PAPERS AND PROCEEDINGS OF THE ROYAL SOCIETY OF TASMANIA, VOLUME 92

THE FISHER ISLAND FIELD STATION—WITH AN ACCOUNT OF ITS PRINCIPAL FAUNA AND FLORA

By

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(WITH 2 PLATES AND 9 TEXT FIGURES)

I. GENERAL DESCRIPTION OF FISHER ISLAND AND ITS MUTTON-BIRD ROOKERIES*

INTRODUCTION

Fisher Island (lat. 40° 10′ S., long. 148° 16′ E.) is among the smallest of the archipelago of islands comprising the Furneaux Group in eastern Bass Strait. It lies off the southern shoreline of the major island in the group, Flinders Island, in Adelaide Bay, a portion of Franklin Sound which separates Flinders Island from Cape Barren Island (fig. 1). Its convenient location to Lady Barron (the main port of Flinders Island, about 220 yards distant), its proximity to important commercial mutton-birding islands and the presence of a small, easily handled nesting colony of mutton-birds (*Puffinus tenuirostris* (Temminck)), made it the obvious choice for a field station when the Commonwealth Scientific and Industrial Research Organization and the Fauna Board of Tasmania began their mutton-bird investigations in 1947.

The island was too small to be specifically noticed in the Admiralty surveys. To the local inhabitants it has been known as Little Island, but in 1941, at the suggestion of Colonel J. E. C. Lord, it was officially named Fisher Island by the Lands Department in honour of Police Sergeant George A. Fisher. This officer, when he was stationed at Flinders Island between 1926 and 1934, undertook investigations on the homing of the mutton-birds on it by means of marking experiments.

The island was declared a fauna sanctuary in 1928, but prior to that date had been constantly raided during the mutton-bird season for eggs and fledglings. For a time a Flinders Island landholder pastured goats on it.

After the island was selected as the site for a field station to investigate the biology of *Puffinus tenuirostris* a single-roomed hut was constructed on it in 1948. This accommodated four persons. An extension in 1956 provided for two additional persons, and the facilities allow field parties comprised of mixed sexes being based on the island. Water is supplied by the roof catchment.

PHYSICAL DESCRIPTION

Fisher Island has an area above high-water mark of 2·1 acres or 10,100 square yards. The additional area uncovered at extreme low tide is approximately 0·75 acres. The shoreline measures about 530 yards and the greatest length, from North Point to South Point, is 150 yards. Its elevation is about 19 feet above spring high-water mark.

Like the other islands in the Furneaux Group, Fisher Island is part of the basement Devonian granite which forms the hills and mountain ridges in the archipelago. On Flinders Island the low-lying plains are covered by Tertiary alluvium and sands, with calcareous deposits in restricted areas. Limited Siluro-Devonian quartzites and slates also occur, and in the northern part of Adelaide Bay, at Petrifaction Bay, are exposures of Tertiary vesicular basalts. None of these formations, however, enter into the structure of Fisher Island, which consists solely of a flattened granite dome, with a limited soil covering which reaches its maximum depth of two feet in only a few places. There is no trace of the post-Tertiary sandy limestone which forms a capping, or limited crust, on some of the other smaller islands, such as Green Island (off Whitemark), Kangaroo Island, Big Woody Island and Tin Kettle Island. This limestone weathers into a richer residual soil than the sandy soils of the granite areas, and hence such islands were soon exploited for pastoral purposes when Flinders Island was settled. This led, in many cases, to the drastic alteration of the environment, detrimental to any mutton-bird colonies that might have been on them. The absence of limestone on such islands as Great and Little Dog, and Little Green Island, and Babel Island, saved them from such severe habitat alteration and they survive as extensive mutton-bird rookeries. A soil survey of the main island of Flinders has been made by Dimmock (1957) but the surrounding islets have not been reported on.

Fisher Island has a fairly level appearance when viewed from seaward, the highest elevation being to the south-west of the buildings. In the south a slight gully has been eroded along the jointing planes in the granite (Snake Gully). On the eastern shore a wave-cut platform, awash at high spring tides, has been eroded. At Potts Point it has a width of 40 feet, and is backed by a low cliff up to nine feet high. Exfoliation is taking place along the margins near North Point and north-west of the hut where, in combination with jointing, the feature known as the Fingers has been produced. Some of the loose blocks here have been displaced seawards. The margin between tide marks is

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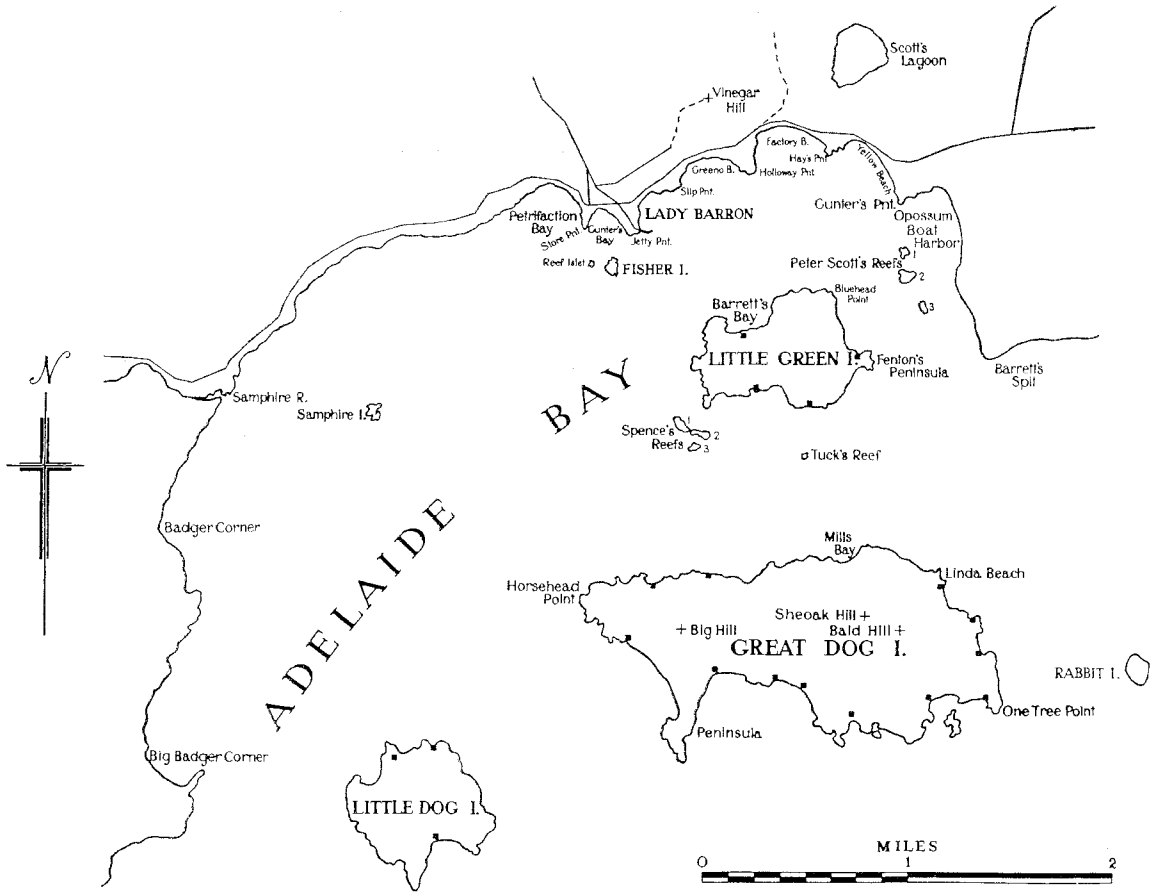

FIG. 1.—Portion of Adelaide Bay based on aerial surveys by the Tasmanian Lands Department.

littered with water-worn granite boulders, particularly along the west and south-west shores. North-east Boat Harbour is the single sandy beach on the island but is only exposed at low water.

THE MARINE ENVIRONMENT

The *Australia Pilot* describes Franklin Sound as " much encumbered by islands and shallow banks, between which there is a somewhat tortuous and, in places, narrow channel available only for vessels with local knowledge ". The Sound is sheltered from the oceanic swell and its north-eastern extension, Adelaide Bay, in which Fisher Island lies, is virtually land-blocked.

(*a*) *Tides*

The range of ordinary spring tides at Fisher Island is just under six feet and of neap tides about four feet. " King " spring tides may range almost two feet more than ordinary spring tides. High water at Full and Change is at 10.15 hours, which means that low-water spring tides occur, during the day, about 5 o'clock in the afternoon. The tidal range is about the same throughout Franklin Sound, as far west as Long Island, but it is greater in the open sea outside the Sound. The range at Goose Island is about nine feet at average tides.

Around Fisher Island the flood tide flows, in general, from east to west, and at ebb from west to east. However for about 1½ to 2 hours before high water the direction of the flood tide is reversed and it flows from the westward. The velocity of the tidal current in the general area is given by the *Australia Pilot* as from 2 to 2½ knots. Around the shores of Fisher Island, however, the rate is faster and would be about three knots.

(*b*) *Sea Temperatures*

Sea water surface temperatures have not been taken in Franklin Sound but the C.S.I.R.O. Division of Fisheries and Oceanography has records from three sampling stations in neighbouring waters (Rochford, 1951-57). These are: off Babel Island (lat. 39° 54′ S., long. 148° 30′ E.), off St. Helens (lat. 41° 18′, long. 148° 30′), and off Low Head (lat. 40° 55′, long. 146° 46′).

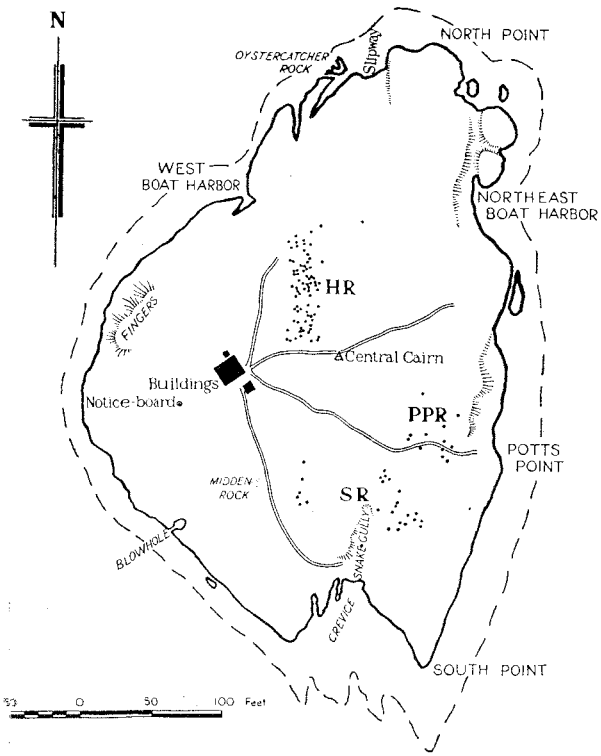

FIG. 2.—Map of Fisher Island after a survey by G. M. Storr, 1952. The occupied mutton-bird burrows in the season 1956-57 are represented by dots. HR = Home Rookery; SR = South Rookery; PPR = Potts Point Rookery.

Off Babel Island surface temperatures vary from 16-18°C. in the summer months (highest recording 18·8° on January 20, 1941) to just under 13° in the winter months (lowest recording 12·7° on August 25, 1940), but there is considerable fluctuation. The temperature becomes higher off-shore, owing to the influence of the warm, southward-flowing East Australian Current. Thus about 30 miles east of Babel Island the surface temperatures in the summer are between 18° and 19° (the highest recording being 19·2° on February 21, 1940). In the winter they drop to just over 13° (lowest recording 13° on August 25, 1940).

At St. Helens the temperatures average slightly lower. The inshore surface values vary from 15° to 18° in the summer and from about 11° to just under 13° in the winter (lowest recording 10·6° on September 24, 1946).

At Low Head the winter temperatures fall slightly below those of Babel Island, and the range lies between about 11° and 12°.

These figures accord broadly with other temperature data reviewed by Garner (1954). A detailed review of the hydrological characteristics of the Tasman Sea region including the waters around the Furneaux Group, is given by Rochford (1957).

CLIMATE

(a) *Rainfall*

A considerable proportion of the rainfall in this area is orographical. In Bass Strait away from land the annual rainfall is only about 20 inches. (Goose Island, the most remote islet in the Furneaux Group, has averaged 22 inches over a 38-year period). The coasts of the larger islands receive 27-30 inches. Inland there is further increase in precipitation according to elevation; the highest rainfall is probably in the Strzelecki Range, which attains an altitude of 2550 feet.

The nearest rainfall-recording station to Fisher Island is Lady Barron, where records have been kept for 15 years. The annual average is 30·45 inches at Lady Barron, 29·42 inches at Pat's River (for 10 years), and 28·48 inches at Whitemark (for 32 years). The main mutton-birding islands in Franklin Sound would all receive about 30 inches.

