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The intertidal zonation at two places in Southern Tasmania

By

ERIC R. GUILER

Department of Zoology, University of Tasmania

WITH 2 PLATES AND 1 TEXT FIGURE

SUMMARY

The zonation at two places in southern Tasmania is described. At South Cape Bay the belts on the shore are almost entirely dominated by the algae which is in contrast to the normal type of zonation in Tasmania. Some peculiar features of the distribution of several species are discussed, all of these peculiarities being attributed to wave action. At First Lookout Point, *Galeolaria* forms a belt on an exposed coast. This is attributed to peculiar intertidal conditions produced by offshore reefs.

(A) SOUTH CAPE BAY

1. INTRODUCTION

South Cape Bay lies at the extreme south of Tasmania, latitude 43° 50′ South (Fig. 1) and is at the most southerly point of the Australian faunal region. The bay is wide but does not make a large indentation into the land mass. It consists of extensive rock platforms as well as surf beaches. Most of the area is backed by high cliffs but in several places there are steep grassy slopes which make access to the shore possible.

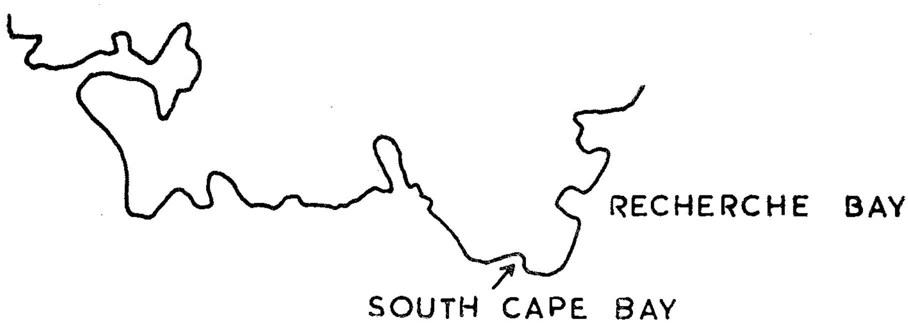

FIG. 1.—Outline map of southern Tasmania showing locality of the work described in the present paper.

The region is difficult to approach and to reach South Cape Bay it is necessary to travel from Hobart, camp overnight at Cockle Creek and the following day walk about six miles along poor bush tracks to the Bay. For this reason only two visits have been made to the area, each visit being of a few hours' duration.

The whole area is extremely exposed to wave action but there are certain important points of difference between the zonation seen here and that occurring on other exposed coasts of Tasmania. The basic zonation found on exposed coasts at Betsy Island, Eaglehawk Neck and the Freycinet Peninsula has been described in earlier papers (Guiler, 1951A, 1951B, 1952A). Comparisons of these areas are made in a later paper (Guiler, 1952B).

2. NOMENCLATURE

The regions of the shore are designated in accordance with the nomenclature of Stephenson and Stephenson (1949) while the meanings of the terms " zone " and " belt " are those proposed by Guiler (1953B).

3. ZONATION

Transect 1

Station: South Cape Bay.
Type: Exposed rocky coast.
Maximum wave action: 0 (1-10), 4, 9, 3.
Description: On the rock platform to the north-west of the boulder beach at the end of the track from Cockle Creek.
Geology: Sandstone with coal strata.
Tidal data: Nil.
Zonation: *Enteromorpha*
Enteromorpha with *Brachyodontes*
Centroceras with *Brachyodontes* and *Jania*
Lithophyllum with *Brachyodontes*
Lithophyllum with *Sarcophycus*
Sarcophycus and *Pyura*.

It has been noted (Guiler, 1952A) that at Eaglehawk Neck much of the wave platform is permanently under water due to waves filling almost imperceptible hollows on the surface of the platform. The same remark is equally true of South Cape Bay, where continual surf water flows over most of the platform.

THE SUPRALITTORAL ZONE

The Supralittoral zone is richly populated by lichens which are growing on the cliffs up to 30 feet above the level of the platforms. In the places where the grass slopes replace the cliffs the lichen belt is absent, tussock grass (*Poa* sp.) being the dominant plant. The coal beds are penetrated at many places by streams or water seepages and in these regions there are minute freshwater algae as well as liverworts and succulent plants growing in the Supralittoral. In the lower parts of the Supralittoral these freshwater seepages are often characterized by the presence of the bright green *Enteromorpha*. The area lies in a high rainfall belt and the influence of freshwater on intertidal life must be considerable.

