—Port Phillip Survey: 59 (23–4).

REMARKS.—The present specimen lacks the small papilla below the atrial opening described by Michaelsen in the type specimen, but I can find no other difference. The identification remains doubtful, however, since good diagnostic characters are few in the genus, and *S. papilliferum* has been known hitherto only from Western Australia.

Synoicum arenaceum (Michaelsen).

Macroclinum arenaceum: Michaelsen, 1924, p. 406, figs. 23–25.

MATERIAL.—Port Phillip Survey: Area 69 (221).

REMARKS.—The colony consists of closely crowded upright columnar lobes flattened at their upper ends and united by a basal mass of common test. The stomach is either smooth externally or has indistinct longitudinal swellings or faint interrupted folds, but in transverse section it shows more distinct, broken folds (Fig. 2). The larval trunk is about 0·5 mm. long, and has three vertical papillae and numerous small lateral vesicles.

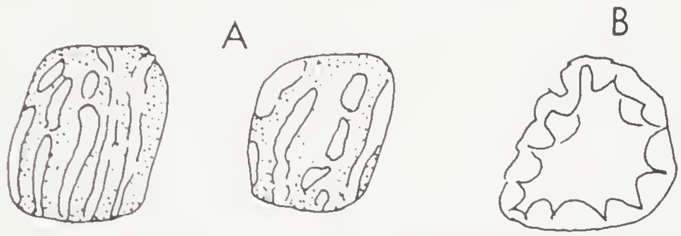

FIG. 2. *Synoicum arenaceum*. Stomach, from side (A), and in transverse section (B).

Ritterella asymmetrica sp. n.

MATERIAL.—Port Phillip Survey: Areas 58 (290); 59 (—); Holotype, National Museum, No. H 39.

Colony.—The colony consists of many slender club-shaped lobes, up to 4 cm. in length, arising from a common basal plate (Fig. 3A). The lobes are sometimes united in pairs near their lower ends or may have a branch or lateral lobe some distance from the apex. A characteristic is the expanded, somewhat spoon-shaped and asymmetrical upper end of the lobes, which has one flattened or slightly concave face and one convex face (Fig. 3B). A low, slightly scalloped ridge separates the two faces. Sand covers the whole surface of the colony, except on a series of small round areas on each face of the ridge. Each bare area on the concave face marks the position of the oral opening of a zooid, and an adjacent bare area on the convex face marks the position of the atrial opening of the same zooid. The zooids are therefore all orientated in the same way, with the ventral side towards the concave face of the expanded head of the lobe.

Zooid.—The zooids (Fig. 3C, D) reach 6 mm. or more in length. The thorax and abdomen are about the same length and the post-abdomen is often longer than their combined length. The oral siphon is terminal and the atrial siphon about one-third of the thoracic length from it. Both siphons usually have plain margins, but in a few zooids six indistinct lobes appear to be present on each siphon. The longitudinal muscles of the body wall are slender. Numerous oral tentacles of alternating sizes are present. Each of the ten rows has about 35 stigmata. There are no parastigmatic transverse bars. Stout triangular dorsal languets are present on the left branchial wall. A short oesophagus leads to the cylindrical or barrel-shaped stomach, which has about ten undivided folds. The

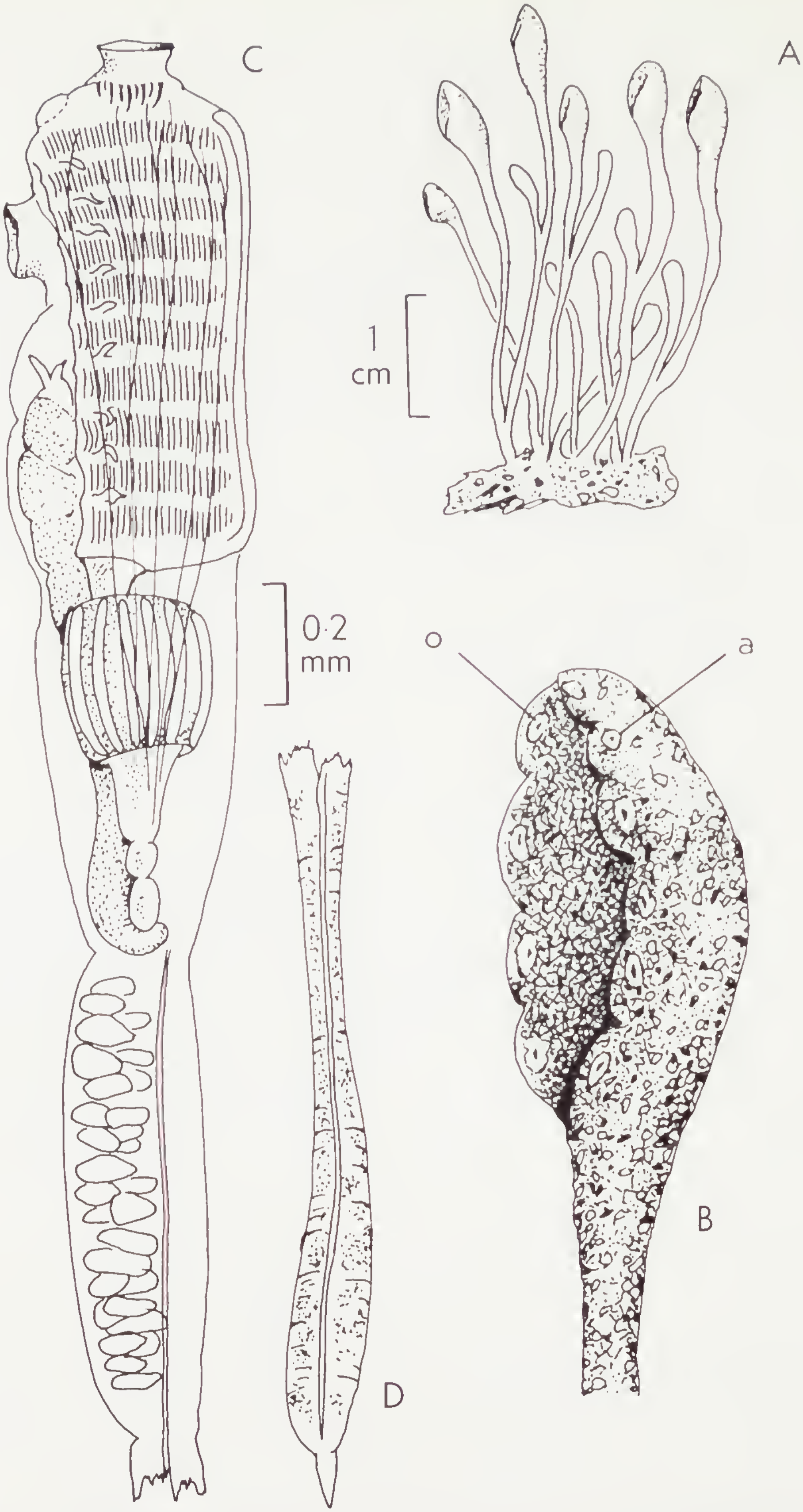

FIG. 3. *Ritterella asymmetrica.* A, colony. B, apex of lobe of colony (a, position of atrial siphon; o, position of oral opening). C, zooid, excluding posterior part, which is continued in D.

post-stomach and mid-gut are distinct, and the rectum ends in a two-lipped anus at the level of the fourth row of stigmata from the posterior end of the thorax. The testicular follicles are arranged along the upper half of the post-abdomen, the lower part of which is occupied by what appears to be storage tissue. The relative amounts of gonad and storage tissue may vary seasonally, as they do in polyclinid zooids.

REMARKS.—The colony of *Ritterella asymmetrica* resembles that of *R. herdmania* Kott (1957), which was originally described by Herdman (1899) as *Psammaplidium pedunculatum*. Differences between the two species are shown in Table 3.

TABLE 2.