The monthly distribution of rainfall at Lady Barron is graphed in fig. 3. It will be seen that the rainfall is predominantly of the winter type, but with generous falls in the remaining months. It is the rainfall in these months, mainly from November to March, that affects the welfare of the mutton-bird rookeries.

On occasions when the late spring, summer and autumn rainfall is abnormally high the mutton-bird rookeries, particularly in the low-lying areas, may suffer severely from flooding. In recent years two seasons have been commercially disastrous because of such rains. In November, 1949, rainfall, totalling 5·52 inches at Lady Barron and 7·26 inches at Pat's River (13 miles N.W. of Fisher Island), devastated the low-lying rookeries at the crucial egg-laying period. The Fauna Board was compelled to cancel commercial mutton-birding at Great and Little Dog and Little Green Islands in the following March-April period.

The greater falls in the summer of 1955-56 also led to a curtailment of the commercial season. The daily falls from December to March during this season are graphed in fig. 4, which demonstrates how repeated heavy precipitation at frequent intervals from late December, culminating in sustained falls in February, deluged the rookeries. The total rainfall for the months December to March, inclusive, was 17·91 inches (for Pat's River, the Lady Barron station having been temporarily discontinued). This is 10½ inches more than the Pat's River average for the period.

The Bureau of Meteorology has analysed the rainfall records of nine selected stations in the Furneaux Group by means of cumulated frequency curves and the percentage chances of receiving specified monthly totals for each month have been calculated. These stations were chosen out of the 12 recording stations on the islands because they have been operating for relatively long periods. The chances of a precipitation of five inches or more at Pat's River at each of the crucial months of the mutton-bird season are as follows:—

November: 6 times in 100 years.
December: twice in 100 years.
January and February: 6 times in 100 years.
March: 9 times in 100 years.

The chance of receiving 10 inches or more of rain in the period December to February, inclusive, has been calculated as 3 times in 100 years, but falls of six inches can be expected in three summers out of 10. Thus the season 1955-56 must be accounted as most extraordinary; the exceptionally heavy summer rains being due to the passage of repeated sub-tropical pressure systems.

On the other hand, relatively dry weather during this period tends to enhance breeding success by the mutton-birds. Fortunately there is a far greater expectancy of such weather than abnormally wet weather. Thus, Whitemark has a 95 per cent chance of receiving only two inches of rain in the period December-February, an 86 per cent chance of receiving three inches, and 70 per cent chance of receiving four inches.

The Goose Island figures are, from the point of view of the mutton-bird environment, more favourable than the Franklin Sound islands. Hence it may be assumed that Chappell Island, and to a lesser extent Babel Island also, will fare better in heavy rainfall years than the Sound islands.

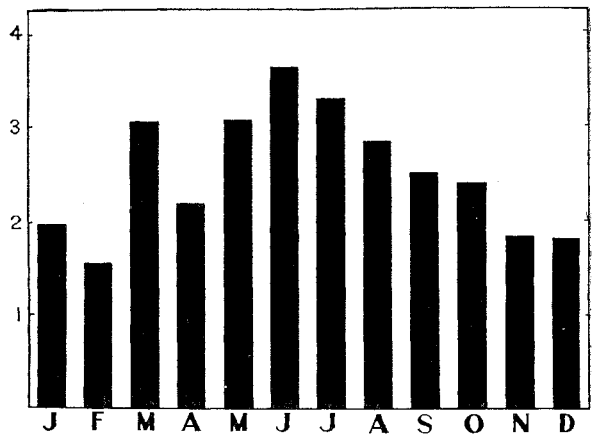

FIG. 3.—Mean monthly rainfall in inches, Lady Barron.

(b) Temperature

There are no temperature recording stations in the Flinders Island region, and the data in fig. 5 have been compiled from records kept at Currie, King Island (lat. 39° 58′, long. 143° 53′). The Commonwealth Bureau of Meteorology, which supplied the data, states that it is reasonable to suppose that temperatures will be similar on the two islands.

The climate is mild, with an absence of extremes. Frost is unknown on the smaller islands such as Fisher Island, but may occur on the main island of Flinders. Light snow has been known to fall on only one occasion on Flinders Island, in August, 1951, when it was noted also on Babel Island.

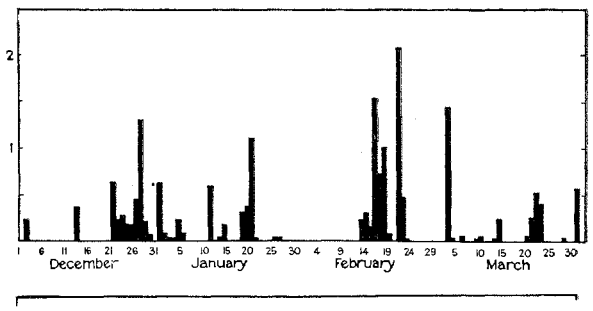

FIG. 4.—Daily rainfall in inches. Pat's River, summer of 1955-56.

(c) Temperatures in Mutton-bird Burrows

The micro-climate in the mutton-bird rookeries is somewhat different from that recorded by instruments in the standard meteorological screens. Within the dense *Poa* tussocks, and in *Acacia* and other thickets, which are sheltered from the wind, temperatures may be high. In the mutton-bird harvesting season, in March-April, conditions can be uncomfortably warm for the operatives. Within their burrows, however, the mutton-birds are protected from the extremes of temperature.

The data in fig. 6 were obtained in 1954 from recordings of maximum and minimum thermometers set in empty mutton-bird burrows and in a box screen in an *Acacia* thicket at Potts Point rookery. The mutton-bird burrow selected for analysis was Burrow 90, which lay 17 yards south-east of the box screen. The heavy lines in the graph show the variations in daily maxima and minima in the box screen, and the broken lines those in the mutton-bird burrow. The means have been computed from daily readings for each week from January 14 to May 5, and from November 19 to December 23, 1954.

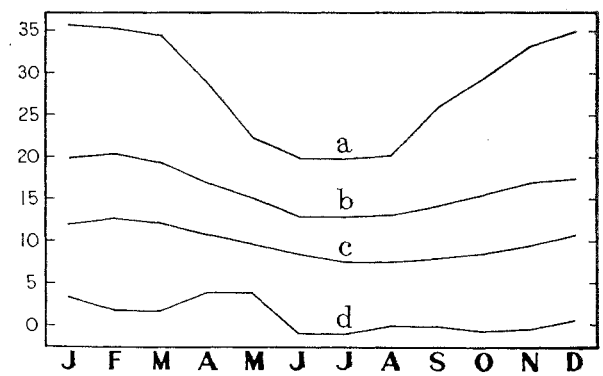

FIG. 5.—Mean monthly temperatures at Currie, King Island, in degrees centigrade, showing absolute maxima (a), mean maxima (b), mean minima (c) and absolute minima (d).

It will be apparent that the temperature in the burrow during the 24 hours oscillates between very narrow limits and that even the seasonal variation is very slight. Outside in the rookery, however, the temperature variations are considerable. The mutton-birds and their chicks are able to exist in a virtually constant environment as far as temperature is concerned.

(d) Mist and Fog

On calm nights, mists may envelope the islands at any season of the year and these may at times be so dense as to reduce visibility to a few yards.

(e) Winds

There is only one wind-recording station in the Furneaux Group, at Pat's River, 13 miles north-west of Fisher Island. Data furnished by the Bureau of Meteorology have been analysed and fig. 7 is a wind-rose for the period during which mutton-birds are present in the breeding area, namely from October to May.

The prevailing winds are from the N.W. to the S.W., and they are strongest from the W. From this direction winds blow with great severity and the gales may last for several days with calm spells between. It is noteworthy that November shows the highest frequency of strong westerlies. This association of boisterous weather with the egg-laying season of the mutton-birds has led to the use of the term "mutton-bird gales" in Bass Strait (cf. Littler, 1910, p. 167). South-easterly weather, though less frequent, can be violent. The least calm period is during the summer, as is the case generally in southern Australia. The autumn improvement starts in March.

For the remainder of the year, June to September, frequency of direction and velocity is generally similar to those for the months depicted in the wind-rose. The principal difference is that N.W. winds are considerably stronger and more frequent in winter, while those from the S.W. are less frequent than in the period October to May.

Westerly weather has a greater effect on Fisher Island than that from any other quarter. There is a considerable fetch across Adelaide Bay from the W. and S.W. and consequently the island shores facing these directions are subjected to relatively heavy wave action and spray effects.

THE MUTTON-BIRD ROOKERIES

The distribution and density of the burrows appears to be controlled by the depth of soil. They are in densest concentration where the soil is of maximum depth, namely 24 inches, and they cut out where the soil covering thins out to between 12 and 9 inches. The birds, have, in fact, utilised as breeding sites all possible parts of the island. The distribution of soil depth has resulted in the burrows being clustered into four main groups (fig. 2), which for convenience of working and record purposes are classified as follows:—

(a) Home Rookery: An area of 311 square yards north-east of the Hut. It is the most numerous rookery with the densest concentration of burrows. In the 1956-57 season 74 of these were occupied. A small group of burrows to the south, the Home Rookery outliers, was not occupied this season. This rookery is almost entirely in the area covered by Tussock grass, *Poa poaeformis*, a plant which dominates the vegetation on all the smaller islands of the Furneaux Group and appears to form the ideal habitat for nesting mutton-birds.

(b) South Rookery: This comprises two small groups of burrows on either side of Snake Gully and occupying 276 square yards of ground. Of these 26 burrows were occupied in 1956-57. Some of the burrows in the western portion are dug into *Tetragonia*-covered ground, but most are among *Poa*.

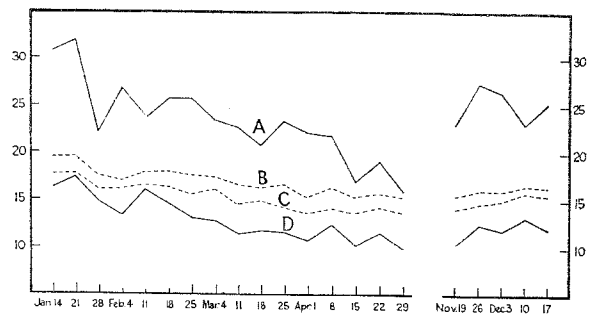

FIG. 6.—Mean weekly temperatures at Fisher Island in degrees centigrade showing maxima in Potts Point Screen (A) and Burrow 90 (B) and minima in Potts Point Screen (D) and Burrow 90 (C). Data for 1954.

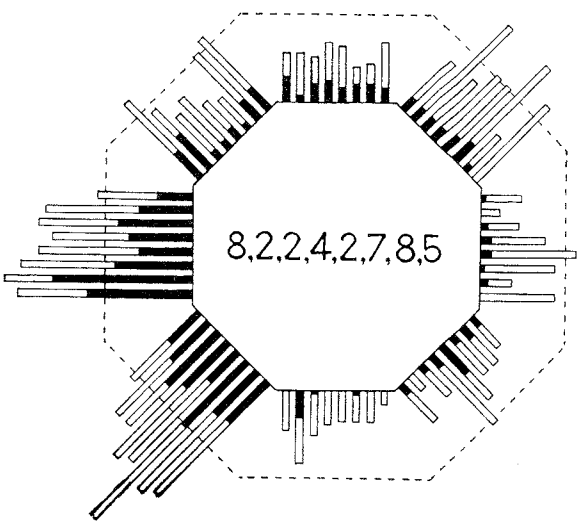

FIG. 7.—Wind-rose for Pat's River showing frequency of wind direction at 9 a.m. (in clockwise order) for each month, October to May inclusive. Solid portion of each histogram shows proportion of wind stronger than 18 m.p.h. (i.e., above Force 4 on the Beaufort Scale). Broken line (outer) octagon is a scale indicating frequency of 12½ per cent. Figures within octagon represent percentage frequency of calms for each month.

(*c*) Potts Point Rookery: North-east of and very close to the previous colony is a group of burrows, covering an area of 120 square yards, on a slope facing the east; 12 were occupied in 1956-57. Most of the burrows are among *Poa*, some under the shelter of dwarf *Leucopogon*, *Rhagodia* and *Acacia* thickets, and a few in rock crevices.

The total area covered by mutton-bird burrows is 707 square yards, or 7 per cent of the area of the island.

In the *Poa* areas the burrows are tunnelled between, or at the sides, of the tussocks, which form a substantial roof over them. In ground where the tussocks are far apart there is danger of the burrows collapsing if walked on. On Fisher Island the regular examination of the burrows, and consequent handling of the birds, appears to have stimulated the birds to dig longer burrows than on the other islands. Thus on Fisher Island the burrows vary in length from one and a half to nearly six feet, but are mostly between two and four feet. On Cat Island, where the birds are never disturbed, the burrows vary from one and a half to just over three feet in length. The burrows of *Puffinus tenuirostris* are shorter than those of *P. pacificus* and *P. carneipes* and enable the commercial harvesting of the fledglings to be carried on with comparative ease.