THE SUPRALITTORAL FRINGE

On this transect there is no Supralittoral fringe such as is to be seen on other parts of the coast of Tasmania. Owing to the platform being largely a pond, especially in the upper region, the only place where the Supralittoral fringe indicator species (*Melaraphe unifasciata* (Gray)) occurs is on a raised part of the platform near the seaward edge. The seaweed *Enteromorpha* forms a belt on the shore at the bottom of the cliffs. There are no other species found associated with it to give a clue as to the tidal region in which it is found. This alga is usually regarded as forming a belt in the Supralittoral fringe but in this case there is some doubt as to the affinities of the species. There are no other species associated with it to give a clue as to the tidal region in which it is found. The height in relation to sea level at which the *Enteromorpha* is found does not provide any assistance since the alga is growing about two inches below the Midlittoral level. If the *Enteromorpha* is to be considered in the Supralittoral fringe then South Cape Bay is of considerable interest since the fringe occupies an area which, although at the furthest part of the shore from the sea, is actually at a lower tidal level than the rest of the shore. If the *Enteromorpha* belt is part of the Midlittoral the region is unique on account of there being no Supralittoral fringe. The *Enteromorpha* is constantly inundated by the surf which however does not, except in gales, cause any splash on the cliffs. This feature could result in a very sharp increase in the percentage air exposure with the result that the Supralittoral fringe is suppressed.

THE MIDLITTORAL

The rock platform is extensive and stretches out for 70 feet from the base of the cliffs, most of the platform falling into the Midlittoral zone (Plate 1). It is intersected by many channels, some of which are deep and contain algae characteristic of the Infralittoral.

Most of the upper part of the Midlittoral is nearly always kept wet by fresh water seepage and wave action. This area is shown by a discontinuous belt of *Ulva* and *Enteromorpha* running around the base of the cliffs and the grassy slopes. This belt is continuous with the pure *Enteromorpha* belt of the Supralittoral fringe.

There is evidence that the area covered by both the *Enteromorpha* belt and the mixed *Enteromorpha*-*Ulva* belt is subject to considerable seasonal variation. The extent of the variation in *Ulva* beds has been noted elsewhere (Guiler, 1954A) and seasonal variations in the density of *Enteromorpha* populations might also be expected. During the visit made in January, 1953, it was observed that both *Enteromorpha* and *Ulva* occupied considerably less area than in December, 1953. This is what might be expected, the heat of the summer sun in January having had considerable effect on the algae with a consequent reduction in the area covered by these seaweeds. In places where there is fresh water pouring out of the cliffs on to the platforms these algal beds are extensive, reaching out about 20 feet from the base of the cliffs. This is particularly accentuated in one area where a small waterfall pours over the cliffs and the wind-blown spray extends both the horizontal and vertical range of these algae.

On lower parts of the platform the *Enteromorpha* is joined by the mussel *Brachyodontes rostratus* (Dunker) to form a mixed belt. *Jania fastigiata* Harv. is the only other common species in this belt, and it forms mats in ponds at this level.

Most of the Midlittoral is dominated by *Centroceras clavulatum* (C.Ag.) Mont. associated with other species. This species has not been encountered in Tasmania before as a belt-forming species. In the upper part of the *Centroceras* belt *Brachyodontes rostratus* and *Melaraphe praetermissa* (May) are both very numerous and are subdominant to the alga. On lower parts of the shore *Jania fastigiata* joins this species along with *Lithothamnion lichenoides* (Ell. et Sol.) Foslie. This area is the first locality in which I have encountered the latter species and although the alga is very plentiful here, it is not found at First Lookout at Recherche Bay. It appears as if it is confined to the South-west area of the Tasmanian coast.

In the *Centroceras* belt there occur several species other than the above mentioned sub-dominants. The most common of these are the limpets, *Siphonaria diemenensis* (Quoy & Gaim.), *S. zonata* Ten.-Woods and *Patelloida marmorata* (Reeve). Of these three species, *S. diemenensis* is by far the most common. *Actinia tenebrosa* (Farq.), *Chthamalus antennatus, Lasaea australis* (Lam.), *Serpula* sp. and some tiny *Lithophyllum hyperellum* Foslie are numerous. A few *Melaraphe unifasciata* are also present. These species give a clear indication of the zone to which the belt can be assigned. It is certain that the *Centroceras* belt is Midlittoral because although a few *Melaraphe unifasciata*, the indicator species of the Supralittoral fringe, are found living in it, the greater number of species in the belt are never found in the Supralittoral fringe. Similarly, none of the species found are known to occur as indicators in the Infralittoral fringe.

It is when we try to decide the belt of the Midlittoral with which the *Centroceras* strip is homologous that there is some doubt. *Lithophyllum* is usually found in the lower Midlittoral or else in the Infralittoral fringe. The Patelloids and *Serpula* are usually very widespread in the lower Midlittoral while *Chthamalus* fits into the barnacle belt. The presence of a relatively dense algal covering on the shore probably assists the upward dispersion of a species requiring a high amount of immersion and it seems likely that in this case *Centroceras* can be considered as homologous to the barnacle belt of other Tasmanian coasts.

