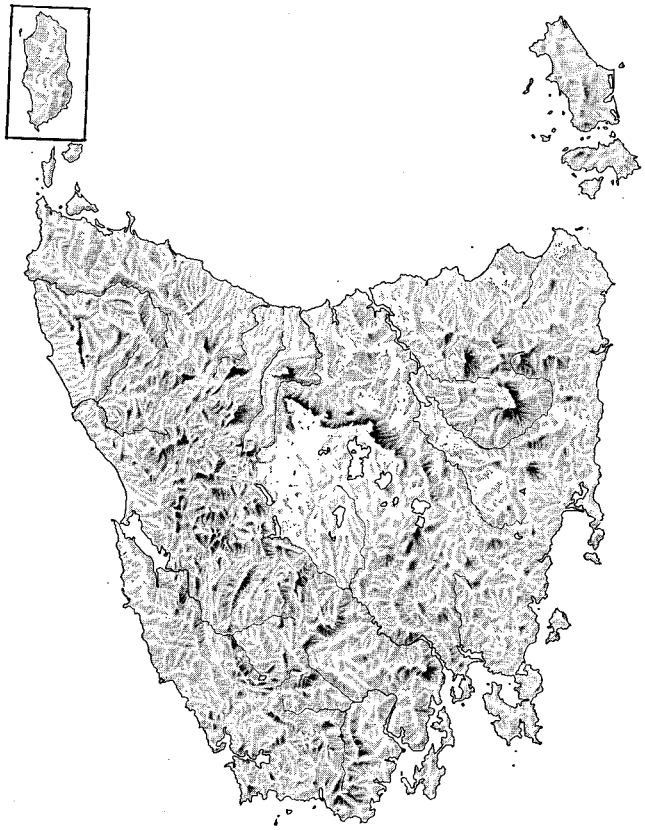
Chapter 2

PHYSICAL ENVIRONMENT

GENERAL DESCRIPTION

Location and Area

The State of Tasmania is a group of islands lying south of the south-east corner of the Australian continent; the major island is called Tasmania and the more important of the lesser islands include King, Flinders and Bruny. The major island, roughly heartshaped with the greatest breadth in the north, extends from 40° 38′ to 43° 39′ South latitude and from 144° 36′ to 148° 23′ East longitude. All the coastline lies in the Southern Ocean except in the north where Bass Strait separates the island from the Australian continent by approximately 150 miles.



Relief Map

The area of the whole State, including the lesser islands, is 26,383 square miles or about 0.9 per cent of the area of the Australian Commonwealth (2,967,909 sq. miles); it is approximately 28 per cent of the size of the United Kingdom.

Australia, extending as it does well north of the Tropic of Capricorn and with much of its area in the zone of the sub-tropical anti-cyclones, is basically a warm, dry continent. By way of contrast, Tasmania is in the temperate zone and practically the whole island is well watered with no marked seasonal concentration; there are no deserts or drought areas as found extensively on the adjacent continent. Because Tasmania is the most southern State of the Commonwealth, there is a tendency to think of it as being close to the Antarctic but its latitude is matched, in the northern hemisphere, by that of Marseilles (France), and Boston (U.S.A.). In addition, the fact that Tasmania is an island shelters it from the extremes of heat and cold experienced in these two centres. The effect of its insular position is illustrated by the variation between summer and winter mean temperatures in coastal towns—this rarely exceeds 15°F. Comparing Hobart (Tasmania) with Melbourne (Victoria), mean maxima are some 6° warmer and mean minima 3° warmer in the Victorian capital although Hobart enjoys slightly more sunlight as it is subject to less fog.

Apart from the Great Dividing Range in the east, Australia is predominantly a land of low plateau and plains with little relief. Again, by way of contrast, Tasmania could legitimately be called the island of mountains, since it has the largest proportion of high country in its total area when compared with the other States. The distinctive feature of the island is not so much the size of the mountains—few exceed 5,000 feet—but rather the frequency with which they occur. The British Admiralty Pilot Book describes Tasmania as "probably the most thoroughly mountainous island on the globe."