On other bird islands in the Sound it is the general practice to run a fire through the tussock areas after the birds leave in early winter. The purpose is to thin out the heavy plant growth and so aid harvesting of the young birds. No management of this type has been attempted on Fisher Island since the investigation began in 1947. However, the denser portions of the *Poa* tussocks in the Home Rookery have been trimmed with a sickle for ease of burrow examination. There has been a tendency for *Tetragonia* to extend over the southern portion of this rookery and by trailing over the *Poa* tussocks to prevent the birds from burrowing in the ground beneath.

On Fisher Island each burrow, whether in use or not, is marked at its entrance by a wooden peg bearing an aluminium plate on which a serial number is punched. In long burrows where the nesting chamber is inaccessible it is impossible, owing to the sandy soil, to use the method adopted at Skokholm Island by Lockley (1942, p. 23) of cutting a sod of turf and using it as a lid. On Fisher Island, where need be, a hole is excavated over the chamber and it is covered over by a wooden trapdoor on which the burrow number is painted.

The birds are present on the island from the last week in September until about the first week in May.

ACKNOWLEDGMENTS

We are indebted to Mr. G. M. Storr for a survey of the island in 1952, his assistance in the analysis of the weather data furnished by the Bureau of Meteorology and for his preparation of the maps and diagrams. Mr. F. Henwood, secretary of the Lady Barron Marine Board, and Trooper L. V. Bailey, of the Lady Barron Police Station, have generously given assistance in the field and provided information.

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II. VEGETATION OF FISHER ISLAND*

INTRODUCTION

Although many specimens have been collected by botanists and casual visitors on the major islands of Bass Strait during the past 150 years, no comprehensive account of the flora has yet appeared. Only a few lists of species are available, and of these the most important are for: King Island [F. V. Mueller in *Vict. Nat.* 4: 140-146 (1888), also *Pap. Roy. Soc. Tasm.*, 1881: 46-48 (1882)]; Deal I. [F. V. Mueller in *Vict. Nat.* 7: 137-139 (1891), also *Pap. Roy. Soc. Tasm.*, 1884: 282-283 (1885)]; Rodondo [J. H. Wills in *Vict. Nat.* 64: 23-24 (1947)], and Flinders Island [various old records in the seven volumes of Bentham's *Flora Australiensis*, 1863-78]. No information has been published on the vegetation of the south coast of Flinders Island (including Fisher Island), Cape Barren or Clarke Islands.

By courtesy of the Wildlife Survey Section, C.S.I.R.O., the writer was enabled to spend a few days at Fisher Island in April, 1954, when notes were made on the land-flora of this small area. Unfortunately his visit coincided with the end of a protracted dry summer season, before any appreciable autumn rains had fallen; nothing was then in flower, and small seasonal plants had completely disappeared. However, in November, 1948, a substantial collection was made by the C.S.I.R.O. of all plants (mostly flowering) that could be found on the island; these, together with supplementary gatherings in December, 1949, and October, 1952, have all been determined by the writer and present a fairly complete picture of the floristic composition. The distribution of principal plant communities was later mapped by Mr. Glen Storr (in fig. 8, "Succulent mat" comprises the *Disphyma, Carpobrotus* and *Pelargonium* communities; "tussock grassland" consists mostly of *Poa; Acacia, Leucopogon, Olearia, Rhagodia* and *Tetragonia* have been grouped together as "dwarf scrub").

For an adequate ecological account of the vegetation, much more time would be needed than was available to the writer in April, 1954, and detailed observations during all seasons of the year would be a prerequisite. Algae and lichens were neither collected nor studied, and the island appears to be singularly poor in larger land-crytogams—no fungi were seen, ferns are absent, and the only mosses noted were *Tortella calycina* (Schwgr.) Dixon and *Bryum billardieri* Schwgr. (both very widespread, hardy species).

GENERAL CHARACTERISTICS OF FLORA

Fisher—being an extremely small (2·1 acres) off-shore island of low relief, with about half the total area consisting of bare granite rock and the remainder with very shallow, friable, "hungry" soil—could not be expected to support a diversified flora, nor to differ appreciably from the nearby mainland. In fact, its plant-cover almost exactly repeats the more impoverished components of the shore-line flora at Lady Barron, only one-eighth of a mile distant, and all the species represented are of wide occurrence on Flinders and most other islands of Bass Strait. Trees and large shrubs are completely lacking, their establishment precluded by the very nature of the environment—poor shallow soil, and exposure to high winds and salt spray. There is no beach-sand, with its characteristic strand vegetation, nor any other formation of particular botanical interest. Marked xeromorphic characters, such as toughness and rigidity or succulence, are evident in the foliage of almost every species represented.

Most vascular plants (at present known to number 33 indigenous and 14 introduced species) are of rare or isolated occurrence, contributing nothing to the facies of the island's vegetation. Only seven species, each in a different genus (viz. *Poa, Disphyma, Carpobrotus, Tetragonia, Acacia, Pelargonium, Leucopogon*), comprise areas large enough to be mapped as more or less pure communities. These dispose themselves in three principal alliances, which are indicated on the accompanying map (fig. 8): 1. *Poa poaeformis-Tetragonia implexicoma* (a kind of tussock grassland), 2. *Disphyma australe-Carpobrotus rossii* (succulent mat-growth), 3. *Acacia longifolia* var. *sophorae-Leucopogon parviflorus* (dwarf scrub formation). Each

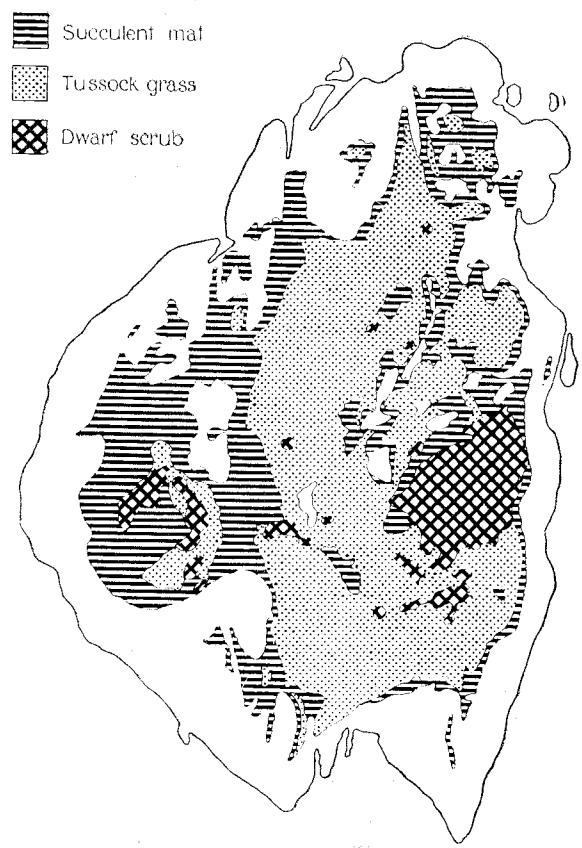

FIG. 8.—Map of Vegetation of Fisher Island, after a survey by G. M. Storr in 1952.

G. M. Storr del.

* By J. H. Willis, National Herbarium of Victoria

of the two dominant species in the alliances usually forms a distinct association, of which the *Poa* and *Disphyma* associations occupy by far the greater areas—together they cover 38 per cent of the island's total area.

Of the 14 alien species, eight are grasses and nine are annuals of wide distribution (almost ubiquitous in coastal areas near settlement); their seed has almost certainly blown onto the island from Lady Barron, except that of *Coprosma repens* which is rare and doubtless attributable to transport by birds (the red succulent fruits being edible).

No attempt has been made to deduce the past botanical history of the area; but Fisher Island probably carried much the same vegetative cover as at present (except for the recently-arrived alien species) when it was joined as a cape or tongue of land to the adjacent granite point of Lady Barron. The absence of such widespread coastal *Compositae* as *Olearia axillaris* (Coast Daisy-bush), *Calocephalus brownii* (Cushion Bush), *Senecio lautus* (Variable Groundsel) and *Sonchus megalocarpus* (Dune Sowthistle) is remarkable.

COMPARISON WITH OTHER MUTTON-BIRD ISLANDS

The number of indigenous species (33) is far too limited for any useful floristic analysis; suffice it to note that 19 families of vascular plants and 30 genera (almost a genus per species) are present. The chief families, in order of species representation, are: *Compositae* (6), *Gramineae* (4), *Ficoidaceae* (3), *Chenopodiaceae* (3). Species occupying the greatest area are those which predominate on other small islands of Bass Strait.

Almost half the species (15) are also of wide occurrence on islands of the Recherche Archipelago (W.A.) inhabited by shearwaters (mutton-birds); these are prefixed by the italic letter "R" in the list that follows. Three other plants (*Poa poaeformis, Crassula sieberiana* and *Acacia longifolia* var. *sophorae*) are replaced by related species in the Recherche (viz. *P. australis, C. miriamae* and *A. cyclopis* respectively). Whereas most shearwater burrows on Bass Strait islands (including Fisher) are excavated under tussock-grass, those of the Recherche islands occur beneath *Carpobrotus, Tetragonia,* or amongst roots of the small umbrageous tree *Melaleuca pubescens* ("moonah"); none of the species appear to be in any way adversely affected by the birds' tunnelling activities. Tussock-grass (*Poa australis*) is a very minor component of the Recherche flora, occurring only in small isolated patches.

PRINCIPAL PLANT COMMUNITIES

DISPHYMA AUSTRALE

This extremely succulent perennial (noon-flower or "pigface") occupies ± 1540 square yards or 14 per cent of the island area, occurring as extensive mats around the whole periphery and being particularly well developed in the south-western sector of Fisher Island where it forms a pure (monospecific) community. Salt-tolerant to a high degree, *D. australe* is the chief pioneer among higher plants. It colonizes the bare granite surfaces immediately above high-water mark—where-

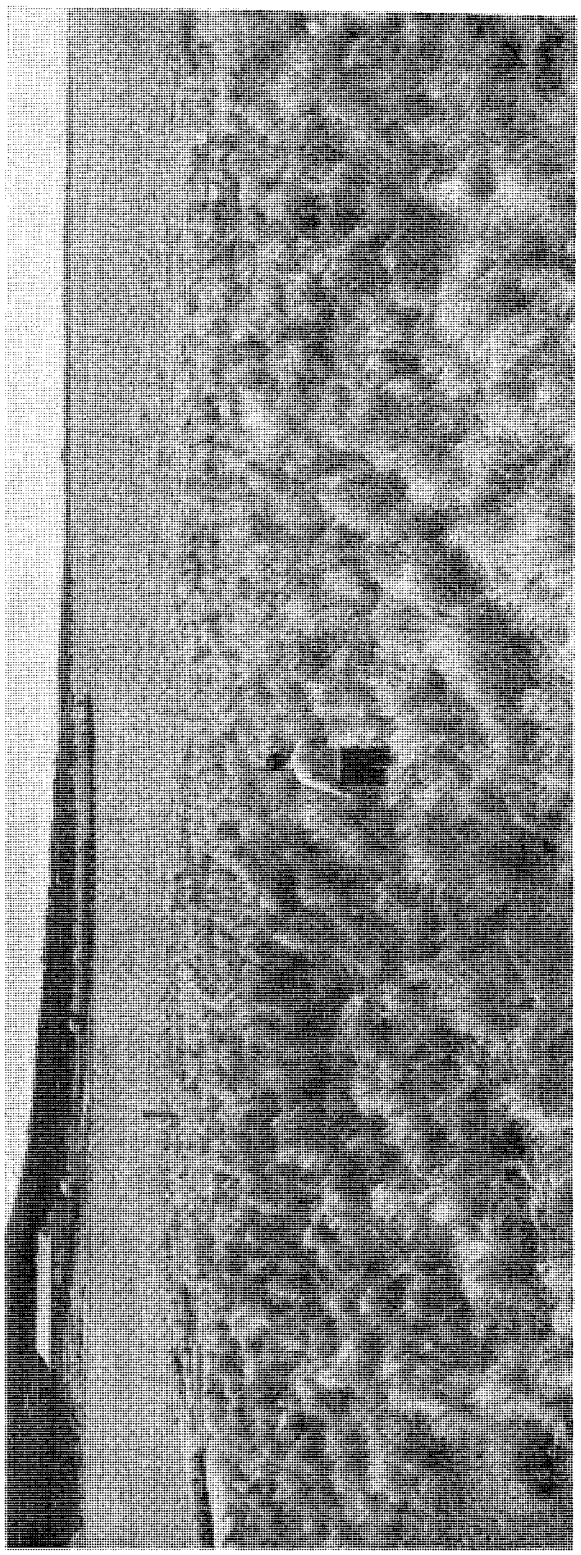

FIG. 9.—View on Fisher Island showing *Poa poaeformis* tussock area; looking north-east towards Lady Barron jetty. —Photo: K. A. Hindwood.

ever seeds can gain a foothold in small cracks and depressions of the rock—and is frequently wetted by salt water. *Disphyma* would certainly aid in intercepting and stabilizing wind-blown sand, thus adding to the soil derived from parent rock and, also by its own litter of dead foliage, &c., providing a shallow substrate in which grasses and finally shrubs could flourish. It is succeeded on the landward side either by *Carpobrotus rossii* (a closely related but larger and less salt-tolerant succulent trailer, with which it forms an alliance) or by the tussock-forming grass *Poa poaeformis* (seq. q.v.).