In this area a harder part of the rock has resisted denudation and projects about 1 foot above the general level of the surface of the platform. The area of this harder rock is small and the whole is thickly populated by *Melaraphe unifasciata*. The platform surrounding this elevation is in the *Centroceras-Brachyodontes* belt. Beyond this harder rock the belt dominated by *Centroceras* passes into a region dominated by the Patelloids, of which *Siphonaria zonata* is the dominant species. This condition is almost unique as *S. zonata* is usually much less numerous than *S. diemenensis*. Perhaps the nearest approach to this condition is seen on Betsy Island where *S. zonata* is locally dominant on sun sheltered rocks.

The Patelloid belt is interesting in this area not only because the dominant species is *S. zonata* but also because the large *Cellana* spp. are absent. The other Patelloids found in the belt are *S. diemenensis, Patelloida marmorata* and *P. conoidea* (Reeve). *Lithophyllum* also occurs in this belt as do *Actinia tenebrosa* and *Lichina lichenoides*. The latter species is particularly well developed.

Practically on the seaward edge of the wave platform there is a small elevation about one foot in height. I was surprised to see that this is populated by *Melaraphe unifasciata* with *Chamaesipho columna* on the seaward face of the prominence. The *Chamaesipho* belt grades into a *Lithophyllum* belt with *Brachyodontes,* Patelloids, a few *Galeolaria* tubes and, only rarely, *Catophragmus polymerus* Darwin.

The presence of *Melaraphe* in a position so close to the edge of the platform shows that the general surface level of the platform is at a level which is very close to the top of the Midlittoral zone. Consequently, the flora and fauna of the platform might be expected to be poor in species as well as in numbers. However, the continuous flow of surf water over the platform assists the population of the rock by a large number of individuals of a small number of species. This small number of species is greater than the number encountered at similar levels on other Tasmanian coasts.

THE INFRALITTORAL FRINGE

Below the *Lithophyllum* and *Brachyodontes* belt the platform falls away in a vertical cliff into very deep water. The face of the cliff is populated by Lithothamnion type algae mixed with *Pyura stolonifera* (Heller) (= *P. praeputialis* of earlier papers, vide Kott, 1953). These two species grade into a mixed belt populated by *Sarcophycus* and *Pyura.* It is impossible to examine this region of the shore in detail.

4. COMPARISON WITH OTHER ADJACENT AREAS AND DISCUSSION

Some of the most interesting zonations yet observed in Tasmania are to be seen on the platforms to the west of the above transect.

On a sloping shelf the mussel *Brachyodontes* forms a dense sheet, closely covering the rock. This condition is similar to that noted at Pirates Bay, except that the wave action at Pirates Bay is much less than that encountered at South Cape Bay. There are mussel beds formed by this species under similar conditions of wave action at Remarkable Cave at the South-Western end of Tasmania. At both South Cape Bay and Remarkable Cave these beds are restricted in area and it is difficult to see any physical factor or factors controlling the distribution of the beds. It may well be controlled by the chance incidence of successful spatfalls.

On one platform where the surf does not pass over the rocks, the zonation is basically the same as that noted above except that there are certain features which elaborate the picture. *Enteromorpha* which is found at the base of the cliffs has a few *Melaraphe unifasciata* living in it. The belt below this is a mixed *Melaraphe-Brachyodontes* which in turn is followed by a *Melaraphe-Brachyodontes-Chamaesipho* belt. This zonation may probably be interpreted as below:—

SUPRALITTORAL FRINGE: *Enteromorpha* with *Melaraphe*
MIDLITTORAL: *Melaraphe-Brachyodontes*
Melaraphe-Brachyodontes-Chamaesipho

The complete zonation on this platform is:—

Enteromorpha with *Melaraphe*
Melaraphe-Brachyodontes-Chamaesipho
Centroceras and *Brachyodontes* with *Scytosiphon*
Brachyodontes
Lithothamnion lichenoides with *Brachyodontes* and *Lichena*
Ulva with *Jania* and *Brachyodontes*
Xiphophora billardieri with *Pyura*
Xiphophora chondrophylla with *Pyura*
Sarcophycus with *Pyura* and *Lithothamnion* spp.