Population Distribution

With a population exceeding 370,000, Tasmania is still thinly populated although its density of 14 persons per square mile is exceeded only by Victoria among the Australian States.

A marked characteristic of the continental States of the Commonwealth is the very high concentration of population in their respective metropolitan areas, Brisbane providing the only example where this concentration falls below 50 per cent of the State's total population. By way of contrast, the Tasmanian population is concentrated in two main areas—(i) Metropolitan Area (Hobart and Suburbs) with about 33 per cent, and (ii) Launceston and Suburbs with about 16 per cent. This deviation from an Australian pattern is partly explained by the relative proximity of Launceston to the principal mainland markets, a factor also operating in favour of the north-western towns of Burnie and Devonport which together now contain a further 8 per cent of the State's population. As might be expected with an island, the main centres of population have grown up around ports.

Economic Development

In the nineteenth century, the basic economic activities were farming, mining, forestry and fishing (with whaling of prime importance in the first half of the century). In the twentieth century, evolution of secondary industry was at first inhibited by two major factors—the smallness of the local island market and the relative advantage enjoyed by competitors located closer to the principal markets. There were, however, two geographical features of the island which could be utilised to offset these disadvantages, namely a mountainous

terrain and an assured rainfall. Taken together, these two factors mean cheap electric power (if the necessary investment is made in dams and generating stations), for it has been estimated that Tasmania has at least 50 per cent of the total Australian hydro-electric potential. In the last three decades, the State Hydro-Electric Commission has developed a generating system such that the turbines now in use are rated at over one million horsepower, and work is still proceeding on harnessing fresh sources. Some indication of the tremendous potential still to be tapped is found in the fact that, apart from Lake Margaret, no use has yet been made of the water resources of the West Coast where the island experiences maximum rainfall. The abundance of cheap electric power has led to the establishment of a number of major industrial plants and has transformed the island's economy, which was once heavily dependent on primary industry. Evidence of this change is given by the Census of 30th June, 1961 when 13.1 per cent of the Tasmanian work force was shown as engaged in "Primary Production" but 22.6 per cent in "Manufacturing". Compared purely on the basis of these two percentages, Tasmania is, relatively speaking, a more industrialised State than Queensland or Western Australia.

An island, by definition, can suffer from isolation and there is little doubt that Tasmania has been handicapped by transport difficulties. Two developments are now operating to minimise the effects of isolation—regular and frequent air services and roll-on roll-off ferries. The air service puts a Tasmanian traveller down in Melbourne in just over one hour's flying time from Hobart, while cargoes are air-freighted daily. Roll-on roll-off ferries are playing the part of a bridge and are carrying tourist cars and loaded road freighters across Bass Strait; the main terminal is Melbourne but a similar direct Hobart-Sydney link has now begun operating.

Origin of Population

Apart from natural increase, the main influence in building up the State's population has been migration from the British Isles and, to a lesser extent, from other Australian States. The Commonwealth Government's post-war policy of encouraging settlers from other European countries has had some effect on the composition of the population but, at the Census of 30th June, 1961, 95 per cent of people in the State claimed to have been born in Australia or in the British Isles. The other main countries of birth were Holland, Germany and Poland, in that order.

PHYSIOGRAPHY

Introduction

Tasmania is an island of mountains and is unique among Australian States in being predominantly influenced by polar maritime air masses. From the point of view of settlement and development, these two factors have combined to create assets against which must be weighed certain liabilities. The island, a mere 180 miles from north to south and 190 miles from east to west, concentrates in small compass an amazing variety of mountain, plateau and plain, of river, lake and tarn, of forest, moorland and grassland, of town, farm and uninhabited, even virtually unexplored country. The temperate maritime climate partly explains Tasmania being called the most English of all States but other factors operate to heighten the comparison—the pattern of agricultural settlement with orchards, hedges and hopfields; the Lake country; the early freestone architecture still common in the east; the roads and villages dotted with oaks, elms and poplars. Here, then, is something new for the visitor to see and all the ingredients for a flourishing tourist industry have been amply provided.