POA POAEFORMIS

The Sea Tussock-grass occurs either as a pure dense community usually one to two feet high—in which most of the island's mutton-bird burrows are situated—or more sparsely in varying mixture with other herbs, and occupies ± 2530 square yards (24 per cent of the island area); it is much more extensive than all other plant associations combined ,being present in all parts of the island except for the periphery and a considerable area of *Disphyma* in the south-west portion. *Poa* gives way to low shrubberies of *Acacia* (in the east) and *Leucopogon* (in scattered clumps) wherever aspect and sufficient soil have permitted the development of these taller, woody, sclerophyllous perennials. An unstable alliance is formed with the trailing, succulent *Tetragonia implexicoma* which may predominate to the exclusion of grass in small patches.

ACACIA LONGIFOLIA var SOPHORAE

Depauperate bushes (four to six feet high) of this normally arboreal wattle comprise one continuous thicket covering 350 square yards (3·3 per cent of island area) on the more sheltered eastern side—at Potts Point, and nowhere else. An occasional shrub (flowers not available) of what appears to be *Acacia mucronata* occurs in mixture with the dominant *A. longifolia* which, apparently, is the climax community on Fisher Island. These plants are not healthy and have been dying back from the branch-tips for some years, at least since 1950 (see note under "Evidence of Change").

LEUCOPOGON PARVIFLORUS

Typically of sand dunes, this coastal heath occurs on Fisher Island in a very stunted form (two to four feet high). Distribution is by no means continuous, as in *Acacia*, but the *Leucopogon* is broken into isolated clumps (seldom more than 10 square yards in extent) scattered through the central, south-eastern and south-western parts of the island. The total area occupied is only about 125 square yards or 1·2 per cent of the whole island. *Leucopogon* and *Acacia* constitute an alliance, but each is present as a more or less pure community. Two other shrubs, *Olearia stellulata* and *Rhagodia baccata*, are minor associates.

The glassworts *Salicornia australis* and *Arthrocnemum arbusculum*, collectively known as "samphire", are to be found occupying two small depressions (just above high-tide level), one on the eastern side of North Point, the other south of Oystercatcher Rocks—the only occurrences of this pioneer halophytic alliance which is such a conspicuous feature on tidal flats and salt-marshes throughout southern Australia.

EVIDENCE OF CHANGE

From the existing distribution of communities, it seems most likely that succession toward a development of woody shrubs would have occurred in the following stages, beginning with a lithosere:

Probably the vegetation has long ago reached a state of equilibrium, and very slight fluctuations in climate (excessive gales, persisting high summer temperatures, water availability, &c.) may conceivably bring about a reversal in the stages of succession. The vigorous growth (and ascendancy) of *Poa* and *Tetragonia* in November, 1956, in places where *Acacia* had died out extensively, lend support to such a hypothesis. Both *Acacia* and *Leucopogon* have been steadily dying back from the branch-tips, with minor recuperations, ever since 1950. The causes of this retrogression are not at present clear: unusually long dry spells late in summer, during the last few years (especially February-May, 1954), combined with severe westerly winds in late winter may have hastened the deterioration. Much dead and dying *Disphyma* is to be found in the extreme south-western sector, and by March, 1957, die-back was also apparent in *Carpobrotus* (especially that above Starling Rock), *Tetragonia* and *Rhagodia* (an exceedingly hardy and usually wind-tolerant semi-shrub).

None of the radical changes associated with fire are to be seen on Fisher Island which has not been burnt for many years, certainly not since 1947—otherwise it might be expected to yield *Senecio capillifolius* Hook. f. (Fennel Groundsel or "fireweed"), a tall showy herb with very finely dissected foliage. This plant appears in the wake of fire, grows vigorously among tussocks of *Poa poaeformis* and lasts only a couple of seasons; it is abundant on nearby Little Green and Great Dog Islands, which are fired periodically to facilitate the operations of mutton-birders, and extends along the north-east coast of the Tasmanian mainland. The species is little known and apparently endemic in this portion of Bass Strait. Two other members of the same genus, *S. linearifolius* and *S. glomeratus*, collectively known as "fireweeds", are of very limited occurrence on Fisher Island.

LIST OF VASCULAR PLANTS ON FISHER ISLAND

Three prefixing signs have been used, as follows:
* Naturalized alien plants.
r. Species of rare occurrence.
R. Species also represented in the Recherche Archipelago, W.A.

MONOCOTYLEDONEAE

Gramineae (Grasses)

* Briza maxima *L.*, 1753—Large Quaking-grass.
* Dactylis glomerata *L.*, 1753—Cocksfoot.
Poa poaeformis (*Labill.*) *Druce*, 1917—Sea Tussock-grass.
*r.** Vulpia bromoides (*L.*) *S. F. Gray*, 1821—Squirrel-tail Fescue.

* Bromus mollis *L.*, 1762—Soft brome.
*r.** Parapholis incurva (*L.*) *C. E. Hubbard*, 1946—Coast Barb-grass.
*r.** Avena sativa *L.*, 1753—Oat.
* Aira caryophyllea *L.*, 1753—Silvery Hair Grass.
* Holcus lanatus *L.*, 1753—Yorkshire Fog.
Dichelachne crinita (*L. f.*) *Hook. f.*, 1853—Long-hair Plume-grass.
r. Deyeuxia quadriseta (*Labill.*) *Benth.*, 1878—Reed Bent-grass.
Stipa teretifolia *Steud.*, 1854—Prickly Spear-grass.

Juncaceae

r. Juncus pallidus *R.Br.*, 1810—Pale Rush.

Liliaceae

R. Dianella revoluta *R.Br.*, 1810—Black-anther Flax-lily.
r. Bulbine semibarbata (*R.Br.*) *Haw.*, 1821—Leek Lily.

Orchidaceae

R.r. Microtis unifolia (*Forst. f.*) *Reichenb. f.*, 1871—Common Onion-orchid.

DICOTYLEDONEAE

Polygonaceae

R. Muehlenbeckia adpressa (*Labill.*) *Meissn.*, 1840—Climbing Lignum.

Chenopodiaceae

R. Rhagodia baccata (*Labill.*) *Moq.*, 1840—Sea-berry Saltbush.
R.r. Salicornia australis *Soland. ex Benth.*, 1870—Austral Glasswort.
r. Arthrocnemum arbusculum (*R.Br.*) *Moq.*, 1840—Samphire Glasswort.

Ficoidaceae

R. Disphyma australe (*Soland. ex Ait.*) *J. M. Black*, 1932—Australian Noon-flower.
R. Carpobrotus rossii (*Haw.*) *N.E. Br.*, 1928—Karkalla (Pigface).
R. Tetragonia implexicoma (*Miq.*) *Hook. f.*, 1856—Bower Spinach.

Portulacaceae

R.r. Calandrinia calyptrata *Hook. f.*, 1840—*Pink* Purslane.

Caryophyllaceae

r. Spergularia media (*L.*) *C. Presl*, 1826—Coast Sand-spurrey.
* Silene anglica L., 1753—French Catchfly.

Ranunculaceae

R.r. Clematis microphylla *DC.*, 1817—Small-leaf Clematis.

Cruciferae

R. Lepidium foliosum *Desv.*, 1814—Coast Pepper-cress.

Crassulaceae

Crassula sieberiana (*Schult. & Schult. f.*) *Druce*, 1917—Sieber Crassula.

Mimosaceae

Acacia longifolia (*Andr.*) *Willd.*, 1806, var. sophorae (*Labill.*) *F. Muell.*, 1863—Coast Sallow Wattle.
r. Acacia (?) mucronata *Willd. ex H. Wendl.*, 1820—Variable Sallow Wattle.

Papilionaceae

* Trifolium dubium *Sibth.*, 1794—Suckling Clover.
* Melilotus indica (*L.*) *All.*, 1785—Small-flower Melilot (King Island Clover).

Geraniaceae

R. Pelargonium australe *Willd.*, 1800—Australian Storksbill.

Oxalidaceae

R. Oxalis corniculata *L.*, 1753—Creeping Wood-sorrel.

Umbelliferae

R. Apium prostratum *Vent.*, 1804-05—Sea Celery.

Epacridaceae

R. Leucopogon parviflorus (*Andr.*) *Lindl.*, 1833—Coast Beard-heath.

Rubiaceae

*r.** Coprosma repens *A. Rich.*, 1832—Hedge Coprosma (Looking-glass Bush).

Stylidiaceae

r. Stylidium graminifolium *Sw. in Willd.*, 1805—Grass Trigger-plant.

Compositae

r. Lagenophora stipitata (*Labill.*) *Druce*, 1917—Common Lagenophora (Bottle-daisy).
Brachycome diversifolia (*R. Graham ex. Hook.*) *Fisch. & C. Mey.*, 1835, var. maritima *Benth.*, 1867—Sea Daisy.
Olearia stellulata (*Labill.*) *DC.*, 1836—Starry Daisy-bush.
Helichrysum bracteatum (*Vent.*) *Andr.*, 1805—Golden Everlasting.
r. Senecio linearifolius *A. Rich.*, 1834—Fireweed Groundsel.
Senecio glomeratus *Desf. ex Poir.*, 1817—Cluster Fireweed.
*r.** Hypochaeris radicata *L.*, 1753—Cat's-ear (Flat-weed).
* Sonchus asper (*L.*) *Hill*, 1769—Spiny Sow-thistle (Rough Sow-thistle).

[Basonyms and synonyms have been omitted from this list.]

III. INTERTIDAL ECOLOGY OF FISHER ISLAND*

INTRODUCTION AND NOMENCLATURE

Throughout this paper the nomenclature used is that of Stephenson & Stephenson (1949) and Guiler (1953). The author of each species is mentioned only once.

This paper is the 12th of a series on various features of the intertidal ecology of Tasmania and is the first to deal with a locality in the Bass Strait area. A visit was made to the north-eastern end of Tasmania at Eddystone Point and the observations made during this visit are incorporated into the discussion at the end of this paper. Eddystone Point was visited in January, 1957. Visits were made to other islands near Fisher Island, namely Little Green Island, Big Dog Island, Woody Island, Babel Island and Cape Barren Island.

ZONATION

The zonation over most of the island follows one basic pattern but there are important variations to this general zonation at several places on the island. Thus it is desirable to consider the zonal patterns at various localities on the island rather than attempt to generalize regarding the zones found on the shore as a whole.

Before commencing upon a general description of the plant and animal zones it is necessary to consider the wave action on Fisher Island which forms part of the inner group of the Franklin Sound Islands. There is no exposure to wave action of oceanic intensity and no ocean swell is experienced on the shores of the island. The greatest exposure to wave action is experienced when westerly or southerly winds blow, but the "fetch" is small and an uncomfortable slop, composed of waves of short length and low amplitude, is the worst sea encountered. The south shore, from South Point to The Fingers, is the most exposed part of the island with lesser exposure on the west coast and least exposure being experienced on the east and north coasts. The latter is the most sheltered part of the island. The tidal phenomena and currents have been treated above by Serventy.

At South Point, a low rounded prominence where there is some wave surge over the Point but not much spray, the zonation is:

Telostichistes parietinus (L.) Norm.
Parmelia conspersa (Ehrh.) Ach.
Parmelia perlata (L.) Ach.
Myxophyceae
Littorina unifasciata (Gray)
Chthamalus antennatus + *Littorina unifasciata*
Chthamalus antennatus + *Melanerita melanotragus* (Smith)
Chthamalus antennatus + *Bembicium auratum* (Quoy & Gaimard)
Chthamalus + *Chamaesipho columna* (Spengler)
Chamaesipho + *Chthamalus* + *Austromytilus erosus* (Lam.)
Galeolaria caespitosa (Lam.) + *Gelidium australe* J. Ag.
Hormosira banksii (Turn.) Decaisne—*Pyura stolonifera* (Heller)
Cystophora spp.

The zonal pattern here is rather complex and some other species may assume dominance over a very restricted area. The *Littorina* belt is not invaded by other species in this region, but the belt formed by *Chthamalus* is composed of a series of sub-belts any one of which may be locally dominant. *Littorina unifasciata* invades the top of the *Chthamalus* belt. Also found in the top of the belt are *Melanerita melanotragus* and *Bembicium auratum*. These three species show little, if any, differentiation into vertical belts but at a glance give the impression of being organisms of zonal significance. However, they give a false picture if considered as such because the individuals of these species form aggregations and it is these aggregations in the restricted area under consideration which give the appearance of belts.