Both this section and the one described above as the type section are most interesting in that they show an almost pure algal zonation. In most other parts of Tasmania the belt-forming species are predominantly animals but at South Cape Bay and in the area of the Hormosiretum at Port Arthur (Cribb, 1954), algae have become the belt-forming species and the shore resembles the conditions seen in the cold temperate regions. The Hormosiretum at Port Arthur is very local and must be considered to be a special case but the algal zonation at South Cape Bay is so widespread that it merits separate consideration. It is obvious that different conditions operate in this area so as to permit two species not hitherto found forming belts on other parts of the Tasmanian coast to assume zonal significance. The presence of the two species of belt-forming seaweeds (*Lithothamnion lichenoides* and *Centroceras clavulatum*), an alteration in the ecological status of *Catophragmus* (see below) and the presence of both *Xiphophora chondrophylla* and *X. billardieri* as belt-forming species above the *Sarcophycus* belt, all point to a major re-orientation of belts on the shore. The principal feature of the new zonation which becomes apparent is the dominance of the algae on the shore. This is a feature of cold temperate regions which has not yet been recorded in Australian seas. It seems probable that South Cape Bay lies on the fringe of a geographical province which is different from the other provinces of Australia. The province is represented by only the restricted area of Southern Tasmania on account of the absence of land masses suitable for intertidal life. It seems unlikely that this province is the northern most limit of the Sub-Antarctic Region since the alga *Sarcophycus* would be replaced by *Durvillea antarctica* (Cham.) Hariot if that were the case. The more acceptable hypothesis is that this is a small, hitherto undetected, province of the Australian Region. However, much collecting and taxonomic work will need to be carried out before this hypothesis can be confirmed or otherwise.

Table 1 shows the distribution of the principal intertidal species in Tasmania. With greater collecting it will be possible to fill in many of the gaps and to add other species to this basic list. Comparison of this list with that given by Bennett & Pope (1953) supports the conclusions reached by these authors that Tasmania is a cool temperate region with close affinities to a southern Victorian region.

TABLE 1

Distribution of the important intertidal species in Tasmania

	North Coast	South Coast	East Coast	West Coast
PORIFERA				
Tethya diploderma Schmidt		X	X	X
Hymeniacidon perlevis (Montagu)		X	X	
Grantessa hirsuta (Carter)		X		
COELENTERATA—Hydroidea				
Obelia australis v. Lind.		X	X	
geniculata (L.)		X		
Gonothyrea hyalina Hincks		X		
Silicularia campanularia (v. Lend.)		X		
Orthopyxis caliculata (Hincks)			X	
Plumularia setacioides Bale		X	X	
setacea (Ellis)			X	
Aglaophenia plumosa Bale		X	X	
parvula Bale		X		
Actiniaria				
Oulactis muscosa (Drayton)	X	X	X	X
Actinia tenebrosa (Farq.)	X	X	X	X
Anthothoe albocincta (Hutton)	X	X	X	X
Anthopleura aureoradiata (Stuck.)		X		
Phlyctenanthus australis Carlgren		X	X	X
Phlyctenactis tuberculosa (Quoy & Gaim.)		X	X	X
CTENOPHORA				
Physalia australis	X	X	X	X
TURBELLARIA				
Leptoplana australis Laidlaw	X	X	X	
ANNELIDA				
Galeolaria caespitosa Lam.	X	X	X	X
CRUSTACEA				
Cirripedia				
Ibla quadrivalvis Cuvier		X	X	
Balanus trigonus Darwin		X		
Tetraclita purpurascens (Wood)	X	X	X	X
Elminius modestus Darwin	X	X	X	
simplex Darwin	X	X	X	
Chthamalus antennatus Darwin	X	X	X	X
Chamaesipho columna (Spengler)	X	X	X	X
Catophragmus polymerus Darwin	X	X	X	X
Isopoda				
Paridotea munda Hale		X		
Euidotea peronii (M.-Edw.)	X	X	X	
Ligia australiensis Dana	X	X	X	X
Cymodoce gaimardii M.-Edw.		X		
Amphoroidea elegans Baker			X	
tridentata (M.-Edw.)	X			
trispinosa (Haswell)	X	X	X	
Zuzara venosa (Stebbing)	X	X		
Sphaeroma quoyana M.-Edw.		X		
Amphipoda				
Orchestia marmorata Haswell	X		X	
Talorchestia diemenensis Haswell		X	X	
quadrimana (Dana)		X		