Assured rainfall and mountain storages have also given birth to massive development of hydro-electric power and, indirectly, to industry. The growth of forests, too, is promoted by suitable factors of rainfall and temperature, and this forms the basis for industries such as timber-milling and newsprint and other paper production.

The mountainous nature of the island is confirmed by survey which shows six features exceeding 5,000 feet, 28 exceeding 4,000 feet and a further 28 exceeding 3,000 feet. The highest mountain is Mt. Ossa (5,305 feet) some ten miles north-west of Lake St. Clair, and north-west again from this peak lie Mt. Pelion West (5,100 feet), Barn Bluff (5,114 feet) and Cradle Mountain (5,069 feet); the furthest distance, 15 miles, is from Mt. Ossa to Cradle Mountain. In the Ben Lomond area, the principal features are Legge's Tor (5,160 feet) and about six miles south, Stack's Bluff (5,010 feet). Each of these mountainous regions and a number of others have been set aside as National Parks and Ben Lomond is renowned for its winter sport.

Water Resources and Rainfall

Fresh water navigation has played very little part in the island's development, the rivers being too fast-running, too shallow or too short. Of the four major ports, three are located on tidal estuaries—Hobart on the Derwent; Launceston on the Tamar; Devonport on the Mersey (Burnie has built a port on the open sea protected by breakwaters). Rivers, however, are significant in the Tasmanian scene for three reasons: (i) use of headwaters for hydro-electric generation, (ii) domestic and industrial water supply, (iii) irrigation, although there are no major schemes, either private or government, in operation. Hobart, for example, draws much of its water supply direct from the upper Derwent River without use of a dam and the flow is adequate to serve a population at least ten times greater than that at present. The development of hydro-electric power has been based on full utilisation of the sources and tributaries of the Derwent, with a chain of power houses stretching from Poatina on the Great Lake to Meadowbanks only 32 miles from Hobart. At Launceston, too, the waters of the South Esk have been harnessed at Trevallyn. This does not exhaust the possibility of future development since the following river systems are still to be exploited: Mersey-Forth-Wilmot (north-west), Arthur (north-west), Pieman (west), Gordon-Franklin-King (west), Huon (south). Work is now proceeding on developing the Mersey catchment and possibly a Gordon scheme will follow.

As a liability must be entered the fact that large areas of the State cannot be cultivated because there is too much rainfall (in contrast with the mainland of Australia where often the reverse situation applies). Further, the mountainous terrain and accompanying highland climate have restricted farming to relatively small areas of suitable country, mainly river valleys, coastal plains and the lower plateaux. Expressing all figures as fractions of the State's total area, farm statistics for 1963-64 show that while rural holdings occupied 38 per cent, areas under crop amounted only to 1.4 per cent and a further 8.9 per cent was reported under clover and grasses (other than native). The remaining 28 per cent includes "bush runs", uncleared scrub or possibly land unsuitable for any rural purpose at all. A high proportion of the residual 62 per cent of the State's area not included in rural holdings is composed of forests, national parks and lakes.

Population Centres

The distribution of the State's population is largely influenced by factors of terrain and climate. A convenient way to summarise the present pattern of settlement is to imagine three circles of 25 mile radius centred on Hobart

(representing the south-east), Launceston (the north) and Ulverstone (the north-west): (i) with Hobart as centre, 42 per cent of the Tasmanian population is located within the 25 mile circle, (ii) with Launceston as centre, 22 per cent, (iii) with Ulverstone, 16.5 per cent. Since all circles are exclusive of each other, these three defined areas will together contain more than 80 per cent of the State's population and this fact justifies the generalisation that the main settlement is in the south-east, the north and the north-west. Residual population not included in the three defined areas is mainly located in the more distant north-west and more distant north-east, in the midlands between Hobart and Launceston, on King and Flinders Islands and along the east coast. Even a 50-mile circle with Queenstown as centre includes only three per cent of the State's population and here the activity is mining, not farming, since this is predominantly an area of high mountains and heavy rainfall. The south-west is completely uninhabited and very thinly populated is the central plateau where the main activities are summer grazing and hydro-electric power generation.