The small barnacle, *Chamaesipho columna*, becomes more common in the *Chthamalus* belt, although *Chthamalus* is still found as the dominant organism. The lichen, *Lichina confinis* (Mull.) Arg., as well as *Bembicium*, *Littorina* and *Melanerita* are common at this level. These four latter species soon cut out, leaving *Chthamalus* still present. A small mussel, *Austromytilus erosus*, is found at this level but it is very patchy in distribution and cannot be considered as a belt forming species. The barnacles cease to be the dominant species on the shore at a slightly lower level where *Galeolaria caespitosa* becomes the dominant species. The latter occurs sparsely in the lower *Chamaesipho* belt and is accompanied by *Rivularia australis* (Harv.).

The *Galeolaria* belt is noticeable for the very close association of this species with the alga *Gelidium australe*. These two species are not found living apart from each other on the shore. The *Galeolaria* tubes are not found in the dense masses which are usually so characteristic of this species but they form a close cover to the rocks (Plate I). Correlated with the absence of dense *Galeolaria* clusters is the lack of species commonly found living in the masses of worm tubes such as *Ibla quadrivalvis* Cuvier, *Kellia australis* (Lam.) and various polychaetes.

The *Galeolaria* belt is replaced by a *Hormosira* belt which has some *Galeolaria* tubes scattered amongst the plants. The most interesting feature of the *Hormosira* belt is that it is characterized in its lower parts by a number of *Pyura stolonifera*, which form a colony of appreciable size. The algae of the Infralittoral Fringe occur below the *Pyura*.

The rocks beside the Blow Hole, on the southern shore of the island, show a different zonation, largely on account of the topography of the coast. In this region there are boulders in the Infralittoral Fringe which give rise to spray which is swept on to the island by the prevailing wind. Consequently, the zonation has been altered to:

Littorina unifasciata
Bare rock
Chthamalus antennatus + *Bembicium auratum*
Lichina confinis + *Chthamalus antennatus*
Chamaesipho columna
Cellana solida (Blainville)
Galeolaria caespitosa
Hormosira banksii
Cystophora spp.

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However, this type of zonation is by no means found over all of the southern shore. The *Littorina* belt is absent over most of this shore-line but the barnacles reach their most dense colonization on this shore, together with *Lichina*. The *Myxophycean* and barnacle belts are particularly well developed on the Lower Midden Rock. A prominent absentee from the shore at Lower Midden Rock is *Bembicium*, the species being rare, even in the barnacle belt, however, *Bembicium* becomes more numerous further to the east on the rocks below the Notice Board. Reading from top to bottom at this place the belts are formed by *Myxophyceae, Chthamalus* with *Lichina, Chthamalus* + *Lichina* + *Chamaesipho, Chamaesipho* + *Lichina* *Chthamalus, Chamaesipho, Cellana, Galeolaria, Hormosira, Cystophora.*

The zonation on the eastern shore shows some differences from that on the southern, the most important difference being the absence of a barnacle belt and the great reduction of the *Myxophyceae* band. On the rocks near North-East Boat Harbour, *Littorina* forms the top belt of the intertidal region, followed by *Bembicium* together with *Austrocochlea concamerata* (Wood), which in turn is replaced by *Cellana*. The belts below *Cellana* are the same as those on the Lower Midden Rock.

There is a change of substratum at the Slipway on the north-western side of the island which leads to an important modification of the zonation. The rocks are replaced by an almost level part of the shore which consists of a muddy sand with stones imbedded in it. The clefts between the surrounding rocks have some sand in them and these clefts together with the sandy area at the Slip, support colonies of the mussel, *Austromytilus erosus*. These mussels have striae extending the length of the shell and are very readily distinguished from individuals of the same species found on the more exposed South Point, which have these striae more less eroded. The mussel belt lies between the *Cellana* and *Hormosira* belts. The *Cellana* belt is partly suppressed, being represented by individuals around the edges of the sandy area.

The North Point zonation is slightly different from that to be seen on the other shores in that a very feebly developed *Corallina* belt occurs below the *Hormosira*. The Infralittoral Fringe algae are all of the genus *Cystophora*, namely *C. cephalornithos* (Lab.) J. Ag., *C. torulosa* (R.Br.) J.A., *C. retroflexa* (Lab.) J. Ag. and *C. uvifera* (Ag.) J.Ag., and they are replaced in the Infralittoral by *Cymodocea* sp. The *Littorina* and *Chamaesipho* belts are well developed at North Point.

NOTES ON SOME SPECIES

The study of a restricted area such as Fisher Island reveals many interesting points regarding the factors controlling the distribution of the species lying on the shore, particularly in their relation to wave action and its associated spray and surf exposure. A more true pucture of the effect of these factors can be gained in a small area where the wave action is slight rather than on a large part of an exposed coastline, since with a restricted amount of wave action, slight variations in its intensity give a more obvious alteration in the distribution of intertidal organisms. I propose to discuss the distribution of some of the common intertidal species of Fisher Island.

(a) *Littorina unifasciata*

Littorina is sporadically distributed around the island. The *Littorina* belt is absent from North Point, North-East Point, most of the Western shore south of the Slip to the Lower Midden Rock where there is an isolated patch of *Littorina*. This species is absent from Lower Midden Rock to near South Point and it is also absent from north of Potts Point to North Point but with an isolated group on a level platform to the north of Starling Rock.

Littorina is most numerous from South Point to Starling Rock on the East Coast of the island. This part of the shore has a well developed *Littorina* belt which ends quite sharply at Potts Point but there is a small patch, mixed with *Bembicium*, on the level or gently sloping rocks. Other places with well developed *Littorina* belts are North-East Boat Harbour, at the Slip, the Blow Hole and South Point.

The explanation of the apparently sporadic distribution of this species lies in its relation to the spray encountered on the shore, though the gregarious behaviour of the littorines may play some part in limiting the distribution of the species. At North-East Boat Harbour there is no spray break, that is to say, the rocks slope upwards directly from low-water mark without any boulders, clefts or hindrances to prevent the spray and waves reaching up the shore. At the Slip and the eastern shore a similar situation prevails. The western shore is steeper than the northern and eastern shorelines and the topography is such that the spray from Infralittoral Fringe boulders may not reach the level of the *Littorina* population, particularly during the periods of relatively calm, warm summer weather.

The direct mechanical effect of wave action probably is not responsible for the absence of the littorines from the Lower Midden Rock and southern parts of the island. The substratum is granite which weathers into a rather smooth rock over which waves could sweep with considerable force, but although I have been on the island during a moderate gale, the wave action was never great enough to sweep the littorines off the rocks. It appears that again the spray from rocks of the Infralittoral Fringe must not reach the level normally occupied by the *Littorina* belt during periods of calm.

There is a patch of *Littorina* on the rocks near the Blow Hole which is in contradiction to the above suggestions, but this patch may well be maintained by the slight amount of spray from the Blow Hole.

South Point is the most exposed part of the island and is exposed to considerable spray. The direct mechanical effect of the waves is reduced by offshore boulders but it is still sufficient to show that this factor, within the maximum limit experienced at Fisher Island, is not one directly controlling the distribution of this gastropod.

It was mentioned earlier that the gregarious habit of this species may have some control over its distribution. It was noted during my visit in December, 1956, that *Littorina* congregated in clusters, 20 being the largest number noticed. Individuals living singly on the rocks were rare, groups of three being the most common aggregations of small numbers of individuals. This habit would lead to a slow spread of the species.

The most dense population of *Littorina* is on the eastern coast where a population density of 12 to 14 individuals per 10 cm. square is reached.

(*b*) *Bembicium auratum*

At first glance it would appear that interspecific competition exists between this species and *Littorina unifasciata*, since, in general, these two species do not commonly occur together on the island. There is a very significant difference in the amount of air exposure which these two species can tolerate, *Bembicium* being less tolerant to air exposure than *Littorina* (Guiler, 1950). Further to this, a patch of rock was cleared of *Littorina*, leaving *Bembicium* at the lower level and this patch was not invaded by *Bembicium*. A cleared area in the *Bembicium* belt was invaded to some extent by *Littorina*, but the argument in this case is somewhat different since *Littorina* may be found on the shore as low down as the barnacle belt. There may be a population pressure exerted by *Littorina* upon *Bembicium* but there is no pressure in the other direction.

Bembicium and *Littorina* are found at the same level to the north of Potts Point. However, with this exception, it is true to say that these two species do not occur at the same tidal level, but they do occur on the same part of the shore at different levels, e.g., most of the eastern shore from South Point to Potts Point.

This species is widely distributed on both the eastern, northern and western shores of the island, but it is practically absent from the southern shore, apart from a few individuals in the barnacle belt near the Blow Hole and a very restricted area beside the Blow Hole in which there is a belt formed by this species. It may be concluded that this species thrives in places where *Littorina* is absent, probably the result of wave splash and spray giving optimum conditions for *Bembicium* but not being sufficient to enable the Supralittoral Fringe dwelling *Littorina* to exist. It must be noted that *Littorina* may exist in patches on the same part of the coast as *Bembicium*, e.g., at North-East Boat Harbour and the two may even form belts at different levels on the same shore as at Potts Point.

Bembicium auratum differs in habit from *Littorina* being usually solitary. The density of population on the eastern shore may be taken as general for the whole island and is approximately 1·03/10 cm. square.

In most places *Bembicium* extends down into the barnacle belt, though in a few, usually spray swept places, the barnacles reach up into the *Bembicium* belt. *Lichina* may also extend into the *Bembicium* belt, though this does not occur on the eastern shore.

(*c*) *Melanerita melanotragus*

This small gastropod is common on the eastern shore but is absent from the southern and western sides of the island. It is found on the northern shore but it is not as numerous on this part of the island as on the eastern side.

Melanerita is of little value as a zonal organism since it is found to have a tidal periodicity in its activity, *Melanerita* adopting a semi cryptic habit during the high-water period. At high water I counted 70 individuals living in open places on the shore between South Point and Potts Point. At low water when the part of the shore which they inhabit below the *Bembicium* belt was exposed, as many as 60 individuals were counted around one pond at Potts Point, and all of the eastern side was similarly populated.

In March, 1954, it was found that *Melanerita* lived in clusters of 10 or more individuals. During by visit in November, 1956, the species was definitely solitary in habit, except when semi-cryptic below stones at the high-water period.

At South Point there are rocks and stones at about the level of the *Galeolaria* belt and these furnish a suitable habitat for *Melanerita* which is very common hereabouts. Stones at North Point also have a *Melanerita* population dwelling below them.

The absence of *Melanerita* from the wave exposed southern and western shores is undoubtedly correlated with the wave action encountered there. *Melanerita* is common on the rocks at Gunter's Bay, which is part of Adelaide Bay on the adjoining Flinders Island.

(*d*) *The Belt-forming Barnacles*

The barnacle belt is nowhere well developed on the island, though considerable populations are found in patches on the Lower Midden Rock, North-East Point, North Point and at South Point. Local restricted areas of barnacle population are encountered in places where there is some spray. The sheltered eastern shore has a very poor barnacle fauna.

The barnacle belt, when present, is found between the *Bembicium* belt, or at South Point, the *Littorina* belt, and the belt dominated by the large limpet *Cellana solida*. An exception to this occurs at South Point where the *Cellana* belt is absent and the barnacle belt passes down into a mixed barnacle-mussel belt, ultimately altering very sharply into the *Galeolaria* belt.

There are only two species of barnacles forming the barnacle belt. The upper part of the belt is dominated by *Chthamalus antennatus*. This belt is often associated with *Littorina* in its top parts and *Bembicium* in the lower, with *Melanerita* occurring at the same level as *Bembicium* on the East Coast and at South Point. There is usually some mixing of *Chthamalus* with the other species of barnacle, *Chamaesipho columna*, which is the belt forming barnacle in the lower part of the barnacle belt. This latter species may have *Melanerita*, *Bembicium* and even *Littorina* living at the same level but is more frequently characterized by a patchy growth of *Lichina confinis* (Meull.) Arg. The lower limit of the barnacle

belt is generally sharp though this may be obscured by *Lichina* or by *Rivularia*, especially on spray soaked places.

In 1954 I noted that there had been a large spatfall of barnacles at South Point as well as at Potts Point. The spat at the latter place was unable to survive in any large numbers but at South Point was apparently successful. During the earlier visit, there were no adult barnacles at Potts Point though there were adults on South Point. The density of barnacle population at Potts Point was 17 *Chthamalus* and 500 *Chamaesipho* in a 10 cm. square, though just north of South Point these figures dropped to 10 and 227 respectively. The counts were made in 1954.

It can be stated that generally the barnacle population is at its highest on places with spray exposure, though some local dense populations occur on sun-sheltered rocks, e.g., at North Point.

(*e*) *Cellana solida*

This large limpet is the most conspicuous feature of the Midlittoral on the island (Plate II). It forms a band which is practically continuous around the island, being broken only at South Point and somewhat diminished by the altered substratum at the Slip.

The limpets are selective as regards their habitat and do not favour places with a large number of small stones. One of their requisites appears to be a fairly smooth surface of sufficient extent to enable them to graze without hindrance by clefts or other stones.