	R. herdmania.	*R. asymmetrica.*
Apex of lobes	concave fan-shaped	spoon shaped
Oral openings	on convex surface	on concave surface
Atrial openings	on concave surface	on convex surface
Rows of stigmata	5	10
Folds on stomach	about 6	about 12

FAMILY CLAVELINIDAE.

Clavelina baudinensis Kott.

Clavelina baudinensis: Kott, 1957, p. 87, figs. 19–21.

MATERIAL.—Port Phillip Survey: Areas 6 (137); 59 (36).

Colony.—The specimen from Area 6 is a wedge-shaped colony, narrow at the base, where a number of root-like hairs of the test are developed. The colony is 2 cm. tall and 2 cm. wide across the top, and the zooids can be seen through the translucent test. This specimen therefore differs somewhat from Kott's specimens. The colony from Area 59 is more typical in shape.

Zooid.—The only feature in which these zooids differ from Kott's type material appears to be the presence of dark-blue pigment on the body wall over the anterior end of the endostyle, round the ganglion, on the dorsal side of the base of the atrial siphon, and over the anus. The anal border, which was not described by Kott, has eight small rounded lobes.

REMARKS.—The previous records of this species are from Western Australia and Victoria.

Podoclavella cylindrica (Quoy and Gaimard).

Polyclinum cylindricum Quoy and Gaimard, 1834, p. 618. For synonymy see Michaelsen, 1930, p. 475.

MATERIAL.—Port Phillip Survey: Area 59 (36).

Zooid.—Kott (1957) distinguished between *P. cylindrica* (Quoy and Gaimard) with 21 rows and *P. australis* Kott with ten rows of stigmata. The present material is intermediate, having about thirteen rows, and I have already suggested that the species are synonymous (Millar, 1960).

Brood pouch (Fig. 4).—A conspicuous brood pouch is present on the right side, at the base of the thorax, on most zooids. It is apparently the expanded terminal part of the oviduct, and opens by an oval slit into the right peribranchial cavity. Many developing embryos are contained in the pouches.

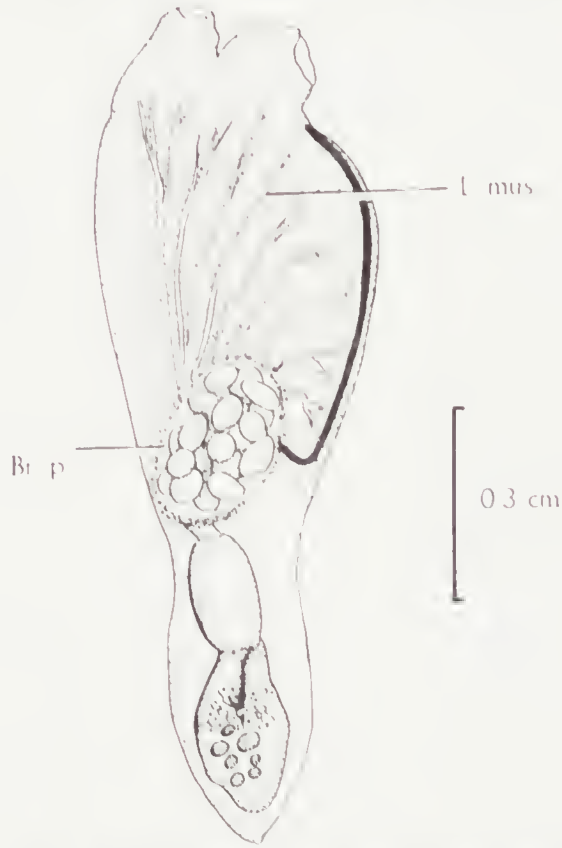

FIG. 4. *Podoclavella cylindrica.* Zooid with test removed, to show brood pouch. Br. p., brood pouch containing embryos. L. mus., longitudinal muscles.

Polycitor giganteus (Herdman).

Polyclinum giganteum: Herdman, 1899, p. 79, figs. 1, 2. Pl. Pcl 11.

MATERIAL.—Port Phillip Survey: Areas 55 (39); 61 (37); 67 (216).

REMARKS.—The specimens, which are quite typical of the species, contained larvae when collected on 10.XI.1957 and 8.XII.1957.

Sycozoa tenuicaulis (Herdman).

Colella tenuicaulis: Herdman, 1899, p. 64, Pl. Dist, 1, figs. 1–16.

MATERIAL.—Port Phillip Survey: Areas 6 (67); 7 (123); 9 (62); 10 (12); 12 (111); 19 (306); 20 (309); 23 (7); 26 (126); 33 (177); 35 (73, 75); 36 (75); 38 (311); 40 (102); 43 (303); 47 (29).

REMARKS.—The species has been well described by Herdman (1899) and Brewin (1953), and is already recorded from Port Phillip (Herdman, 1899; Kott, 1957).

Sycozoa cerebriformis (Quoy and Gaimard)

Aplidie cerebriforme: Quoy and Gaimard, 1834, p. 625, figs. 16, 17.

MATERIAL.—Port Phillip Survey: Areas 58 (150–4); 59 (36); 66 (291–2).

Distaplia viridis Kott.

Distaplia viridis: Kott, 1957, p. 96, figs. 28–30.

MATERIAL.—Port Phillip Survey: Area 61 (37).

REMARKS.—The single specimen agrees well with Kott's description and, like her material, show no ovary but only a rosette of testis follicles beside the intestinal loop. The larvae measure about 1·0 mm. from the end of the papillae to the base of the tail.

Kott, (1957) noted that this species resembles *D. domuncula* Michaelsen from South Africa, but considered it to be probably separate. The gonads clearly distinguish the two species; they are contained in a sac below the abdomen in *D. domuncula* (Michaelsen, 1923; Millar, 1955) but are beside the intestinal loop in *D. viridis*.

Distaplia stylifera (Kowalevsky)?

Didemnium styliferum: Kowalevsky, 1874, p. 443, pl. 30, figs. 1–16.

MATERIAL.—Port Phillip Survey: Areas 10 (12); 22 (119); 23 (68).

Colony.—The colonies are club-shaped rather than mushroom-shaped as in the well developed specimens described by Van Name (1945). Each head has several systems of zooids, each system with its own common cloacal opening.

REMARKS.—I have some doubt whether these specimens belong to *D. stylifera* or to *D. australensis* Brewin. Brewin (1953) uses four distinguishing characters: (1) the arrangement of zooids in systems, (2) the number of stigmata per row (3) the nature of the brood pouches, and (4) the geographical distribution. Distribution is not a good specific character, the number of stigmata per row is very variable in *D. stylifera* (Brewin, 1953) and no brood pouches are developed in the present material, so identification as *D. stylifera* rests mainly on the systems of zooids.

Cystodites dellechiajei (Della Valle).

Distoma dellechiajei: Della Valle, 1877, p. 40.

MATERIAL.—Port Phillip Survey: Area 56 (295).

FAMILY CIONIDAE.

Ciona intestinalis (Linnaeus).

Ascidia intestinalis: Linnaeus, 1767, vol. 1, pp. 2, 1087.

MATERIAL.—Port Phillip Survey: Area 37 (40).

FAMILY CORELLIDAE.

Corella eumyota Traustedt.

Corella eumyota: Traustedt, 1882, p. 271, pl. 4, figs. 2, 3; pl. 5, figs. 13, 14.

MATERIAL.—Port Phillip Survey: Area 42 (38).

FAMILY PEROPHORIDAE.

Perophora hutchisoni Macdonald

Perophora hutchisoni: Macdonald, 1859, p. 377, pl. 65, II, figs. 1–3.

MATERIAL.—Port Phillip Survey: Area 59 (79).

Colony.—These specimens, some of which are growing on the fronds on an alga, closely resemble the type specimens illustrated by Macdonald (1859), and, like them, are heavily coated with sand grains.