Physiographic Regions

To explain this particular pattern of settlement, it is necessary to isolate the various physiographic regions of the State as follows:

Central Plateau: The main feaure is a relatively undissected, dolerite-capped plateau sloping generally south-eastward from an average level of 3,500 feet in the north to 2,000 feet in the south, and drained almost wholly by the Derwent system (although recent hydro-electric development has involved diversion of some waters to the north at Poatina). The northern and eastern boundary of the Plateau is the Great Western Tiers (paradoxically named since they lie in the central north of the island). This is known as the Lake country of the island and is the chief source of the State's hydro-electric power.

High Dissected Plateau: West of Lake St. Clair, the dolerite caps steeply tilted sediments and the plateau is much dissected; it is formed of a series of peaks and broken ridges. The coastlands in the extreme south of the region are rugged but in the D'Entrecasteaux Channel and Huon River areas, narrow coastal belts have been devoted to specialised agriculture.

Western Ranges: The high dissected plateau is bounded by a mountainous series of ranges running parallel to the west coast and in this region are located the principal mines of the State. The south of the region is completely uninhabited.

Western Coastal Platforms: Throughout almost the entire length of the west coast, an uplifted and much dissected peneplain slopes down westward from about 900 feet to end abruptly in cliffs more than 100 feet high. In the south of this region, superhumid button grass plains predominate, and the area is uninhabited. On the coastal plain south of the Arthur River, however, dairy cattle are wintered on agistment runs while north of the river dairying begins to appear and swamps formed by recent emergence have been cleared for farming.

North-West Plateau: North of the Western Ranges lies a plateau averaging nearly 2,000 feet and important mainly for forestry; the coastlands derive mainly from basalt, giving rise to intensive mixed farming based on dairying, potatoes and crops for canning, such as peas and beans.

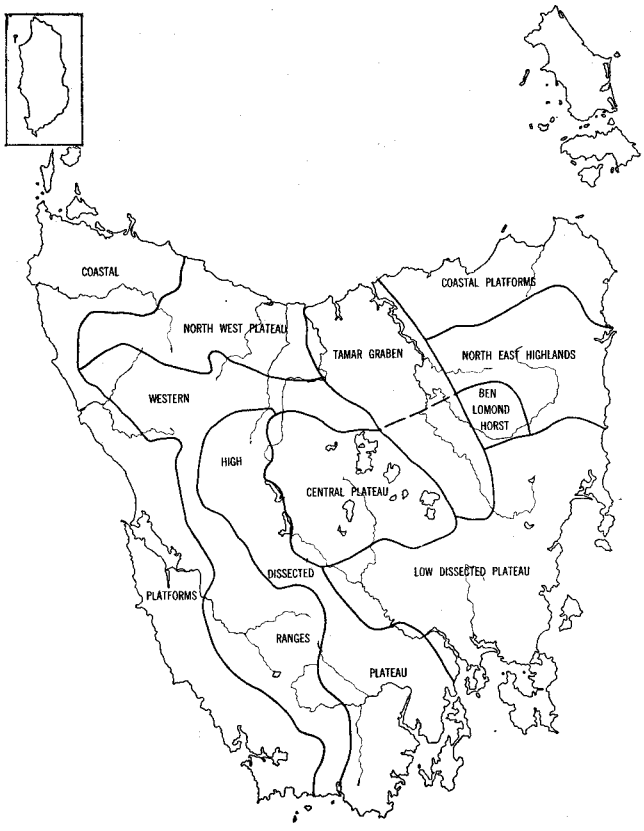
Tamar Graben: This graben (rift valley) is the largest plain and the leading agricultural and pastoral district in the State; it ends in the drowned inlets of the Tamar and Mersey estuaries and Port Sorell in the north.

North-East Coastal Platforms: This region consists of undulating lowland but the soils are acid and the land is used only for grazing.