Cellana extends as high as the *Bembicium* belt but it is usually found in clefts or living in the shade of rocks at this level, though one specimen was found living on an open surface in the *Bembicium* belt near North Point. The lower limit of the *Cellana* belt is very sharply marked by the top of the *Galeolaria* belt, the rough surface presented by the worm tubes being unsuited to the grazing habit of the limpets.

In November, 1956, there were approximately 4140 *Cellana* living on Fisher Island. Six hundred and ten of these lived between North-East Boat Harbour and South Point, 1712 were found between South Point and The Fingers while 1817 occupied the shore between The Fingers and North Point. These figures show clearly that the limpets are found in greatest numbers on the shores where there are boulders and large stones at the required tidal level which furnish them with a grazing surface. The gently sloping, almost boulder free, eastern shore supports the smallest population of limpets.

The limpets live on the sun exposed faces of rocks or in the shade of overhangs, boulders, &c. There are probably more limpets living in the latter habitat than in the former. I am unable to decide whether this is due to a love of shade or to a concentration of food supply in these places. *Cellana* does not live in dark places, possibly because of a lack of their algal food supply. This points to the possibility that the shade concentrations of this species may be a response to the availability of food.

The *Cellana* belt is not found at South Point. In 1954 a belt dominated by this limpet did occur on this Point. In December, 1956, *Cellana* cut out about three and a half metres to the north of the Point (Plate II). One possible reason for the absence of the limpet is the presence of *Austromytilus erosus*. This mussel was not recorded from this point in 1954 and the dense clusters of the species could well offer a habitat unsuited to *Cellana*. However, this is only a part explanation of the absence of the limpet from the Point since there are neither mussels or limpets on a large part of the shore between the Point and the part of the shore where the *Cellana* belt commences. It is hard to credit that wave action may play a part in limiting the distribution of *Cellana* since the limpet is found in equally exposed situations on Lower Midden Rock. Also, since the limpet was found on the Point in 1954, why would wave action be a factor in 1956 but not in 1954? The reason for the change in the zonation is to be sought in other directions (see discussion below).

Individuals of *Cellana solida* frequently have other species living on their shell. The algae so found are *Enteromorpha* sp. and *Bostrychia mixta* H. & H. The barnacle, *Chamaesipho columna* is found on limpet shells, particularly those living in the lower part of the limpet belt on the southern coast. *Bembicium auratum* may also live on the shells as does *Siphonaria diemenensis* (Quoy and Gaim.). Limpets can often be recognized by the algal tufts which live attached to *Cellana* and to the only other large limpet, *Patelloida alticostata* (Angas).

The limpet belt also has other species occurring in it. *Galeolaria caespitosa* is found in this belt but it is always semi-cryptic in habit and does not form a coating to the rocks except under overhanging boulders. Another limpet, *Patelloida alticostata* is found in the lower part of the *Cellana* belt, though it is more frequently found on that part of the shore dominated by *Galeolaria*. Two species of *Siphonaria* are found with *Cellana* but neither are in any sense dominant. They are *Siphonaria diemenensis* and *Siphonaria funiculata* Reeve, the latter being the scarcer species. Other species are *Cominella lineolata* (Lam.), *Austrocochlea constricta* (Lam.), *Austromytilus erosus*, *Colpomenia sinuosa* (Roth.) Derb. and Sol., *Rivularia australis* and *Enteromorpha* species. The latter species is common in places where there is water seepage.

The shells of *Cellana* are usually fairly heavily eroded. This is especially true of the individuals in air exposed situations and also the large, and presumably old, individuals found highest on the shore. At low levels the shells tend to be less eroded. Young small individuals, about 2 cms. in length, live at the lowest part of the *Cellana* belt and are frequently not eroded.

(*f*) *The Galeolaria-Hormosira Belt*

I propose to consider these two species together since they are usually closely associated on the shores of Fisher Island. The *Galeolaria* belt is continuous around the island but is not as well developed on the western as on the eastern shore. This is in accordance with earlier observations

on this species which has been found to be tolerant of wave exposure. *Galeolaria* does not form the thick encrustations seen at times on other parts of the Tasmanian coast, but is in the nature of a continuous cover to the rocks. As a consequence of this, the rich fauna of the *Galeolaria* belt is absent. The most remarkable feature of this belt is the close association between *Galeolaria* and the alga *Gelidium australe*. This seaweed forms conspicuous yellowish tufts in the *Galeolaria* belt.

Hormosira is also continuous around the island, forming a narrow belt at the bottom of the Mid-littoral region. This belt is widest at the Slip and North-East Point, where the substratum is nearly horizontal at the level occupied by *Hormosira*. This is the only place where the *Hormosira* belt is of sufficient width and where there is also suitability of substratum for the development of a varied fauna.

The following species occur on or under the stones at North-East Point:—*Arca* (Barbatia) *pistachia* Lam., *Lepsithais vinosa* (Lam.), *Zeacumantus diemenensis* (Quoy & Gaim.), *Zemitrella acuminata* (Menke), *Austrodrillia beraudiana* (Crosse), *Cymatiella verrucosa* (Reeve), *Mitra* sp. juv. (?*rhodia* Reeve), *Austrocochlea constricta, Austrocochlea concamerata, Acanthochiton sueurii* (Blainville), *Ischnochiton* sp. juv., *Modiolus pulex, Bembicium auratum*.

At the Slipway there is a patch of mussels embedded in sand. These mussels are *Modiolus pulex* Lam. Below them are the Grapsid crab *Leptograpsus variegatus* (Fabr.), *Ibla quadrivalvis* Cuvier, *Cominella lineolata, Lepsithais vinosa, Sabia conica* Schumacher, *Melanerita melanotragus, Micrastraea aurea* Jonas, *Serpulorbis sipho* (Lam.), *Fax tenuicostata* (Tenison-Woods), *Sypharochiton maugeanus, Cryptoplax iredalei* (Ashby.), *Hymeniacidon perlevis* (Montagu), *Patiriella exigua* (Lam.), *Alabes rufus* (Macleay).

The *Hormosira* belt passes into a very poor *Corallina* belt which may only be two inches in vertical height on the eastern shore. There are no shelves, &c., at a level suitable for the development of the *Corallina* belt, the *Hormosira* passing directly into the algal belt, *Cystophora* spp., or the Infralittoral Fringe. However, the bottom part of the *Hormosira* belt contains a large number of ascidians of the species *Pyura stolonifera* (Herdman). The *Pyura* is not present in sufficiently large numbers to form a belt, but its presence on South Point indicates that the wave action there, and nowhere else on the island, is sufficient to maintain this species. Another species found on South Point is a remarkable sponge, grey in colour 25-30 cms. in diameter with its surface raised into ridges on which the osculae are placed. A large Conid shell, *Floraconus anemone* (Lam.) together with two small shells of the same species were found in amongst the *Pyura* tests.

(g) The Austrocochlea Species

Two species of *Austrocochlea* are found between the tides on Fisher Island. The most conspicuous of these is the large *A. constricta*, in which the shell is heavily ridged. This species is common at North Point and at places on the eastern shore between North Point and Potts Point. It also occurs at Western Boat Harbour.

The second common species of *Austrocochlea, A. concamerata*, is found frequently with *A. constricta* but also living in places from which *constricta* is absent. Like *constricta*, it is intolerant of wave action and is found only on the eastern shore from Potts Point to North-West Boat Harbour. Both these species are found amongst the large boulders at South Point and in gullies on the western coast.

(h) Other Species

The only barnacles which are common on Fisher Island, other than the two species mentioned above, are *Tetraclita purpurascens* (Wood) and the stalked *Ibla quadrivalvis* (Cuvier). The former species is always semi-cryptic in habit being found under boulders, in clefts, between rocks and in extremely sun-shaded places. Individuals of *Tetraclita* are slightly different from those found on the mainland of Tasmania in that they frequently have a furry epidermal covering to the shells. I have seen this only rarely on Tasmanian specimens. *Tetraclita purpurascens* is especially common under rocks between South Point and Lower Midden Rock. *Ibla quadrivalvis* is also semi-cryptic in habit and is most common under the stones at North Point. *Ibla* has a greater toleration for sun exposure than *Tetraclita* and is found in places experiencing more sun exposure than the situations favoured by the latter species. It is particularly interesting to note that there is no association with *Galeolaria* on sun exposed rocks such as is found in many places in Tasmania. However, this association does occur under boulders on Fisher Island.

The small lamellibranch, *Kellia australis* (Lam.) is common in Tasmania, usually living in large numbers below *Galeolaria* tube masses or suitable algal masses such as *Lithophyllum hpyerellum* (Foslie). However, on Fisher Island in the absence of *Galeolaria* masses and *Lithophyllum* this mollusc is found living in clusters at North Point, generally in the shelter of stones, but not in close association with other animals or plants.

NOTES ON THE ECOLOGY OF EDDYSTONE POINT

Eddystone Point furnishes a different type of habitat from that seen on Fisher Island, the wave action there is strong but there is a point of similarity in that the substratum at both localities is granite. This zonation at Eddystone is variable due to the broken nature of the shoreline offering different wave exposures but in general the following is the pattern which is followed:—

Littorina unifasciata
Chamaesipho columna
Siphonaria funiculata + *Siphonaria diemenensis*
Cellana solida
Corallina and/or *Lithophyllum*
Sarcophycus potatorum

This pattern is characterized by an absence of *Galeolaria caespitosa* as a belt-forming organism on exposed places, though this species may form dense clusters in clefts on sheltered localities. It occurs as scattered tubes over most of this area. Mussels (*Austromytilus erosus* and a few *Mytilus planulatus*) are found only in clefts or in sheltered positions.

The Midlittoral Belts

Lichina confinis forms a scattered belt in places below the *Littorina* belt at approximately the wave level of the *Siphonarias*. Like the latter species, the *Lichina* belt is sporadic in occurrence.

The salient feature of this belt was the relative scarcity of *Chthamalus antennatus*. This species does occur at Eddystone and is very common further to the west on the North Coast, e.g., West Head (Kershaw, 1957).

In places with broken water the lower part of the *Chamaesipho* belt is populated by *Catophragmus polymerus* Darwin, though this species is very local in distribution. The lower part of the *Chamaesipho* belt is often mixed with *Poneroplax albida* (Blainville) which may be considered to form a belt in places on the rocks. *Poneroplax* is often mixed with *Lithophyllum hyperellum* (Foslie). In the absence of *Lithophyllum* the lower part of the *Chamaesipho* belt contains *Cellana solida*.

Siphonaria funiculata (Reeve) is common on sun-sheltered or partially sheltered rocks in the upper half of the barnacle belt below *Littorina* and is usually associated with *S. diemenensis*.

The Infralittoral Fringe

Sarcophycus potatorum (Labill.) Kutz is the dominant alga of this part of the shore together with *Phyllospora comosa* (Labill.) J. Ag. The dominant alga in places with submaximal wave action is *Lessonia corrugata* Lucas and the species of *Cystophora* may become locally important in very sheltered gullies. It is noteworthy that the plants of *Sarcophycus* are not as large as on other exposed Tasmanian coasts. There are a few *Pyura* around the holdfasts of *Sarcophycus* but they are small in size.

DISCUSSION

This paper describes the zonation and general ecology of an area in the north of Tasmania. This area proves to be of considerable interest, the zonation being somewhat different from that seen on other parts of the Tasmanian coast. Kershaw (1957) described the ecology of an area at the Tamar Heads, also in North Tasmania and Fischer (1940) worked at Burnie. Kershaw's paper was primarily concerned with the mollusca and Fischer's observations were very brief and mentioned only the zone forming species.

The most obvious feature on the island is the very prominent and almost continuous *Cellana* belt. The belt is rarely continuous anywhere else that I have examined in Tasmania and *Cellana* certainly has never been found to be as conspicuous.

The principal points of interest on Fisher Island do not lie in the organisms forming belts on the shore but in the species which are encountered there and in the absence of certain species.

One species, represented by three individuals, which I was very surprised to encounter in the intertidal region was the urchin, *Goniocidaris tubaria* (Lam.). This species is very common on certain dredging grounds 5-10 fathoms in Southern Tasmania but I have never found it in the intertidal region in the south. *Amblypneustes ovum* (Lam.) is another urchin which is usually found below water in Southern Tasmania. The Vermetid species *Serpulorbis sipho*, common below stones at North Point, is another which I have never found between tidemarks in Tasmania.

The absence of limpets, such as species of *Conacmaea, Patelloida* and *Chiazacmea* which extends into Victoria or even New South Wales, are absent or rare on Fisher Island and from many of the surrounding islands of Franklin Sound. In December, 1956, I did not see any *Collisellina latistrigata* (Angas), though I recorded the species in 1954 when it was rare. Apart from *Cellana*, the only limpets collected are *Patellanax chapmani* (Ten.-Woods) *Patelloida alticostata* and *Notoacmaea scabrilata* (Angas) together with *Siphonaria diemenensis* (Quoy & Gaim.). The latter species is not common and the *Siphonaria "zonata"* form of this species is absent from the island. This is very surprising in view of the widespread distribution of this form in Tasmania.