REMARKS.—The only records of the species are from Fremantle and Albany and from Stewart Island, New Zealand if *P. boltenia* Michaelsen is a synonym, as suggested by Michaelsen and Hartmeyer (1928).

FAMILY ASCIDIIDAE.

Ascidia sydneiensis Stimpson.

Ascidia sydneiensis: Stimpson, 1885, p. 387.

MATERIAL.—Port Phillip Survey: Area 59 (23–4).

REMARKS.—The specimen has a much-convoluted slit of the dorsal tubercle and an accumulation of mud in the gut, both characters commonly found in the species.

Ascidia gemmata Sluiter.

Ascidia gemmata: Sluiter, 1895, p. 177, pl. 9, figs. 7–9.

MATERIAL.—Port Phillip Survey: Areas 5 (57); 6 (66, 137); 7 (123); 21 (176); 22 (119); 23 (7, 69–70); 27 (41); 31 (131); 33 (177); 43 (274); 52 (252); 64 (163); 67 (216).

REMARKS.—The shape of the body and the gut vary somewhat, as indicated in Fig. 5, but the rather soft greenish-grey test and the simple U-shaped slit of the dorsal tubercle help to identify the species, in addition to the closely set papillae of the prebranchial zone which Kott (1952) also found.

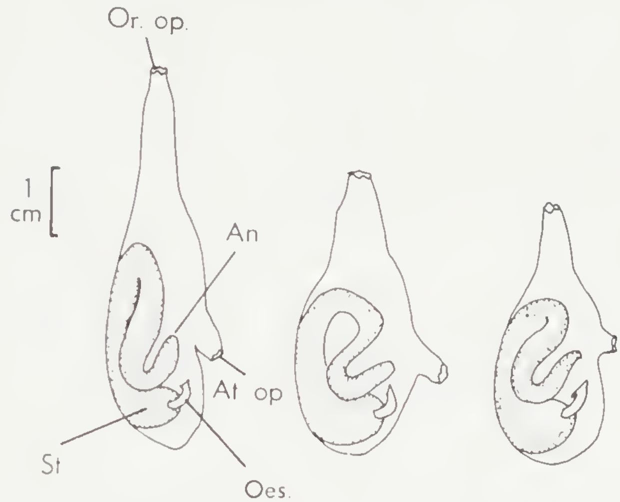

FIG. 5. *Ascidia gemmata*. Three specimens with test removed, to show variation in shape of body and gut. An., anus. At. op., atrial opening. Oes., oesophagus st., stomach.

Ascidiella aspersa (Müller).

Ascidia aspersa: Müller, 1876, p. 225.

MATERIAL.—Port Phillip Survey: Areas 12 (111–3, 198); 22 (119); 23 (70–1); 32 (277); 33 (177); 35 (72, 121); 37 (40, 296); 55 (22).

FAMILY STYELIDAE.

Botryllus gracilis Hartmeyer and Michaelsen.

Botryllus gracilis: Hartmeyer and Michaelson, 1928, p. 338, fig. 22.

MATERIAL.—Port Phillip Survey: Area 6 (118).

Colony.—The single colony, which had been growing on the shell of a living mussel, is very thin and almost transparent. In the alcohol-preserved material the zooids are pale grey.

Zooid.—The zooids are as described by Hartmeyer and Michaelsen (1928) except that in the present material short tubular oral siphons are developed whereas the type specimens had sessile branchial openings.

Larva.—Larvae, numbering one or two, are present in the atrial cavity of many of the zooids, and are of the type common in the subfamily Botryllinae. There is a single black sense organ, a ring of ampullae round the anterior end of the trunk, and three anterior papillae. The trunk is about 0·44 mm. long.

REMARKS.—Neither the type nor the present material had gonads sufficiently well developed to show whether the species is a *Botryllus* or a *Botrylloides*, but, like Hartmeyer and Michaelsen (1928), I believe it to be a *Botryllus*.

This species has been recorded hitherto only from Sharks Bay, Western Australia.

Botryllus stewartensis Brewin.

Botryllus stewartensis: Brewin, 1958, p. 447, figs. 3 A, A, A, A, A, A.

MATERIAL.—Port Phillip Survey: Area 51 (250).

Colony.—The dome-shaped mass is 10 cm. in diameter and consists of closely crowded upright columnar lobes each with an expanded end the centre of which forms a shallow depression. The lobes converge at their lower ends and join a narrow irregular mass of test which constitutes a short stalk.

REMARKS.—This is a much more massive specimen than the type material, but the arrangement and structure of the zooids are similar, and in particular the shape of the lobes and the coating of sand are such unusual features in the family that identification is almost certain.

Botrylloides magnicoecus (Hartmeyer)?

Botrylloides nigrum: Herdman var. *magnicoecum*: Hartmeyer, 1913, p. 135.

MATERIAL.—Port Phillip Survey: Area 18 (61): Flinder's Jetty.

Colony.—The colonies are of the kind described by Kott (1952), and consist of long fleshy lobes, the basal parts of which are devoid of zooids. The narrow systems of zooids are parallel to the long axis of the lobes.

REMARKS.—The records of this species accepted by Hartmeyer and Michaelsen (1928) include specimens from Western Australia, China, India, East Africa, South Africa, and possibly Europe. It would not be surprising if some of the records referred to other species, particularly since specific characters in *Botryllus* and *Botrylloides* are not entirely satisfactory. I am therefore identifying the present material as *B. magnicoecus* only provisionally.

Symplegma viride Herdman.

Symplegma viride: Herdman, 1886, p. 144, pl. 18, figs. 7–14.

MATERIAL.—Port Phillip Survey: Area 6 (137).

REMARKS.—This species is already known from Queensland, South Australia and Western Australia.

Amphicarpa diptycha (Hartmeyer).

Distomus diptychos: Hartmeyer, 1919, p. 87, pl. 2, fig. 48.

MATERIAL.—Port Phillip Survey: Areas 42 (38); 59 (23–4, 36).

REMARKS.—The specimens agree better with *A. diptycha* (Hartmeyer) than with *A. elongata* Kott, but the distinctions between these two related species are not very marked.

Polyandrocarpa lapidosa (Herdman).

Goodsiria lapidosa: Herdman, 1899, p. 99, pl. Pst. III, figs. 1–12.

MATERIAL.—Port Phillip Survey: Areas 60 (235); 67 (216).

Colony.—The largest colony collected is 10 by 7 by 5 cm. Sand grains are present not only on the surface as in the specimens described by Herdman (1899) and Kott (1952), but also throughout the depth of the test.

Zoid.—The body wall is delicate and pink, and the siphons short or moderately long. Herdman and Kott both noted the irregularity of the branchial stigmata, but the present specimens show quite regular stigmata. The slit of the dorsal tubercle is almost straight and transverse, or crescentic with the open interval facing posteriorly. The anal border, which Kott found to be smooth, is indented to form numerous shallow rounded lobes, in the Port Phillip specimens.

REMARKS.—The similarity between *P. lapidosa* and the South African *P. anguinea* (Sluiter) has been noted (Millar, 1963). In both species the large zooids are closely crowded to form a hard compact colony incrusted or impregnated with sand grains, and the long narrow branchial sac has a similar arrangement of folds and bars, but the shape and alignment of the stomach differ, and the form of the dorsal tubercle (Fig. 6).

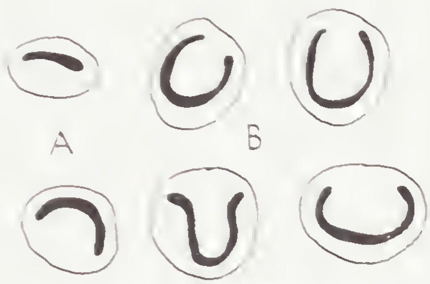

Fig. 6. Dorsal tubercles of A, two specimens of *Polyandrocarpa lapidosa* and B, four specimens of *P. anguinea*.