North-East Highlands and Ben Lomond Horst: This region comprises mostly uplifted remnants of old fold mountains dominated by the 5,000 foot dolerite-capped plateau horst of Ben Lomond, an outlier of the Central Plateau. Here agriculture is largely confined to small basalt-derived basins, and some minerals are worked.

Low Dissected Plateau: In the south-east lies a low dissected dolerite plateau averaging perhaps 1,200 feet and used mainly for grazing. The northern coastlands of this region are narrow and also devoted to sheep but the southern coastland is important for its specialised agriculture. At the extreme south of the region is the drowned estuary of the Derwent, and the Tasman and Forestier Peninsulas.

(*The above regions derive from a classification by J. L. Davies*, M.A., PH.D., *University of Tasmania.*)



Physiographic Regions (after J.L.Davies)

DESCRIPTION OF STATISTICAL DIVISIONS

Introduction

Earlier the State of Tasmania was briefly described by analysing its terrain into nine physiographic regions. For statistical purposes, the State is analysed in divisions but these do not necessarily coincide with physiographic regions and have been evolved empirically, mainly on the basis of affinity of type of rural production or identity of economic interest. For obvious reasons of convenience and simplicity, statistical divisions are built from combinations of *whole* municipalities and this fact alone will largely explain the divergence of the statistical divisions from the physiographic regions. Two examples will suffice: (i) Esperance Municipality is included in the Southern Division; only the eastern coastlands of the municipality are settled, the balance lying in the uninhabited south and southwest of the island; thus, due to the relatively large area of Esperance Municipality, the Southern Division not only includes the hop and fruit growing areas of the Derwent, Huon and Channel districts but also Port Davey and Lake Pedder in the remote west; (ii) Deloraine Municipality extends into at least three physiographic regions: the Tamar Graben, the Western Ranges and the Central Plateau. For statistical purposes, it is grouped with other municipalities in the North Western Division.

Statistical Divisions

In subsequent chapters, data for the State will be given in terms of statistical divisions and the following briefly describes each (with population estimates as at 30.6.65):

1. *South Central Division:* The cities of Hobart and Glenorchy, on the west bank of the Derwent Estuary, are separated only by an administrative boundary and together constitute continuous urban development. (Population estimate—91,686.)

"Hobart and Suburbs" is an auxiliary statistical grouping used in some chapters and composed as follows: the South Central Division and the *suburban* portions of the bordering municipalities of Kingborough and Clarence. Both municipalities have large tracts of rural land and are grouped in other statistical divisions. (Population estimate, Hobart and Suburbs, 123,967.)

2. *North Central Division*: The City of Launceston on the Tamar is ringed by four municipalities, which, in addition to suburban elements, have large tracts of rural land; accordingly the City of Launceston is treated as a division in its own right. (Population estimate—37,381.)

"Launceston and Suburbs" is an auxiliary statistical grouping used in some chapters and composed as follows: the North Central Division and the *suburban* portions of the bordering municipalities of Beaconsfield, St. Leonards, Lilydale and Westbury; these municipalities are grouped in other statistical divisions. (Population estimate, Launceston and Suburbs, 59,440.)

3. *North Western Division*: The constituent municipalities are King Island, Circular Head, Wynyard, Burnie, Penguin, Ulverstone, Kentish, Devonport, Latrobe and Deloraine. In general, the division extends north from the Pieman River mouth in the west, then along Bass Strait to the east of Port Sorell. Rainfall in the division is generous—from forty to fifty inches near the shore-line to sixty or seventy inches on the higher country inland. The area is cut into sections by rivers discharging into Bass Strait, the chief being the Mersey, Forth, Leven, Blythe, Cam, Inglis, Black, Duck and Montagu.

It has large tracts of fertile soil which, together with good rainfall and a mild climate, account for relatively dense settlement and an ascendancy in dairying, beef-cattle farming, potato growing and production of crops for canning and quick-freezing (e.g. green peas and french beans). The division is making extensive use of its timber resources, not only for sawmilling but for large undertakings producing fine writing and printing paper, parchment and other special papers, and hardboard.