	North Coast	South Coast	East Coast	West Coast
Decapoda				
Palaemon serenus (Heller)	X			
Macrobrachium intermedius (Stimpson)		X	X	X
Petrolisthes elongatus M.-Edw.	X	X	X	X
Petrocheles australiensis Miers		X		
Callianassa ceramica Fulton & Grant	X	X	X	
Upogebia simsoni (Thomson)		X	X	
Lomis hirta (Lam.)	X	X	X	X
Leptochela robusta Stimpson	X			
Petalomera lateralis (Gray)		X	X	
Cancer novae-zealandiae (Jacq. & Lucas)		X	X	
Halicarcinus planatus (Fabr.)	X			
ovatus (Stimpson)		X	X	
Leptomithrax sternocostulatus (M.-Edw.)	X	X		
Paramithrax minor Filhol		X	X	
Naxia aurita (Latr.)		X		
Nectocarcinus tuberculosus M.-Edw.		X	X	X
integrifrons (Latr.)		X		
Ovalipes bipustulatus M.-Edw.		X	X	X
Heteropilumnus fimbriatus (M.-Edw.)		X		
Pilumnus tomentosus Latr.	X		X	
Leptograpsus variegatus (Fabr.)	X	X		
Brachynotus octodentatus (M.-Edw.)	X			
spinosus (M.-Edw.)		X		X
Cyclograpsus punctatus (M.-Edw.)	X	X	X	X
Paragrapsus quadridentatus (M.-Edw.)	X	X	X	X
gaimardii (M.-Edw.)	X	X	X	X
Plagusia capensis de Haan	X	X	X	X
Helice haswellianus (Whitelegge)		X	X	
Heloecius cordiformis (M.-Edw.)		X	X	
Mictyris platycheles (M.-Edw.)	X	X	X	
Ebalia laevis (Bell)	X	X		
MOLLUSCA				
Amphineura				
Poneroplax albida (Blainville)		X	X	X
costata (Blainville)		X	X	
Ischnochiton lineolatus Blainville	X	X	X	
milligani Iredale & May	X	X	X	
mayi Pilsbry		X	X	
Ischnoradsia evanida Sowerby		X	X	
Haploplax smaragdina (Angas)	X	X	X	X
Sypharochiton pellis-serpentis (Quoy & Gaim.)	X	X	X	X
Gastropoda				
Scutus antipodes Mont.		X	X	
Hemitoma aspera Gould		X		
Haliotis noevosum Martyn		X	X	X
Austrocochlea concamerata (Wood)	X	X	X	
constricta (Lam.)	X	X	X	X
obtusa (Dillw.)	X	X	X	
odontis		X	X	
Clanculus plebejus (Philippi)		X	X	
Fossarina petterdi Crosse		X	X	
Astele subcarinata Swainson		X	X	
Phasianella australis (Gmelin)		X	X	
Subninella undulata (Solander)	X	X	X	X
Melanerita melanotragus (Smith)	X		X	X
Patelloida alticostatus (Angas)	X	X	X	X
marmorata (Ten. Woods)		X	X	X
Montfortula conoidea (Reeve)	X	X	X	X
Actinoleuca calamus (Grosse & Fischer)		X	X	

	North Coast	South Coast	East Coast	West Coast
Notacmaea septiformis (Quoy & Gaim.)		X	X	
Cellana limbata (Philippi)		X	X	X
variegata (Blainville)		X	X	
Melaraphe praetermissa (May)		X	X	X
unifasciata (Gray)	X	X	X	X
Bembicium melanostoma (Gmelin)		X	X	X
nanum (Lam.)	X	X	X	
Patella perplexa (Pilsbry)	X			
Dardanula melanochroma (Tate)	X	X		
Merelina australiae (Ten.-Woods)		X		
Assimania brazieri (Ten. Woods)		X		
Pyrazus diemenensis (Quoy & Gaim.)		X	X	
Argobuccinum tumidum (Dunker)	X	X	X	
Polinices conicus (Lam.)	X	X	X	X
Trivia australis (Lam.)		X	X	
Marginella pygmaea Sowerby		X	X	
Floraconus anemone (Lam.)		X	X	
Fasciolaria australasia (Berry)	X	X	X	X
Colus novae-hollandiae (Reeve)		X	X	
Parcanassa pauperata (Lam.)		X	X	X
Cominella eburnea (Reeve)		X	X	
lineolata (Lam.)	X	X	X	X
Salinator fragilis (Lam.)	X	X		
Siphonaria diemenensis Quoy & Gaim.	X	X	X	X
zonata Ten.-Woods		X	X	X
tasmaniensis Ten.-Woods		X	X	
Philine angasi (Crosse & Fischer)		X	X	
Tethys tasmanica Ten.-Woods		X		
Lamellibranchiata				
Glycymeris striatularis (Lam.)	X	X	X	X
Neotrigonia margaritacea (Lam.)		X	X	
Mytilus planulatus (Lam.)	X	X	X	X
Brachyodontes erosus (Lam.)		X	X	
rostratus (Dunker)	X	X	X	X
Lasaea australis (Lam.)	X	X	X	X
Clausinella placida (Philippi)		X	X	
Bassina disjecta (Perry)	X	X	X	X
Marcia corrugata (Lam.)		X	X	
scalarina (Lam.)		X	X	
Soletellina biradiata Wood		X		
Mactra rufescens Lam.		X	X	
Spisula trigonella Lam.		X	X	
Anapella cycladea (Lam.)		X	X	
Amphidesma angustata (Reeve)	X	X	X	
Hiatella australis (Lam.)		X	X	
ECHINODERMATA				
Asteroidea				
Asterina scobinata Livingstone	X	X	X	
Astropecten schayeri Döderlein		X		
Coscinasterias calamaria (Gray)		X	X	X
Patiriella calcar (Lam.)	X	X	X	X
exigua (Lam.)		X	X	X
gunnii (Gray.)		X	X	
Tosia australis Gray	X	X	X	
Crinoidea				
Crinoid sp.		X		
Ophiuroidea				
Amphiura constricta Lyman		X	X	
Ophionereis schayeri (Müller & Troschel)		X		