The absence of anemones is another feature of Fisher Island. The red *Actinia tenebrosa* (Farq.) is found on the nearby Little Green Island and on rocks in Gunter's Bay on the mainland of Flinders Island, but is absent from Fisher Island, in spite of there being plenty of apparently suitable semicryptic habitats. The larger *Oulactis muscosa* (Drayton) is also absent from Fisher Island, though it is also absent from surrounding islands. The geographic range of this species is from Southern Tasmania to New South Wales so that we must look to reasons other than geographic distribution to explain the absence of this species from Fisher Island.

The crab fauna is poor in species but not in numbers. There are no Porcellanids below stones, which is very much the opposite of conditions on the Tasmanian mainland where *Petrolisthes elongatus* (M.Edw.) frequently occurs in thousands on shores similar to that on the North Point of Fisher Island. The Grapsid *Helice haswellianus* (Whitelegge) occurs at North-West Boat Harbour in large numbers, every stone sheltering one or more individuals. *Leptograpsus variegatus* (Fabr.) is common under rocks or in clefts on the upper part of the shore.

The long period covered by the three visits to Fisher Island has enabled me to make some observations on the long time changes which have taken place on the shore. Not only do the changes consist of minor alterations in the species present but the actual zonation on the island has altered. As I intend to discuss this topic fully elsewhere, it is sufficient to record the major changes that have taken place. The main change is the appearance of *Hormosira* as a belt forming species. In 1954 there was little *Hormosira* on the island, except at South Point where there were sporadic plants. At this time, the zonation there was barnacles, *Galeolaria, Galeolaria* + *Pyura*. *Hormosira* has colonized part of the shore around all of the island since 1954, probably to the detriment of the serpulids.

The barnacle population, as noted above, has become greater since 1954, probably due to the successful large spatfall noted in that year. However, this colonization was not achieved at the

expense of other species since, with the exception of South Point and some other very restricted areas, there is plenty of available space in the barnacle belt.

It is noteworthy that *Melanerita melanotragus* is much more common than on the east and west coasts of Tasmania where it is scarce to rare and is absent in the south. *Melanerita* is very common on the north coast of Tasmania at Kelso (Kershaw, 1957) and Burnie.

Fisher Island shows some important gradations between the zonation seen in Tasmania and that described for Victoria by Bennett and Pope (1953). It is important to note that Bennett and Pope were primarily concerned with exposed coasts and that the Eddystone Point area is also an exposed region so that Fisher Island is not ecologically under the same conditions as either of the other localities and true comparisons cannot be made. However, from descriptions of other sheltered localities in Tasmania it is possible to draw certain general conclusions regarding the ecological position of Fisher Island.

Bennett and Pope record that the chiton *Poneroplax albida* is a belt forming species in Southern Victoria. I have never regarded this species as being sufficiently numerous in Tasmania to warrant the status of a belt forming species being conferred upon it. However, at Eddystone Point this chiton is very much more common than in more southerly parts of Tasmania but it is apparently much smaller in size. It is not surprising that this species is absent from Fisher Island, since it is generally found on coasts experiencing at least moderate wave action. This latter remark applies equally well to the alga *Lithophyllum hyperellum* Foslie, which is very common at Eddystone Point. Although it occurs on the exposed parts of Babel Island, *Lithophyllum* is a species of southern exposed coasts, being not found in Victoria.

The continuity and importance of *Cellana* at Fisher Island, the associated islands of Franklin Sound and at Eddystone Point are features which are essentially Northern Tasmanian in affinities. This large limpet is widespread throughout Tasmania but nowhere in the south does it reach the importance attained at both Eddystone Point and Fisher Island. It is noteworthy that *Cellana solida*, although recorded from Victoria by Macpherson (1955) was not recorded by Bennett and Pope. Pope (1955) records it as absent from Victoria. The poverty of other species of limpets and *Siphonarias* both in species and numbers at Fisher Island is somewhat puzzling. A number of Patellids and Siphonarids occur both at Eddystone Point and in Victoria. Cape Barren Island supports a varied fauna of patellids as well as a large number of *Siphonaria diemenensis* (Quoy & Gaim.). The absence of these organisms from Fisher Island must be due to some local feature.

The position of *Cellana* relative to other zonal organisms is one of considerable interest. In Southern Tasmania at Blackman's Bay (Guiler, 1950) it was noted that *Cellana* occurred below the *Galeolaria* belt together with *Patelloida alticostata* and *Siphonaria diemenensis*. Under certain conditions *Cellana* was found above *Galeolaria*, particularly in regions with some splash from waves. This conclusion was in contrast to the conditions described in New South Wales by Dakin, Bennett & Pope (1948) where *Cellana* occurs above *Galeolaria*. It is worthy of note that *Cellana* has now become sparse in the Blackman's Bay area (Dudgeon in litt.). In general throughout Tasmania, there may be a Patelloid belt below *Galeolaria* but the characteristic habitat of *Cellana* is above *Galeolaria* on less than semi-exposed coasts. *Cellana* does occur on exposed coasts, e.g., Eaglehawk Neck where it occurs in a mixed Patelloid belt above the Corallines. This level is probably equivalent to below *Galeolaria* but it is difficult to compare these levels with accuracy since *Galeolaria* does not form belts on exposed coasts.

The barnacles of Fisher Island reflect the typical north coast feature of many more *Chthamalus antennatus* in the upper part of the barnacle belt. This feature has been noted elsewhere as occurring at Boat Harbour (Guiler, 1952), Kelso (Kershaw, loc. cit.) and it is also to be seen on Cape Barren Island and at Eddystone Point.

In conclusion, it can be said that the intertidal zones on Fisher Island and Eddystone Point, apparently in common with certain other localities in Northern Tasmania, show greater affinities with Victoria than with Southern Tasmania. In particular, the presence in the intertidal region of some species which are found in the Infralittoral in the south, e.g., *Serpulorbis sipho* and *Goniocidaris tubaria* together with an apparent reduction in the size of cold water loving species such as *Sarcophycus* and *Poneroplax albida*, points to a slight warming of the cool water. However, at this stage, it cannot be assumed that this warming is sufficient to warrant the removal of the seas of Northern Tasmania from the cool temperate Maugean province to which they have been assigned. Certain species found at Fisher Island, such as *Chthamalus antennatus*, *Melanerita melanotragus* and *Patellanax chapmani*, are common in Victoria and Eddystone Point but are absent or scarce in Southern Tasmania. *Melanerita* is fairly numerous at Coles Bay but is rare at Eaglehawk Neck in south-eastern Tasmania. All of the dominant species are cold temperate in affinities but the warm temperate element is very much stronger at Flinders Island than in Southern Tasmania.

FAUNAL LIST

The list of the more common animal species found between the tidemarks on Fisher Island is set out below. This list is based upon my own observations and upon a reference collection of Mollusca made by E. H. Sedgwick in February, 1954, and identified by Miss J. Hope Macpherson. It should be stressed that this list is by no means complete and must serve as a beginning for further collections.

	Habitat.	Status.	Author
PORIFERA			
Hymeniacidon perlevis (Montagu)	Below stones, N. Pt.	Frequent	E. R. Guiler
Large grey species	S. Pt.	Frequent	E. R. Guiler
TURBELLARIA			
Leptoplana australis (Laidlaw)	Below stone, N. Pt.	Frequent	E. R. Guiler
ANNELIDA			
Galeolaria caespitosa (Lam.)	Ubiquitous, Midlittoral	V. common	E. R. Guiler
CRUSTACEA			
Ibla quadrivalvis (Cuvier)	Amongst mussels, N. Pt.	Common	E. R. Guiler
Tetraclita purpurascens (Wood)	Semi-Cryptic	Common	E. R. Guiler
Chthamalus antennatus (Darwin)	Barnacle belt	V. common	E. R. Guiler
Chamaesipho columna (Spengler)	Barnacle belt	V. common	E. R. Guiler
Halicarcinus planatus (Fabr.)	Amongst mussels, N. & S. Pt.	Frequent	E. R. Guiler
Necrocarcinus integrifrons (Lat.)	Frequently found dead on shore		E. R. Guiler
Leptograpsus variegatus (Fabr.)	Under rocks, Supralittoral Fringe	Common	E. R. Guiler
Helice haswelliannus (Whitelegge)	Under rocks, Midlittoral, N. Pt.	Common	E. R. Guiler
MOLLUSCA			
Sypharochiton maugeanus (Ired. & May)	Semi-cryptic clefts, ubiquitous	Common	E. H. S. & E. R. G.
Cryptoplax striata (Lam.)	N. Pt.	Scarce	E. H. S. & E. R. G.
iredalei (Ashby.)	N.E. Boat Harbour	Scarce	E. R. Guiler
Ischnochiton elongatus (Blainville)	N. Pt. cryptic	Scarce	E. R. Guiler
Aulacochiton cimolia (Reeve)			E. R. Guiler
Acanthochiton sueurii (Blainville)	N. Pt., below stones	Scarce	E. R. Guiler
Arca pitsachia (Lam.)	N. Pt., amongst stones	Frequent	E. R. G. & E. H. S.
Ostrea sinuata (Lam.) = *angasi* (Thompson, 1954)			E. H. S.
Equichlamys bifrons (Lam.)	Doubtful if intertidal		E. H. S.
Austromytilus erosus (Lam.)	N. & S. Points	Common	E. H. S. & E. R. G.
Modiolus pulex (Lam.)	N. Point	Common	E. R. G.
Kellia australis (Lam.)	N. Point	V. common	E. R. G.
Venerupsis exotica (Lam.)	N. Point	Scarce	E. R. G.
Katelysia sp. juv.	?	?	E. H. S.
Pseudarcopagia victoriae (Gat. & Gab.)	?	?	E. H. S.
Notohaliotis ruber (Leach)	I. L. Fringe	Frequent	E. H. S.
Neohaliotis emmae (Reeve)	I. L. Fringe	Frequent	E. H. S.
Schismotis laevigata (Donovan)	I. L. Fringe	?	E. H. S.
Scutus antipodes (Montford)	Midlitt. Fringe	?	E. H. S.
Cellana solida (Blainville)	Midlitt. Fringe	V. common	E. H. S. & E. R. G.
Patellanax chapmani (Ten.-woods)	Midlitt. and N. West Boat Harbour	Frequent	E. R. G.
Patelloida alticostata (Angas)	Midlitt., general	Common	E. R. G.
Notoacmea scabrilirata (Angas)	N. Point	Scarce	E. R. G.
Clanculus undatus (Lam.)	N. Point	Common	E. H. S. & E. R. G.
Clanculus plebejus (Philippi)	?	?	E. H. S.
Phasianotrochus bellulus (Dunker)	?	?	E. H. S.
Thalotia conica (Gray)	?	?	E. H. S.
Austrocochlea concamerata (Wood)	N. & E. Coasts	Common	E. H. S. & E. R. G.
Austrocochlea obtusa (Dillwyn)	Generally distr.	Common	E. H. S. & E. R. G.
Stomatella imbricata (Lam.)	?	?	E. H. S.
Herpetopoma baccata (Menke)	?	?	E. H. S.
Gena impirtusa (Burrow)	?	?	E. H. S.
Micrastrea aurea (Jonas)	Below mussels, N. & S. Pts.	Common	E. H. S. & E. R. G.
Phasianella australis (Gmelin)	?	?	E. H. S.
Melanerita melanotragus (Smith)	N. & E. Coasts	V. common	E. H. S. & E. R. G.
Bembicium imbricatus (Gray)	?	V. common	E. H. S.
Bembicium auratum (Quoy & Gaim.)	Ubiquitous	V. common	E. R. G.
Littorina unifasciata (Gray)	Ubiquitous	V. common	E. R. G.
Serpulorbis sipho (Lam.)	S. & N. & E. Coasts	Scarce	E. R. G.