The two main ports of the division are Burnie and Devonport, the latter being the main terminal for a roll-on roll-off ferry service to Melbourne; urban development has not been confined to these two centres, however, and the coast road along Bass Strait runs through a number of townships serving the rural hinterland.

Until recently, the north-west coast was isolated from the central west coast, the only direct link being the Emu Bay Railway; the new Murchison Highway now connects the two areas and makes the coastal road along Bass Strait part of the "round the State" route. (Population estimate, 82,715.)

4. *North Eastern Division*: The constituent municipalities are Beaconsfield, George Town, Lilydale, Scottsdale, Ringarooma, Portland, Fingal and Flinders. In general, the division extends from east of Port Sorell along Bass Strait, then south along the Tasman Sea as far as the Denison River.

In terms of terrain, the division exhibits wide variety, including as it does the Tamar Estuary, the north-east coastal plains and the north-east highlands. In the Tamar Valley from Trevallyn to the sea, the average rainfall is about 30 inches; elsewhere it varies from 30 inches on the coastal plains to 60 inches on some of the highlands. The rivers in the division, apart from the Tamar and South Esk, are mostly small; the Piper, Brid, Big Forester, Little Forester and Ringarooma flow into Bass Strait while the Mussel Roe, Anson, George and Scamander flow into the Tasman Sea.

Along the Tamar Estuary, the main rural activity is orcharding; elsewhere farming, dairying and grazing play an important role alongside tin and coal-mining, sawmilling, and metallurgical refining.

The main ports for the division are those on the Tamar Estuary, including Launceston, Beauty Point and Bell Bay, the last being the outlet for metallurgical refinery products, including aluminium, from plants at George Town. In considering the estimated population of the division (34,762) it should be taken into account that approximately 25 per cent is located in *suburban* portions of Beaconsfield and Lilydale municipalities adjacent to Launceston.

5. *North Midland Division*: The constituent muncipalities are St. Leonards, Evandale, Longford and Westbury. Lying between the Western Tiers and Ben Lomond, the heart of the division contains the largest area of level land in the island and is thought to have its origin in two vast freshwater lakes of an earlier era. The ancient lake-bed soils were easily worked by the early settlers and the area became the island's main centre for cereal crops; cereal crop growing is still practised extensively but the rich grazing potential of the land is also being exploited. Rainfall varies from forty inches in the west to twenty five inches in the south; the chief rivers are the North and South Esk, the Meander and the Macquarie.

In considering the estimated population (26,058), it should be taken into account that nearly 50 per cent is located in *suburban* portions of St. Leonards and Westbury municipalities adjacent to Launceston.

6. *Midland Division*: The constituent municipalities are Bothwell, Hamilton, Campbell Town, Ross and Oatlands. In the west are the Central Plateau and Lake Country, generally at an elevation that allows only limited summer grazing. To the east is a lower dissected plateau where graze more sheep than in any other division. Rainfall varies from 80 inches in the extreme west to almost as low as 20 inches in the east and south. The principal rivers in the sheep belt are the Macquarie, Elizabeth and Clyde; the division also contains the western source and upper waters of the Derwent. (Population estimate, 9,855.)

7. *South Eastern Division*: The constituent municipalities are Glamorgan, Spring Bay, Sorell, Richmond, Clarence, Brighton and Green Ponds. The division includes the east coast from the Denison River south to Forestier Peninsula and the east bank of the Derwent almost to New Norfolk. In the west of the division, rainfall is as light as twenty inches with slightly more in the east. There is good farmland in the area north of the Derwent but, taken as a whole, the division is mainly devoted to grazing.

In considering the estimated population (39,384), it should be taken into account that approximately 66 per cent is located in the *suburban* portion of Clarence Municipality adjacent to Hobart.