P. anguinea was originally described as a solitary ascidian in the genus *Styela*, and although budding has not been observed in either that species or *P. lapidosa* there can be little doubt that they are colonial species of the genus *Polyandrocarpa*.

Oculinaria australis Gray.

Oculinaria australis: Gray, 1868, p. 564, 1 fig.

MATERIAL.—Port Phillip Survey. Area 56 (295).

REMARKS.—This very distinctive species has previously been recorded only on the west coast of Australia.

Polycarpa pedunculata Heller.

Polycarpa pedunculata: Heller, 1878, p. 106, pl. 6, fig. 30.

MATERIAL.—Port Phillip Survey: Areas 6 (65); 7 (123); 9 (62); 18 (59); 25 (129); 26 (126); 27 (302); 28 (140); 29 (107); 38 (127); 39 (42); 59 (24).

REMARKS.—Some specimens have a wide base and others a narrow base, but none has a definite stalk like that of the type specimen. In other respects, however, there is good agreement with the description by Heller

(1878) and Michaelsen (1905). The distinctions between *P. pedunculata* and *P. stephenensis* Herdman are not satisfactory. The stalk is probably a variable character. *P. pedunculata* has about 200 small gonads grouped in areas into which the inner surface of the body wall is divided, and *P. stephenensis* has not more than 100 gonads, which are comparatively large, and not grouped. I have already found some specimens (Millar, 1963) agreeing well with *P. stephenensis* and others from Fremantle with gonads which numbered only 30–40, as in *P. pedunculata* but which were grouped in separate areas as in *P. stephenensis*. It may be that only one species is involved, which varies considerably.

Styela etheridgii Herdman.

Styela etheridgii: Herdman, 1899, p. 38, pl. Cyn. XIII, figs. 1–8.

MATERIAL.—Port Phillip Survey: Areas 5 (57); 6 (65); 10 (11–4); 11 (212); 12 (111); 18 (59); 19 (305); 32 (277); 39 (48); 55 (148); 63 (159).

REMARKS.—This is a variable species, as shown by Kott (1952), and the specimens from Port Phillip all fall within the normal range of variation.

Styela plicata (Lesueur).

Ascidia plicata: Lesueur, 1823, p. 5, pl. 3, fig. b.

MATERIAL.—Port Phillip Survey: Areas 5 (165–6); 17 (170); 18 (59); 26 (301); 27 (41); 28 (140); 31 (10, 131–4); 37 (40); 39 (43).

Asterocarpa cerea (Sluiter).

Styela cerea: Sluiter, 1900, p. 24, pl. III, figs. 9–11.

MATERIAL.—Port Phillip Survey: Areas 22 (119); 23 (68–70).

Gonads.—The gonads are the most characteristic feature of this species, and are well developed in the present specimens, one of which shows, on the left, a single group of two *Cnemidocarpa*-type gonads, and on the right, four or five groups each of 2–4 gonads. Most of the gonoducts point in a ventral direction.

REMARKS.—The relationships and synonymy of this species have been discussed in detail by Hartmeyer (1927) and Brewin (1946). It appears that there is either one species widely distributed in southern waters, or a group of similar species. A number of these species, including possibly *A. cerea*, differ only slightly from typical species of *Cnemidocarpa*, and I am not certain that generic separation is necessary.

FAMILY PYURIDAE.

Pyura irregularis (Herdman).

Cynthia irregularis: Herdman, 1882, p. 141, pl. XVI, figs. 10–12.

MATERIAL.—Port Phillip Survey: Areas 5 (166); 9 (179–180); 18 (59); 19 (181), 31 (131).

Dorsal tubercle.—The dorsal tubercle (Fig. 7), as in Kott's (1952) description, has anterior blister-like pads and a simple U-shaped slit contained in a long narrow peritubercular area.

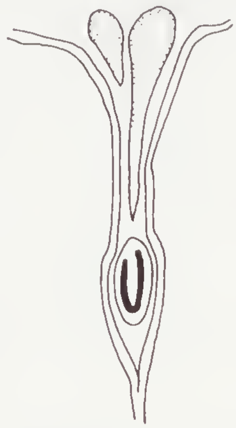

Fig. 7. *Pyura irregularis*. Dorsal tubercle and associated pads.

Pyura pachydermatina (Herdman).

Boltenia pachydermatina: Herdman, 1881, p. 81.

MATERIAL.—Port Phillip Survey: Areas 42 (108); 52 (252); 56 (295); 58 (151); 59 (24, 36).

REMARKS.—This species has been divided into a number of varieties. The present specimens agree with var. *gibbosa* Herdman in the structure of the anal border (Fig. 8), which is one of the few distinguishing characters.

Fig. 8. *Pyura pachydermatina*. Part of anal border.

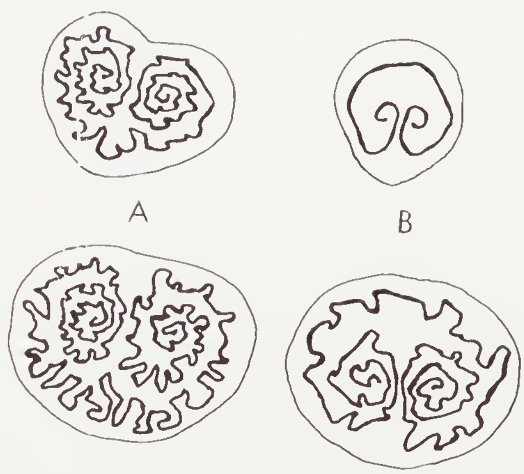

Fig. 9. Dorsal tubercles of A, two specimens of *Pyura praeputialis* from Port Phillip and B, two specimens of *Pyura stolonifera* from South Africa.

Pyura praeputialis (Heller).

Cynthia praeputialis: Heller, 1878, p. 94, pl. III, fig. 16, pl. IV, fig. 22.

MATERIAL.—Port Phillip Survey: Areas 2 (201); 5 (166–8); 9 (178–180); 10 (11–5); 11 (125, 191–2); 26 (126); 28 (140); 30 (10); 39 (312–4); 42 (108, 265, 288); 47 (29); 59 (24, 36); 63 (159–62); 64 (163); 67 (216).

REMARKS.—Heller described two similar species, *Cynthia stolonifera* from South Africa, and *Cynthia praeputialis* from Australia. These are species of *Pyura* that have been considered identical (Kott, 1952), although Kott admits that "the nomenclature of the group is still very confused".

P. stolonifera and *P. praeputialis* appear to be distinguishable as shown in Table 4.

TABLE 3.

	P. stolonifera.	*P. praeputialis.*
Body form ..	Short finger-like test processes round siphons and anterior body. Usually no anterior body depression.	No anterior processes. Marked anterior body depression round siphons.
Dorsal tubercle ..	Basically C-shaped with open interval posterior.	Basically C-shaped with open interval anterior.

These distinctions are based on a comparison that I have made of numerous South African specimens with material from Port Phillip and from New South Wales [British Museum (Nat. Hist.) specimens]. In both species the pattern of the slit of the dorsal tubercle becomes very complex in large specimens, but small specimens show the basic form (Fig. 9). The Australian material invariably has the open interval of the slit anterior. In most South African specimens the open interval is posterior, and I have seen only one in which it is lateral and two anterior. Although Heller's original account of *P. stolonifera* does not clarify the point, Hartmeyer (1911) re-examined the type specimens and his fig. 9, plate 57, clearly shows the open interval posterior. The same pattern is seen in Hartmeyer's fig. 10, plate 57, of a South African specimen from the German South-polar Expedition of 1901–03. Hartmeyer noted the presence of a rudimentary seventh branchial fold in *P. stolonifera*, contrasting with the six folds always present in *P. praeputialis*. He therefore concluded that the two species are closely related but separate, a finding with which I agree.

Pyura fissa (Herdman).

Cynthia fissa: Herdman, 1881, p. 58.