	North Coast	South Coast	East Coast	West Coast
Holothuroidea				
Chiridota gigas Dendy	X	X	X	
Mensameria thomsoni (Hutton)		X	X	
Paracaudina australis (Semper)	X	X		
Stichopus mollis (Hutton)		X	X	
Echinoidea				
Amblypneustes ovum (Lam.)		X	X	X
Echinocardium cordatum (Pennant)		X	X	
Heliocidaris erithrogrammus (Val.)		X	X	X
UROCHORDATA				
Ciona intestinalis L.		X		
Pyura stolonifera (Heller)		X	X	X
Boltenia pachydermatina Herdman		X	X	X

The second of these sections is one of the most interesting, yet perplexing, in Tasmania; a Coralline belt is usually found on the lower part of the shore, somewhere near the Patelloid belt. However, in this instance, the various Coralline seaweeds are found at a remarkably high level on the shore. It is possible that the spray-laden atmosphere and the prevalent rough weather have enabled the algae to grow higher on the shore in this area than on other parts of the coastline.

The presence of *Xiphophora chondrophylla* and *X. billardieri* is noteworthy. Up to date this alga has been regarded as an indicator of the intensity of wave action, being found in places where the wave action is somewhat reduced below the maximum, *Sarcophycus* being the indicator of the most intense wave action, followed by *Lessonia* and then *Xiphophora* spp. At Fossil Island it was noted that the presence of large boulders reduced the wave action so that a vertical zonation of algae resulted, those species with the least wave action toleration being found highest on the shore. In other words a horizontal zonation was re-orientated into the vertical plane. The same alteration has taken place at South Cape Bay although *Lessonia*, the species intermediate between *Sarcophycus* and *Xiphophora* is represented by only a few plants. In this instance the reason for the re-orientation of the zones is not clear. The wave action may be slightly less higher on the shore in the *Xiphophora* belt than it is in the *Sarcophycus* belt but this reduced wave action is still much more intense than any other wave action which I have seen tolerated by *Xiphophora*.

The presence of *Pyura* in the *Xiphophora* as well as in the *Sarcophycus* belt indicates that the former weed is occurring in the Infralittoral fringe. At this particular point the vertical height between the crest of the waves and the troughs is of the order of 12 feet. In gales this distance must be much greater. Yet all of this area is exposed intermittently and forms a very extensive Infralittoral fringe. This fringe is homologous with the narrow band about 6 inches in vertical height seen on sheltered shores.

The distribution of the large limpet, *Cellana limbata* (Philippi) is yet another interesting feature of the area. The limpet is absent from the first two platforms examined but on another similar platform the species is numerous with individuals reaching a large size. The limpet appears to thrive in places where the wave action is just below the maximum. This is not in accordance with the observed distribution of the species on the East Coast where *Cellana* usually inhabits some of the most exposed places.

The surf barnacle, *Catophragmus polymerus* Darwin, follows a similar distribution pattern. On the East Coast and at Betsy Island this barnacle is found in places where the wave action is not only intense but where there is also broken water. However, the species is also found in regions where there is less wave action but considerable surf, e.g., at Frying Pan Island in Port Arthur. At South Cape Bay the barnacles are almost totally absent from fully exposed places, nor are they found on the surface of the platform. Clefts and narrow channels in the platforms are richly populated by this species, some of the largest specimens measuring 5 cm. from the base to the terga, these specimens being the largest I have seen in Tasmania. It is important to note that the distribution of *Catophragmus* on the South Coast forces an alteration to a previous conclusion regarding the relation of the belts formed by this species in Tasmania and Australia. In the earlier paper (Guiler, 1954B) it was pointed out that *Catophragmus,* although forming intertidal belts in Tasmania, does not form them under exactly the same ecological conditions as in New South Wales. This conclusion must now be extended so that it is clear that there is no *Catophragmus* belt in southern Tasmania.