8. *Southern Division*: The constituent municipalities are Esperance, Port Cygnet, Huon, Kingborough, New Norfolk, Bruny and Tasman. The division includes the Derwent Valley, the Huon Valley and the D'Entrecasteaux Channel district as well as Bruny Island and Tasman Peninsula; the western half is uninhabited. Rainfall in the west approaches 60 inches or more, in the Huon and Channel districts 35 inches and in the lower Derwent Valley 25 inches or less. The main rural industries are concentrated on hops, orchards and small-fruit while exploitation of timber is important, not only for sawmilling, but also for the mills at Boyer and Geeveston where native hardwoods are converted to paper pulp. The main port used by the division is located at Hobart with Port Huon used seasonally in the export of fruit.

In considering the estimated population (34,354), it should be taken into account that nearly 20 per cent is located in the *suburban* portion of Kingborough adjacent to Hobart.

9. *Western Division:* The constituent municipalities are Waratah, Zeehan, Gormanston, Queenstown and Strahan. The division reaches south from the mouth of the Pieman River to Port Davey and extends east almost to Lake St. Clair. Agriculture plays virtually no part in this area of heavy rainfall and rugged mountains. In a division where rain is measured in feet rather than inches, it is difficult to generalise but 30-year averages for individual stations are as follows:—Gormanston, 120 inches; Lake Margaret, 143 inches; Queenstown, 99 inches; Waratah, 89 inches; Zeehan, 97 inches. Considering the mountainous terrain and abundant rainfall, it is not surprising that the island's largest river, the Gordon, should flow in this division, discharging into Macquarie Harbour; the Pieman River to the north is almost as big. The only port—Strahan on Macquarie Harbour—is approached through a narrow rocky entrance called Hells Gates; strong currents and a sand bar are additional navigational hazards.

Settlement in the division is mainly related to mining since this is the island's richest mineral-bearing tract, the chief minerals being copper, zinc, silver-lead and tin. A large deposit of iron ore has recently been surveyed near

the Savage River, the chief barrier to immediate exploitation being the distance from the possible harbours and the lack of any means of carriage; conveyance by pipeline of treated ore to Brickmakers Bay near Stanley is seen as the solution and construction has started.

Until recently, the west coast was isolated from the north-west coast, the only link being the Emu Bay Railway. The completion of the Murchison Highway now puts the main western towns on a "round the State" route.

The estimated population (9,029) is mainly concentrated in and round Queenstown, the centre of the Mt. Lyell Company's operations.

LOCAL GOVERNMENT AREAS

Area of State

Until recently, the official area of the State of Tasmania was stated to be 26,215 sq. miles (16,778,000 acres), this measurement dating from the previous century; a re-calculation from existing maps in 1907 confirmed that figure. In 1963, a further calculation was carried out using a new series of maps which incorporated fresh survey data and the new official area was announced as 26,383 sq. miles (16,885,000 acres).

The State is composed of 49 local government areas (cities and municipalities) and three of these are either islands or groups of islands.

Details of the "island municipalities" are as follows:

Island Municipalities:—	Area (Sq. Miles)
Bruny	139.81
King Island	424.40
Flinders	768.93
Total	1,333.14
Remaining Municipalities and Cities	25,049.86
Grand Total	26,383.00

While the "island municipalities" include the bulk of the lesser islands forming part of the State, some islands are still included in the area of coastal municipalities, e.g. Maria Island in Spring Bay Municipality. Macquarie Island, site of an Antarctic Research Station and situated in 54° South latitude, is a Tasmanian dependency and included in the Esperance Municipality; the island is 21 miles long with an average width of two miles.

Area of Municipalities and Cities

In the table that follows, the measured area of the State (16,884,971 acres or 26,382.76 sq. miles) has been rounded, in total, to the nearest 1,000 acres and to the nearest sq. mile. The corrections necessary to reconcile to the round-

ed totals have been made by adjusting the area of Esperance, the largest municipality. It should be noted that the area given for any coastal municipality does not necessarily represent the area within its proclaimed boundaries; where such boundaries lie in the sea, these have been disregarded so that the stated area relates to a physical boundary (i.e. the coastline) and not to a legal boundary (which may lie in a seaway or estuary).