MATERIAL.—Port Phillip Survey: Areas 31 (10); 35 (73).

REMARKS.—This species does not appear to have been recorded since Herdman described it from Bass Strait. Its distinguishing characters, shown by the type material and confirmed by the specimens from Port Phillip, are (1) the external form as illustrated by Herdman, (2) the oral tentacles, which have short primary branches, some having short secondary branches but many with none (Fig. 10), (3) the simple dorsal tubercle with one or both horns turned outwards, and (4) the six branchial folds on each side.

FIG. 10. *Pyura fissa*
Oral tentacle.

Microcosmus spiniferus (Herdman).

Cynthia spinifera Herdman, 1899, p. 32, pl. Cyn. X, figs. 1–12.

MATERIAL.—Port Phillip Survey: Areas 6 (63–4, 137); 19 (181); 21 (176); 23 (70); 28 (141), 31 (132); 35 (121), 63 (159–62); 64 (163); 69 (100).

REMARKS.—Herdman (1899) and Kott (1952) described the dorsal lamina as smooth, but the material from Port Phillip always has a toothed edge to the lamina, which, however, is sometimes rolled over in such a way as to hide the teeth.

Microcosmus australis Herdman.

Microcosmus australis: Herdman, 1899, p. 23, pl. Cyn. V.

MATERIAL.—Port Phillip Survey: Areas 5 (57, 165–9); 6 (118, 137); 7 (123); 11 (190); 14 (175); 23 (70); 35 (121); 42 (38, 108, 265); 47 (29); 62 (99).

REMARKS.—The relationships between *Microcosmus claudicans* (Savigny), *M. exasperatus* Heller and *M. australis* Herdman are uncertain. Hartmeyer and Michaelsen (1928) divided *M. claudicans* into four subspecies: *typicus*, *exasperatus*, *australis* and *squamiger*, of which the last three occur on various parts of the Australian coast. Kott (1952) recognized a variety *australis* of the species *M. claudicans*. I do not have sufficient material from other regions for comparison, but prefer to adopt Herdman's species *M. australis* for the Port Phillip specimens.

Kott (1952) described three gonads on the left and four on the right, although Herdman (1899) referred to one on each side. I find only one gonad on each side, but it is broken up into three or four masses united by a common oviduct and sperm duct.

Herdmania momus (Savigny).

Cynthia momus: Savigny, 1816, p. 143, pl. 1, fig 2, pl. 4, fig. 1.

MATERIAL.—Port Phillip Survey: Areas. 12 (198); 31 (10); 58 (151); 59 (24, 36); 61 (37); 66 (291–2); 67 (216).

REMARKS.—Hartmeyer and Michaelsen (1928) and Kott (1952) recognized several varieties or forms of this species but the specimens from Port Phillip Bay do not indicate whether or not the subdivision is justified.

FAMILY MOLGULIDAE.

Molgula sabulosa (Quoy and Gaimard).

Ascidia sabulosa: Quoy and Gaimard, 1834, p. 613, pl. XCI. figs. 19–22.

MATERIAL.—Port Phillip Survey: Areas 9 (84); 10 (13, 15); 18 (60); 27 (284); 37 (40); 50 (266); 51 (270).

REMARKS.—*M. sabulosa* and *M. pedunculata* Herdman have been regarded as identical (Kott, 1952), but, as I have shown (Millar, 1960) there are constant differences in the dorsal tubercle and gonad. *M. pedunculata* is an Antarctic and *M. sabulosa* an Australian species.

Molgula janis Kott.

Molgula janis: Kott, 1952, p. 295, fig. 158.

MATERIAL.—Port Phillip Survey: Area 60 (235).

REMARKS.—The larger of the two specimens has a greatest diameter of 1·5 cm. In most respects these specimens agree well with Kott's description, but differ in the following features: (1) the absence of flap-like extensions of the test and body wall round the siphons; (2) a maximum of five longitudinal bars on some branchial folds and the presence of at least one bar on the dorsal face of some folds.

These differences appear much less important than the similarities, and in particular the ring-shaped testis and the general branchial structure, which are characteristic of *M. janis*. A strand of connective tissue passes from the branchial wall to the body wall through the central opening of the testis (Fig. 11.)

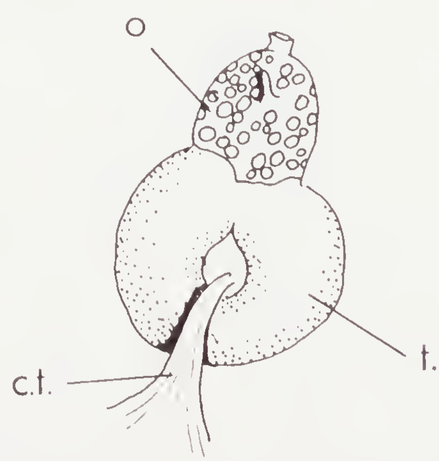

FIG. 11. *Molgula janis*, Gonad. O, ovary, t, testes, c.t., connective tissue.

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TABLE A.

Number for each station where material was collected, with date, area number, dive or dredge number and water depth.

Station Number.	Date.	Area.	Dive D. Dredge Dr.	Depth (fms).
1	26.5.57	23	D. 1	$4\frac{3}{4}$
2	,,	23	D. 2	$4\frac{3}{4}$
3	,,	23	D. 3	$4\frac{1}{4}$
4	,,	14	D. 4	4
5	,,	14	D. 5	$3\frac{1}{4}$
6	,,	23	D. 6	$4\frac{3}{4}$
7	,,	23	D. 7	$4\frac{3}{4}$
8	,,	14	D. 8	$3\frac{1}{2}$
9	,,	23	D. 9	$5\frac{1}{4}$
10	16.6.57	31	D. 1	$5\frac{1}{4}$
	11.9.60	31	D. 1	$5\frac{1}{4}$
11	23.6.57	10	D. 1	$8\frac{1}{2}$
12	,,	10	D. 2	8
13	,,	10	D. 3	7
14	,,	10	D. 4	7
15	,,	10	D. 5	4
16	14.7.57	63	D. 1	4
17	,,	63	D. 2	$3\frac{1}{2}$
18	,,	63	D. 3	3
19	,,	63	D. 4	$2\frac{1}{2}$
20	,,	63	D. 5	$2\frac{1}{2}$
21	,,	63	D. 6	$2\frac{1}{2}$
22	,,	55	D. 7	$4\frac{1}{2}$
23	15.9.57	59	D. 1	$2\frac{1}{2}$
24	,,	59	D. 2	$1\frac{1}{2}$
25	,,	59	D. 3	$2\frac{1}{2}$
26	13.10.57	47	D. 1	9
27	,,	47	D. 2	$8\frac{1}{2}$
28	,,	47	D. 3	$8\frac{1}{4}$
29	,,	47	D. 4	5
30	,,	47	D. 5	3
31	,,	47	D. 6	3
32	,,	48	D. 7	$2\frac{1}{2}$
33	,,	48	D. 8	2
34	,,	48	D. 9	$1\frac{1}{2}$
35	,,	55	D. 10	$3\frac{1}{2}$
36	10.11.57	59	D. 1	5
	,,	59	Intertidal	collection