	Habitat.	Status.	Author
Zeacumantus diemenensis (Quoy & Gaim.)	N. Coast below stones	Frequent	E. R. G.
Ianthina smithiae (Reeve)	?	?	E. H. S.
Sabia conica (Schumacher)	N. Point	Rare	E. R. G.
Notocypraea verconis (Cotten & Godfrey)	?	?	E. H. S.
Negyrina subdistorta (Lam.)	?	?	E. H. S.
Cymatiella verrucosa (Reeve)	N. Pt.	Scarce	E. R. G.
Pterynotis triformis (Reeve)	?	?	
Lepsithais vinosa (Lam.)	Below mussels, N. Pt. & S. Pt.	Common	E. R. G.
Dicathais textiliosa (Lam.)	?	?	E. H. S.
Zemitrella acuminata (Reeve)	N. Pt.	Frequent	E. R. G.
Cominella lineolata (Lam.)	N. & S. Pt.	Common	E. H. S. & E. R. G.
Fax tenuicostata (Ten.-Woods)	N. Pt.	Rare	E. R. G.
Austrosipho grandis (Gray)	?	?	E. H. S.
Parcanassa pauperata (Lam.)	?	?	E. H. S.
Pleuroploca australasia (Perry)	S. Pt.	Scarce	E. R. G. & E. H. S.
Mitra sp. juv. (?*rhoda*)	N. Pt.	Scarce	E. R. G.
Amoria undulata (Lam.)	S. Pt.	Rare	E. R. G. & E. H. S.
Austrodrillia beraudiana (Crosse)	N. Pt.	Scarce	E. H. S. & E. R. G.
Floraconus anemone (Lam.)	S. Pt.	Rare	E. R. G.
Salinator sp.			
Siphonaria diemenensis (Quoy & Gaim.)	W. & N. Coasts	Scarce	E. R. G.
Decorisepia rex (Iredale)			E. H. S.
Crumenasepia ursulae (Cotton)			E. H. S.
ECHINODERMATA			
Patiriella exigua (Lam.)	Slipway	Frequent	E. R. G.
Amblypneustes ovum (Lam.)	N.E. Boat Harbour	Several	E. R. G.
Goniocidaris tubaria (Lam.)	N.E. Boat Harbour	Several	E. R. G.
UROCHORDATA			
Pyura stolonifera (Heller)	S. Pt.	Common	E. R. G.

ACKNOWLEDGMENTS

I am indebted to Dr. D. L. Serventy for his co-operation in carrying out this work and to the Tasmanian Animals and Birds Protection Board and the Commercial Scientific and Industrial Research Organization for the use of the facilities on Fisher Island. I also wish to thang the Commissioner of Police for permission to use the police boat and to Trooper L. Bailey for his assistance in many ways. Mr. R. C. Kershaw very kindly identified the Mollusca for me and to him I express my thanks.

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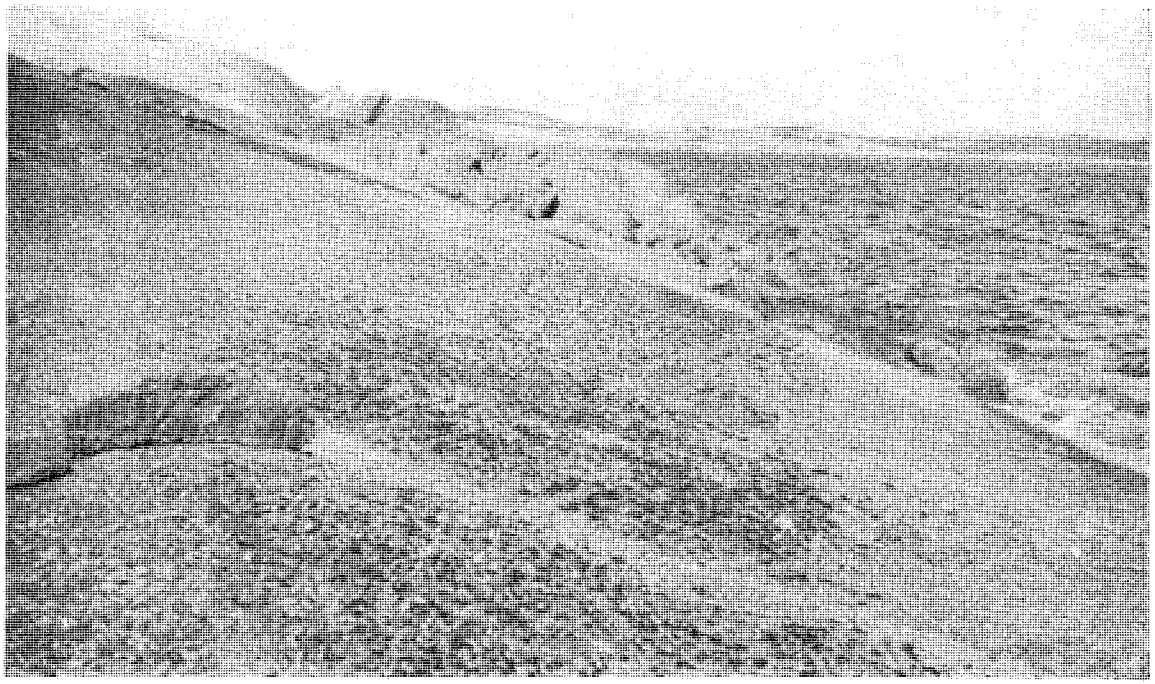

FIG. 1.—South point Fisher Island, showing the top of the barnacle zone with *Lichina*.

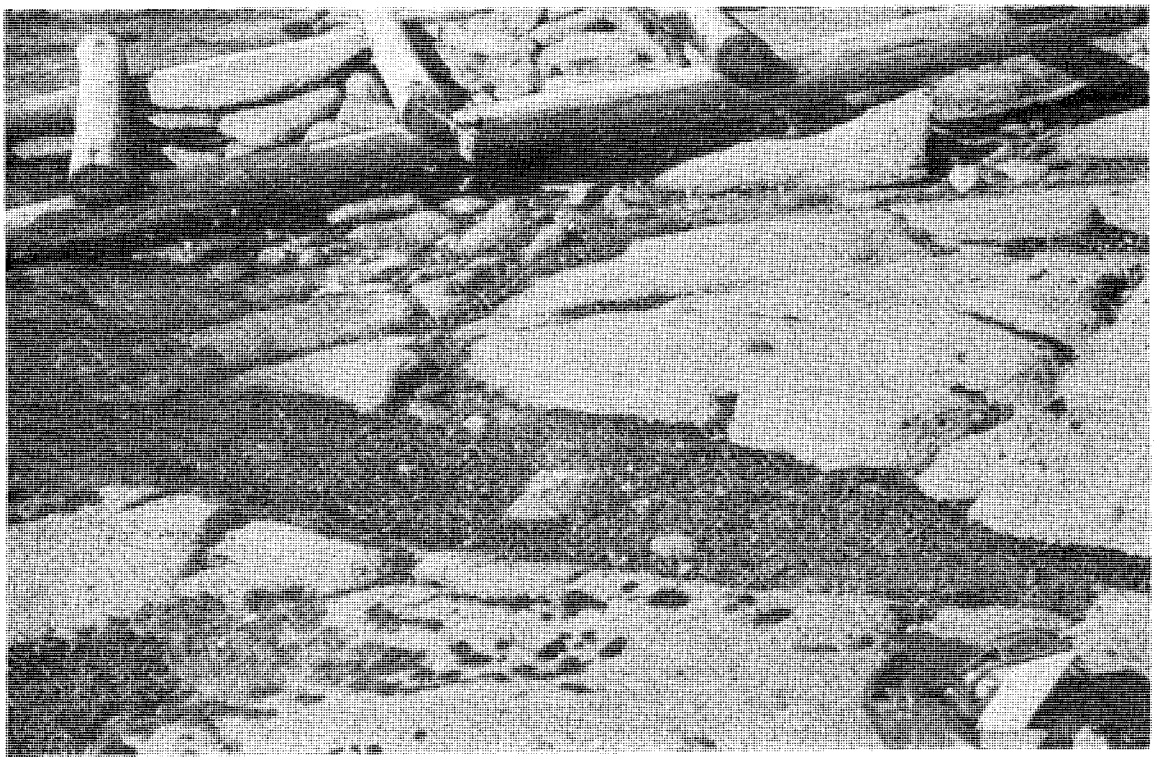

PLATE I

FIG. 2.—Mussels at the slip-way, North Point.

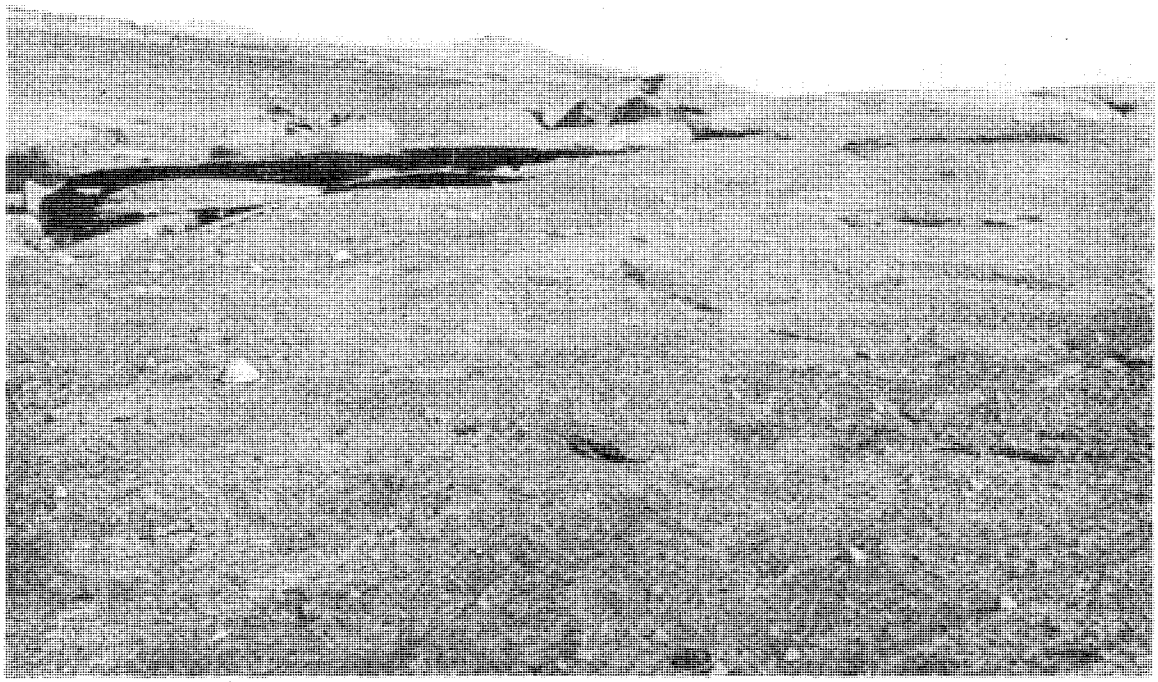

FIG. 1 —The *Bembicium* and *Cellana* belts on the east shore, Fisher Island.

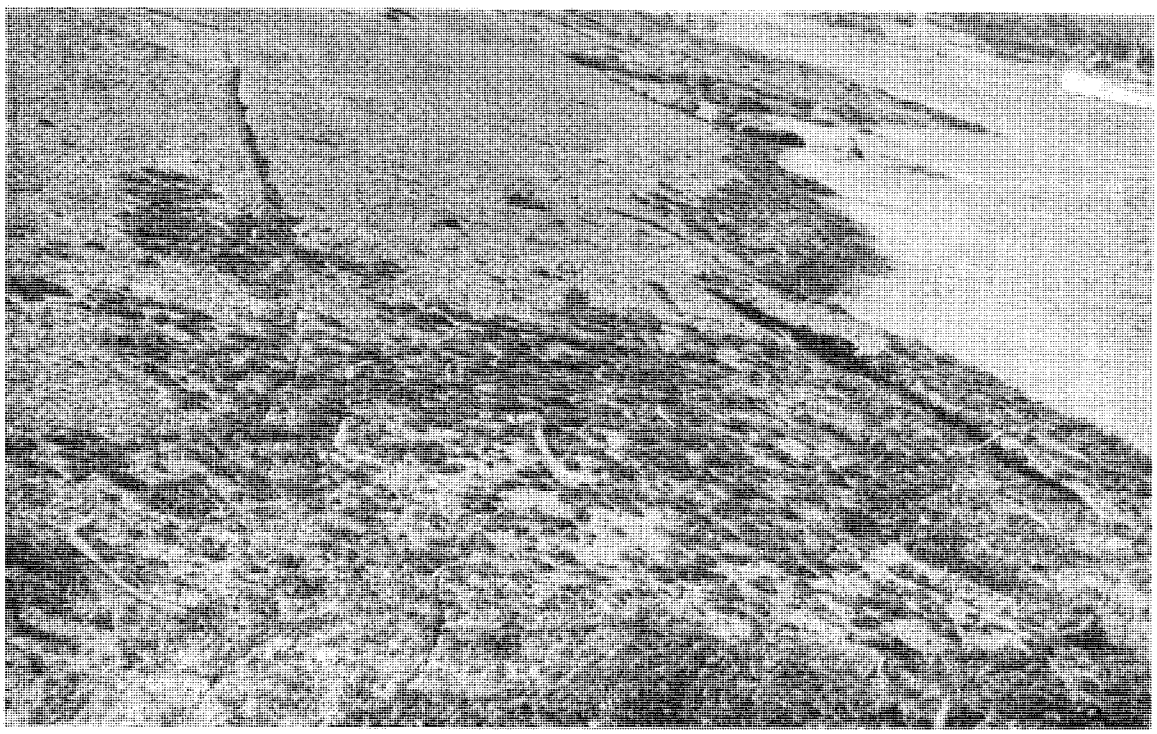

PLATE II

FIG. 2.—South Point looking north. *Pyura* in right foreground, *Galeolaria* and *Bostrichia* above.