5. OTHER SPECIES

The whole area is rich in species, most of which occur in ponds or in Infralittoral clefts. The area would undoubtedly furnish interesting Infralittoral collecting were it not for the difficulty of access and removal of material. However, the intertidal region is not rich in species probably due to the intense wave action killing or removing all but the most robust and hard-clinging species. A list including most of the other species inhabiting the various zones is given below.

Supralittoral Fringe:

Enteromorpha sp.
Melaraphe unifasciata (Gray)
Melaraphe praetermissa (May)
Ulva lactuca L.

Midlittoral:

Melaraphe unifasciata
Brachyodontes rostratus
Chamaesipho columna
Siphonaria diemenensis
Siphonaria zonata
Catophragmus polymerus
Cellana limbata
Patelloida conoidea
Patelloida marmorata
Galeolaria caespitosa (scarce)
Brown anemone

Algae

Centroceras clavulatum (C.Ag) Mon.
Jania fastigiata
Jania spp.
Lithophyllum hyperellum Foslie
Lichena officinalis
Ulva lactuca
Porphyra sp.
Lithothamnion (flesh coloured)
Lithothamnion (red coloured)
Adenocystis lessonii

Midlittoral: *continued.*

Dicathais baileyana (Ten. Woods)
Patiriella calcar (Lam.)
Patiriella exigua (Lam.)
Oulactis muscosa (André)
Sypharochiton pellis-serpentis (Quoy & Gaim.)
Poneroplax albida (Blainville)
Calliostoma hedleyi Pritchard & Gatliff
Actinia tenebrosa
Subninella undulatus
Lepidonotus sp.
Serpula sp.
Lasaea australis (Lam.)

Algae: *continued.*

Scytosiphon lomentarius
Colpomenia sinuosa
Lithothamnion lichenoides

Infralittoral fringe:

Pyura stolonifera

Xiphophora chondrophylla
Xiphophora billardieri
Lessonia corrugata
Lithothamnion spp.

(B) FIRST LOOKOUT POINT

This point which is composed of broken reefs, is much easier of access than South Cape Bay, being only two miles from Cockle Creek. The wave exposure here is almost as great as that at South Cape Bay, the area being exposed to southerly gales. It is, however, sheltered from the prevailing south-westerly weather.

The most important feature of the zonation is the presence of an extremely well-developed *Galeolaria* belt co-existing on exposed shores with *Sarcophycus.* I have always pointed out that the presence of *Galeolaria* colonies on exposed coasts is feature of the coasts of New South Wales which is not found in Tasmania. In the area under consideration, the zonation is as set out below.

Melaraphe
Chamaesipho
Chamaesipho and *Siphonaria zonata*
Galeolaria and *Lithophyllum*
?Patelloids
Sarcophycus

An unusual feature is the large quantity of *Lithophyllum* associated with the serpulids.

The salient physical factor is the amount of surf breaking on the reefs. The reef habitat appears eminently suitable for colonization by *Catophragmus* yet the barnacle is absent, careful searching failing to reveal a single specimen. The species appears further down the coast to the South at a place where there is no *Galeolaria belt.* It would appear, therefore, that the serpulids have replaced *Catophragmus* in this very restricted part of Tasmanian shores and so reproduced Australian conditions. The reason for this behaviour probably lies in the submarine reefs which lie offshore at this point. These reefs are often awash at low water and they form an effective backwater which, although providing plenty of surf, prevent the full force of the waves crashing on the shore. Dakin, Bennett & Pope (1948) record that *Galeolaria* is a surf-loving species found at exposed places in New South Wales, so that it is possible that conditions suitable to this species are reproduced at this point. Offshore reefs of this nature are not common in Tasmania which would explain the absence of this type of zonation from anywhere else on the coastline.

In a recent paper, I pointed out that there was a series of cyclical changes constantly taking place on the coasts of Tasmania (Guiler, 1953A). On a sheltered coast this cycle reaches its climax in thick *Galeolaria* beds. It is possible that this is true of all other types of coast and First Lookout Point is the only place in Tasmania that is in its climax state. I believe this to be most unlikely since *Galeolaria* is absent or scarce on all other exposed places. The more likely explanation is that offered above where unusual conditions occur for the growth of *Galeolaria*. It is highly significant that at distance of 800 yards either side of First Lookout Point the zonation is normal, though with *Lithophyllum* replacing *Catophragmus*.