5050/64.—25

TABLE A.—*continued.*

Station Number.	Date.	Area.	Dive D. Dredge Dr.	Depth (fms).
36	7.4.59	59	D. 1	3
	21.2.60	59	D. 1	6
	16.4.61	59	D. 1	3
	5.5.63	59	D. 1	2
37	8.12.57	61	D. 1	4
38	13.1.58	42	Intertidal and near-shore	collection diving
39	19.1.58	55	D. 1	2
40	16.2.58	37	D. 1	2
41	,,	27	D. 1	$1\frac{1}{2}$
42	9.3.58	39	D. 1	$1\frac{1}{4}$
43	,,	39	D. 2	$2\frac{1}{2}$
44	,,	39	D. 3	$3\frac{1}{2}$
45	,,	39	D. 4	$3\frac{1}{2}$
46	,,	39	D. 5	3
47	,,	39	D. 6	3
48	,,	39	D. 7	3
49	,,	27	D. 8	6
50	,,	27	D. 9	5
51	20.4.58	5	D. 1	4
52	,,	5	D. 2	3
53	,,	5	D. 3	3
54	,,	5	D. 4	$2\frac{1}{2}$
55	,,	5	D. 5	3
56	,,	5	D. 6	3
57	,,	5	D. 7	2
58	,,	5	D. 8	2
59	18.5.58	18	D. 1	6
60	,,	18	D. 2	$4\frac{1}{2}$
61	,,	18	D. 3	$3\frac{1}{2}$
62	,,	9	D. 4	$2\frac{1}{2}$
63	29.6.58	6	D. 1	$6\frac{1}{4}$
64	,,	6	D. 2	5
65	,,	6	D. 3	5
66	,,	6	D. 4	$4\frac{1}{2}$
67	,,	6	D. 5	$4\frac{1}{2}$
68	14.12.58	23	D. 1	$8\frac{1}{2}$
69	,,	23	D. 2	8
70	,,	23	D. 3	9
71	,,	35	D. 4	11
72	,,	35	D. 5	9

TABLE A.—*continued.*

Station Number.	Date.	Area.	Dive D. Dredge Dr.	Depth (fms).
73	14.12.58	35	D. 6	9
74	,,	36	D. 7	8
75	,,	36	D. 8	8
76	,,	36	D. 9	5
77	,,	36	D. 10	4
78	,,	36	D. 11	4
79	18.1.59	59	D. 1	2
80	,,	58	D. 2	$2\frac{1}{2}$
81	,,	58	D. 3	2
82	8.3.59	13	D. 1	4
83	,,	13	D. 2	6
84	28.3.59	9	Intertidal	collection
85	7.4.59	60	Dr.1	6
86	,,	60	Dr.2	11
87	,,	59	Dr.1	$7\frac{1}{2}$
88	,,	58	Dr.1	7
89	8.4.59	58	Intertidal	collection
90	,,	58	Dr.1	6
91	,,	58	Dr.2	6
92	19.4.59	13	D. 1	4
93	,,	13	D. 2	2
94	,,	13	D. 3	2
95	,,	14	D. 4	$1\frac{3}{4}$
96	10.5.59	62	D. 1	6
97	,,	69	D. 2	$6\frac{1}{2}$
98	,,	62	D. 3	6
99	,,	62	D. 4 ; Dr.1	6
100	,,	69	D. 5	3
101	21.6.59	40	D. 1	1
102	,,	40	Dr.1	5
103	12.7.59	10	D. 1	$2\frac{1}{4}$
104	,,	10	D. 2	$2\frac{1}{2}$
105	,,	10	D. 3	$2\frac{1}{2}$
106	,,	10	D. 4	$2\frac{1}{2}$
107	9.8.59	29	D. 1	$2\frac{1}{2}$
108	,,	42	D. 2	2
109	,,	42	D. 3	$2\frac{1}{2}$
110	18.10.59	12	D. 1	$8\frac{1}{2}$
111	,,	12	D. 2	9
112	,,	12	D. 3	9
113	,,	12	D. 4	10

TABLE A.—*continued.*

Station Number.	Date.	Area.	Dive = D. Dredge = Dr.	Depth (fms).
114	15.11.59	12	D. 1	10
115	,,	21	D. 2	10
116	,,	14	D. 3	3
117	,,	14	D. 4	2
118	17.1.60	6	D. 1	¾
119	10.4.60	22	D. 1	11½
120	,,	34	D. 2	11
121	,,	35	D. 3	11
122	,,	24	D. 4	4
123	22.5.60	7	D. 1	3½
124	,,	20	D. 2	12
125	,,	11	D. 3	8
126	14.8.60	26	D. 1	3½
127	,,	38	D. 2	5
128	,,	25	D. 3	5
129	,,	25	D. 4	2
130	11.9.60	30	D. 2	6
131	,,	31	D. 3	8
132	,,	31	D. 4	8½
133	,,	31	D. 5	9½
134	,,	31	D. 6	9½
135	,,	30	D. 7	2
136	16.10.60	6	D. 1	1½
137	15.1.61	6	D. 1	2½
138	22.1.61	27	D. 1	2½
139	,,	27	D. 2	1½
140	,,	28	D. 3	3
141	,,	28	D. 4	3½
142	,,	16	D. 5	3
143	,,	16	D. 6	3½
144	26.2.61	55	D. 1	10
145	,,	55	D. 2	8¾
146	,,	55	D. 3	8
147	,,	55	D. 4	5½
148	,,	55	D. 5	3½
149	,,	55	D. 6	2½
150	21.5.61	58	D. 1	3
151	,,	58	D. 2	3½
152	,,	58	D. 3	3½
153	,,	58	D. 4	6½
154	,,	58	D. 5	5

TABLE A.—*continued.*

Station Number.	Date.	Area.	Dive Dredge D. Dr.	Depth (fms).
155	25.6.61	68	D. 1	5½
156	,,	68	D. 2	7½
157	,,	68	D. 3	6
	,,	68	D. 4	6
158	,,	68	D. 5	8
159	20.8.61	63	D. 1	10
160	,,	63	D. 2	5
161	,,	63	D. 3	4
162	,,	63	D. 4	3½
163	,,	64	D. 5	2
164	,,	64	D. 6	1½
165	26.10.61	5	D. 1	5
166	,,	5	D. 2	7
167	,,	5	D. 3	7
168	,,	5	D. 4	1½
169	,,	5	D. 5	3
170	12.11.61	17	D. 1	5½
171	,,	17	D. 2	4½
172	,,	17	D. 3	3
173	,,	17	D. 4	2
174	,,	29	D. 5	6¼
175	18.12.62	14	D. 1	2½
176	19.12.62	21	D. 1	12
177	,,	33	D. 2	12
178	20.3.63	9	D. 1	1½
179	,,	19	D. 2	3½
180	,,	9	Dr.1	3
181	,,	19	Dr.2	3½
182	,,	18	Dr.3	4
183	,,	18	Dr.4	3½
184	,,	18	D. 4	4½
185	,,	18	Dr.5	4
186	,,	18	Dr.6	4¼
187	,,	18	D. 6	6½
188	,,	18	Dr.7	7
189	,,	18	Dr.8	7
190	21.3.63	11	Dr.1	6
191	,,	11	D. 1	6
192	,,	11	Dr.2	5
193	,,	10	Dr.3	6
194	,,	10	Dr.4	8

TABLE A.—*continued.*

Station Number.	Date.	Area.	Dive D. Dredge Dr.	Depth (fms).
195	21·3·63	11	D. 2	10½
196	,,	12	Dr.5	11
197	,,	11	D. 3	9
198	,,	12	Dr.6	9
199	,,	6	D. 4	8½
200	,,	6	Dr.7	8
201	22.3.63	2	Dr.1	3½
202	,,	3	Dr.2	2½
203	,,	3	Dr.3	2½
204	,,	7	D. 1	2½
205	,,	7	Dr.4	2½
206	,,	7	Dr.5	4
207	,,	7	D. 2	2½
208	,,	7	Dr.6 ; D. 3	5½
209	,,	13	D. 4	7
210	,,	13	Dr.7	9
211	,,	12	Dr.8	11
212	,,	11	Dr.9	8
213	3.4.63	59	D. 1	8
214	,,	59	Dr.1	6
215	,,	60	D. 1	6
216	,,	67	Dr.1	4
217	,,	67	D. 1	3½
218	,,	68	Dr.1	5
219	,,	68	Dr.3	6¾
220	,,	68	Dr.4	7½
221	,,	69	Dr.1	4
222	,,	69	Dr.2	5
223	4.4.63	58	D. 1	2
224	,,	59	Dr.1	9
225	,,	59	Dr.2	8¾
226	,,	59	Dr.3	8
227	,,	59	D. 2	8
228	,,	50	Dr.1	3½
229	,,	50	Dr.2	2½
230	,,	50	Dr.3	3
231	,,	50	Dr.4	2
232	,,	50	Dr.5	2
233	,,	50	D. 3	2
234	,,	59	Dr.6	8
235	,,	60	Dr.7	8

TABLE A.—*continued.*

Station Number.	Date.	Area.	Dive D. Dredge Dr.	Depth (fms).
236	5.4.63	49	Dr.1	½
237	,,	49	Dr.2	½
238	,,	50	Dr.3	1
239	,,	61	D. 1	4
240	,,	61	Dr.4 ; D. 2	2
241	,,	61	Dr.5	7½
242	,,	61	D. 3	11
243	,,	62	D. 4	11
244	,,	62	Dr.6	9½
245	,,	63	D. 5	9
246	,,	63	Dr.7	8½
247	,,	63	D. 6	7
248	,,	63	D. 7	4½
249	,,	63	D. 8	4½
250	30.4.63	51	Dr.1	3½
251	,,	43	Dr.1	10½
252	1.5.63	52	Dr.1 ; D. 1	13
253	,,	53	Dr.1	12
254	,,	54	Dr.1 , Dr.2	10
255	,,	55	D. 1	6
256	,,	55	D. 2	4
257	,,	48	D. 1	4
258	,,	47	Dr.1	8½
259	,,	47	Dr.2	10½
260	,,	46	Dr.1	11
261	,,	45	Dr.1	13
262	,,	44	Dr.1	13
263	,,	43	Dr.1	9
264	2.5.63	42	Dr.1	4
265	,,	42	Dr.2	3½
266	,,	50	Dr.3	2½
267	,,	50	Dr.4	2½
268	,,	60	Dr.1	1½
269	,,	60	D. 1	1½
270	,,	51	Dr.1	5
271	,,	51	D. 1	6
272	,,	43	Dr.1	6
273	,,	31	Dr.1	8
274	3.5.63	43	D. 1	6
275	,,	31	D. 1	3
276	,,	31	D. 2	8

TABLE A.—*continued.*

Station Number	Date	Area	Dive D Dredge Dr	Depth (Fms)
277	3.5.63	32	D. 1	13
278	,,	30	Dr.1	8
279	,,	30	Dr.2	7
280	,,	30	D. 1	1½
281	5.5.63	42	D. 1	2
282	14.5.63	16	D. 1	5
283	,,	16	D. 2	2¼
284	,,	27	Dr.1	1½
285	,,	28	Dr.1	3
286	,,	28	Dr.2	5
287	,,	29	Dr.1	5½
288	,,	42	Dr.1	2
289	,,	42	Dr.2	2
290	15.5.63	58	Dr.1	7
291	,,	66	Dr.1	10
292	,,	66	D. 1	10
293	,,	58	D. 1	6
294	,,	57	Dr.1	10
295	,,	56	D. 1	3
296	16.5.63	37	D. 1	2
297	,,	37	Dr.1	1¼
298	,,	37	Dr.2	4¼
299	,,	25	Dr.1	5
300	,,	26	D. 1	3
301	,,	26	Dr.1	2½
302	,,	27	Dr.1	4
303	17.5.63	43	D. 1	3½
304	,,	19	Dr.1	7
305	,,	19	Dr.2	9
306	,,	19	D. 1	9
307	,,	18	Dr.1	6
308	,,	18	Dr.2	6
309	,,	20	Dr.1	11
310	,,	31	Dr.1	4½
311	19.5.63	38	Dr.1	4
312	,,	39	Dr.1	4
313	,,	39	Dr.2 ; Dr.3	1½
314	,,	39	D. 1	4½
315	,,	28	Dr.1	5
316	,,	28	Dr.2	6
317	,,	29	Dr.3	4½

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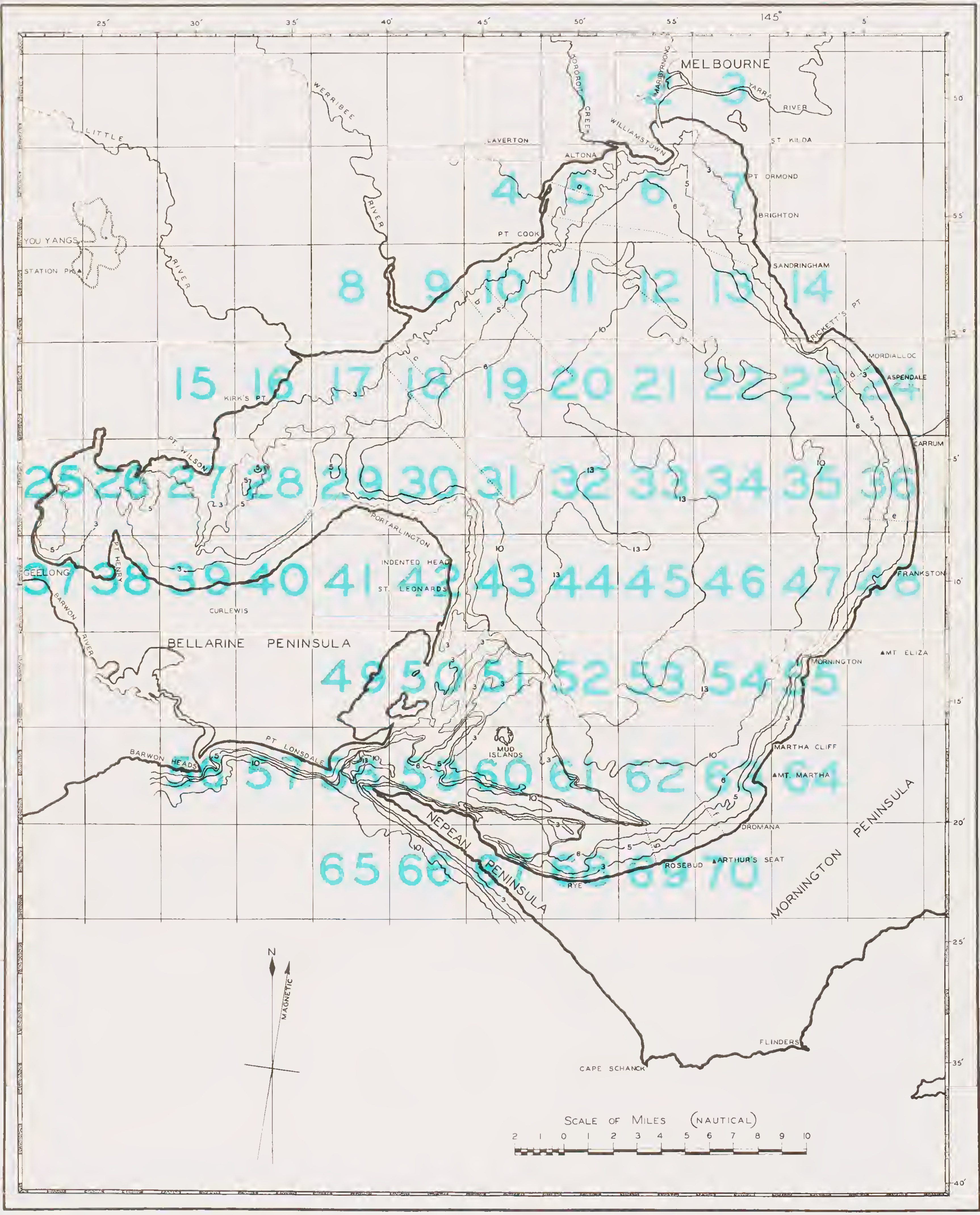

Chart 1.—Bathymetric Chart of Port Phillip Bay showing the 3, 5, 6, 10 and 13 fathom contour-lines.