Catophragmus polymerus presents several problems in its distribution. On the East Coast this species is found in the most exposed places and at Betsy Island the barnacles also thrive in exposed, rough water. However, at both First Lookout Point and South Cape Bay the species is rare in exposed places, in no places forming a belt. It is found in sheltered clefts and some "cryptic" places. On the west coast at Trial Harbour the species is plentiful in its normal habitat. It is probable that at this latitude, *Catophragmus* is just on the southern limit of its geographical range and is seeking a less rigorous habitat. A similar feature has been noted with another Australian barnacle, *Tetraclita purpurascens* Wood, which is entirely semi-cryptic in Tasmania. This species is rare in the South.

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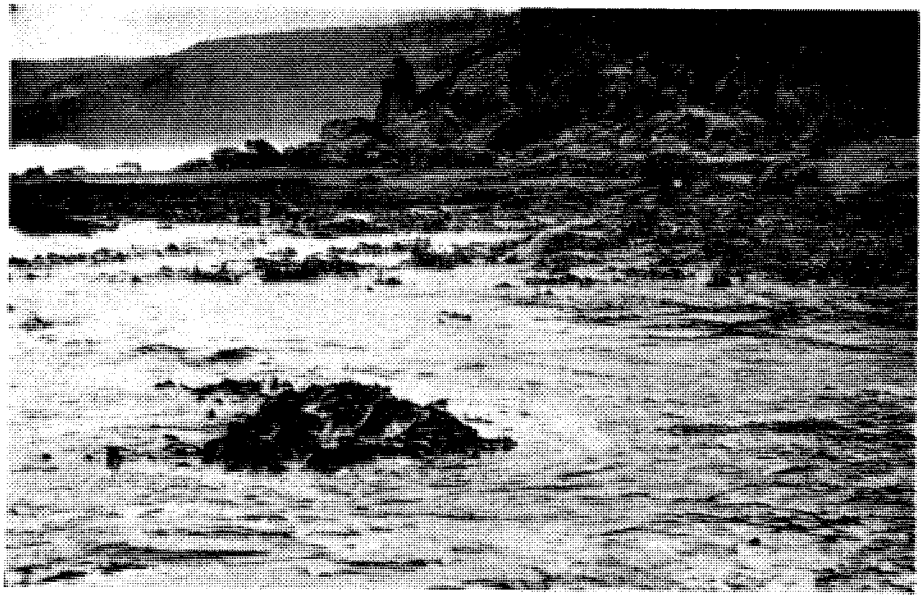

FIG. 1.—*Sarcophycus* on the rocks to the north of the transect, Dec. 1953. The intensity of the spray can be judged from the haze in the background. Printed from a Kodachrome.

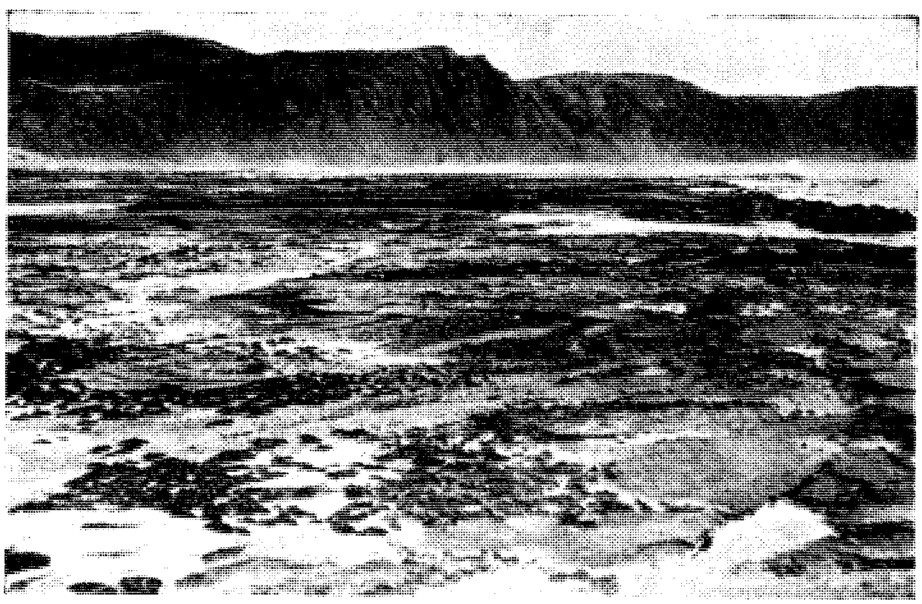

FIG. 2.—The platforms at South Cape Bay, Dec. 1953. The prominent dark patches are *Brachyodontes*, the lighter areas are *Centroceras* and some of the white patches are *Jania* or *Lithothamnion*.