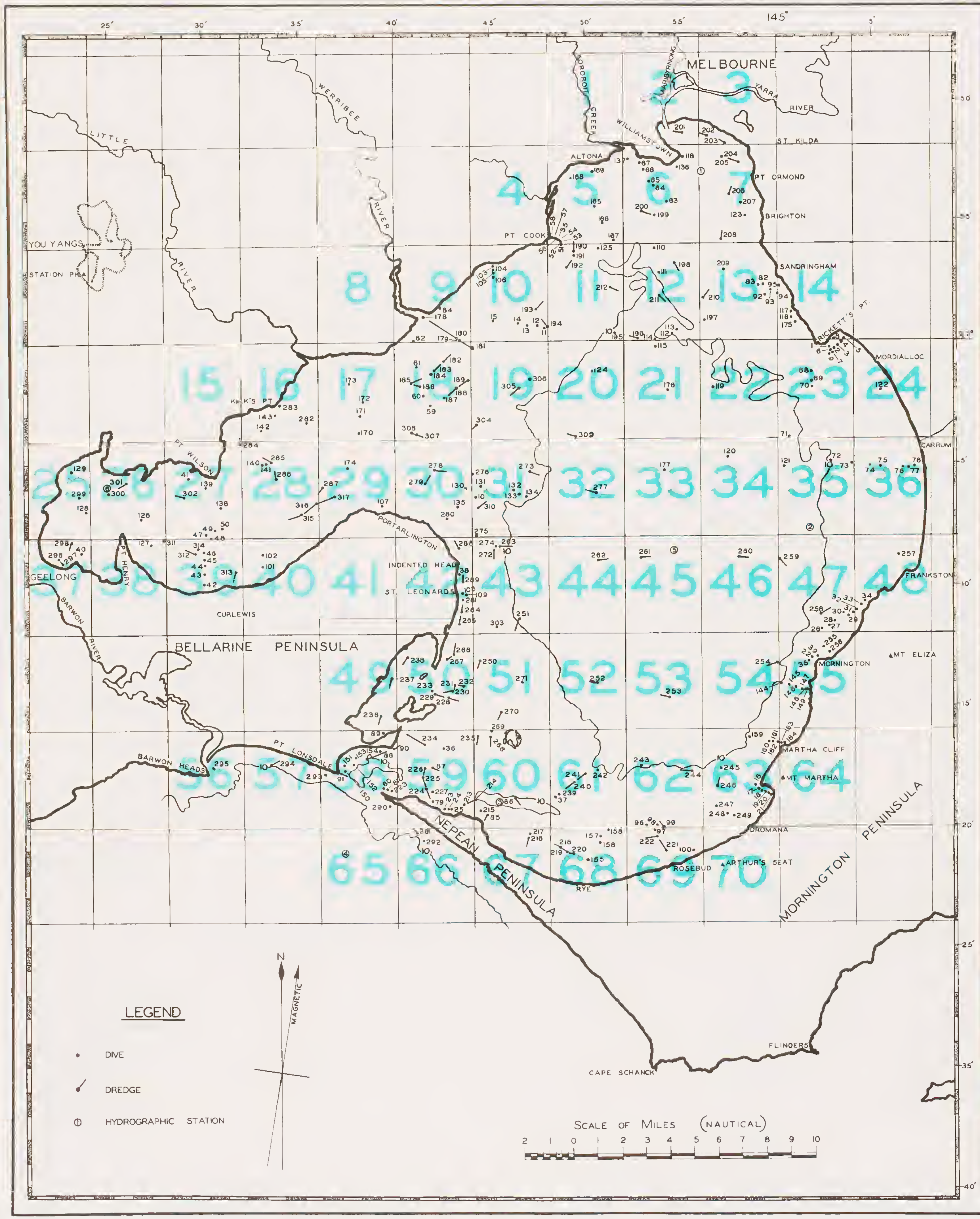

Chart 2.—Port Phillip showing sampling stations and positions of hydrographic stations.

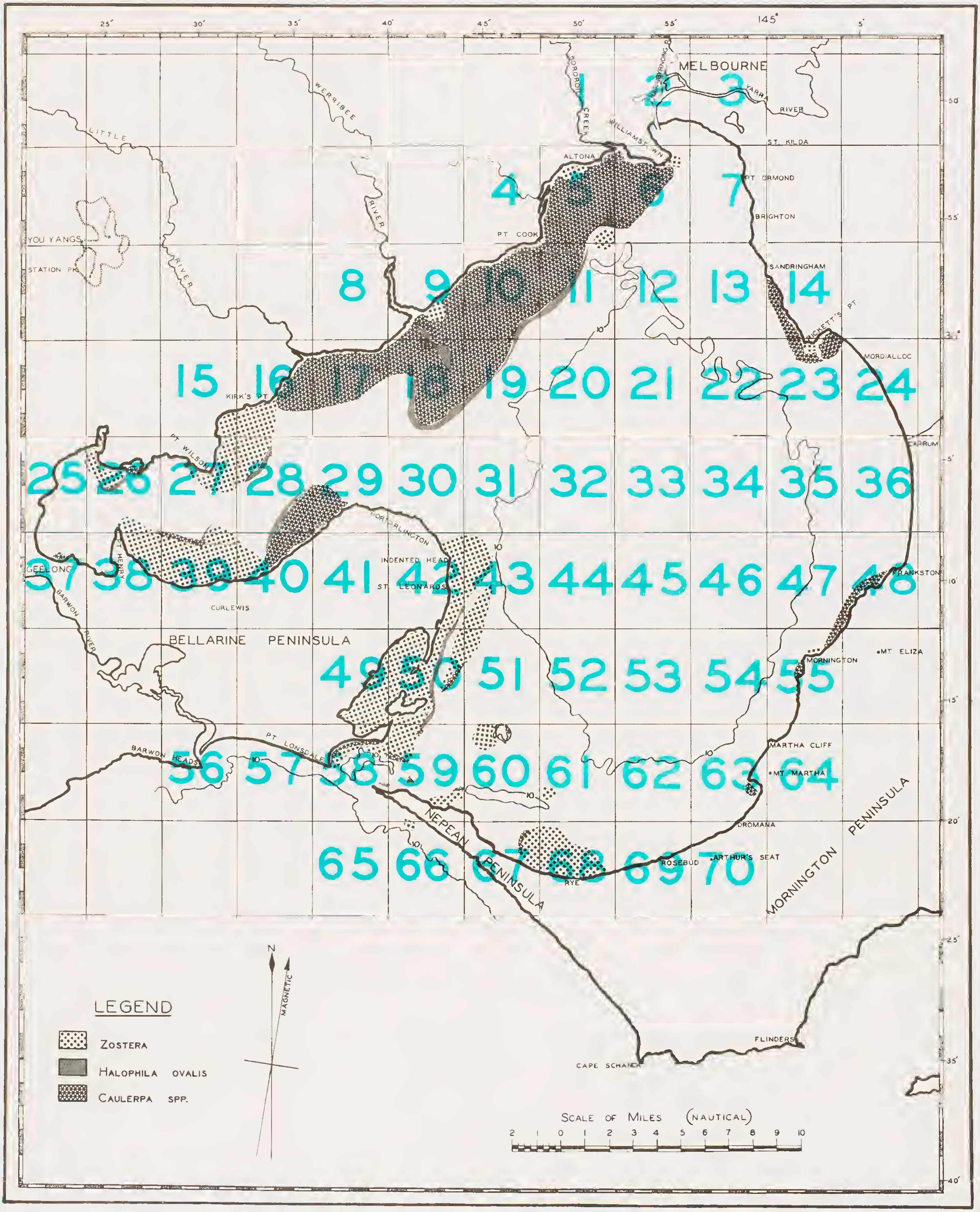

Chart 3—Distribution of Angiosperms and Caulerpa spp.