Area of Statistical Divisions and Local Government Areas

Local Govt. Area and Statistical Division	Area		Local Govt. Area and Statistical Division	Area	
	Acres	Sq. Miles		Acres	Sq. Miles
Hobart (*a*)	19,728	30.83	Bothwell	644,463	1,006.97
Glenorchy (*a*)	29,593	46.24	Campbell Town	354,714	554.24
TOTAL S. CENTRAL DIVISION	49,321	77.07	Hamilton	1,445,459	2,258.53
			Oatlands	380,520	594.56
Launceston (*a*)	6,974	10.90	Ross	306,488	478.89
TOTAL N. CENTRAL DIVISION	6,974	10.90	TOTAL MIDLAND DIV.	3,131,644	4,893.19
Burnie	152,647	238.51	Brighton	108,905	170.16
Circular Head	1,215,094	1,898.58	Clarence	62,075	96.99
Deloraine	720,687	1,126.07	Glamorgan	379,325	592.70
Devonport	28,696	44.84	Green Ponds	102,827	160.67
Kentish	293,436	458.49	Richmond	140,391	219.36
King Island	271,615	424.40	Sorell	193,199	301.87
Latrobe	135,608	211.89	Spring Bay	277,195	433.12
Penguin	106,712	166.74	TOTAL S.E. DIVISION	1,263,917	1,974.87
Ulverstone	126,342	197.41			
Wynyard	200,772	313.71	Bruny	89,476	139.81
TOTAL N.W. DIV.	3,251,609	5,080.64	Esperance (*b*)	1,528,586	2,388.59
			Huon	191,306	298.92
Beaconsfield	157,628	246.29	Kingborough	87,682	137.00
Fingal	674,953	1,054.61	New Norfolk	325,121	508.00
Flinders	492,115	768.93	Port Cygnet	59,385	92.79
George Town	161,614	252.52	Tasman	118,570	185.27
Lilydale	168,987	264.04	TOTAL S. DIV.	2,400,126	3,750.38
Portland	390,783	610.60			
Ringarooma	403,238	630.06	Gormanston	709,627	1,108.80
Scottsdale	319,143	498.66	Queenstown	34,973	54.65
TOTAL N.E. DIV.	2,768,461	4,325.71	Strahan	922,355	1,441.17
			Waratah	669,373	1,045.90
Evandale	244,513	382.05	Zeehan	742,009	1,159.39
Longford	246,506	385.17	TOTAL W. DIV.	3,078,337	4,809.91
St. Leonards	220,202	344.06			
Westbury	223,390	349.05			
TOTAL N. MIDLAND DIVISION	934,611	1,460.33	TOTAL TASMANIA (*c*)	16,885,000	26,383.00

(*a*) Cities.

(*b*) Measured area is 2,388.42 sq. miles (1,528,557 acres).

(*c*) Measured area is 26,382.76 sq. miles (16,884,971 acres).

Area of Tasmania and Other Australian States

The following table compares the area and length of coastline of Tasmania with those of other Australian States and Territories:

Australia: Areas and Coastline of States and Territories

State or Territory	Area	Proportion of Total Area	Coastline	Area per Mile of Coastline
	Sq. Miles	Per Cent	Miles	Sq. Miles
Tasmania	26,383	0.89	(*a*) 900	29
New South Wales ..	309,433	10.43	(*b*) 700	443
Victoria	87,884	2.96	680	129
Queensland	667,000	22.47	3,000	222
South Australia	380,070	12.81	1,540	247
Western Australia ..	975,920	32.88	4,350	224
Northern Territory ..	520,280	17.53	1,040	500
A.C.T.	939	0.03	..	..
Mainland	2,941,526	99.11	11,310	260
Australia	2,967,909	100.00	12,210	243

(*a*) Excludes coastline of islands totalling at least a further 500 miles.

(*b*) Includes coastline of Jervis Bay which is part of Australian Capital Territory.

Islands of Bass Strait

There are in Bass Strait numerous islands, the chief being the Furneaux group (Flinders, Cape Barren and Clarke), King Island and the Hogan, Curtis and Kent groups. These all form part of the State since the boundary line between Tasmanian and Victorian sovereignty is defined as 39° 12′ South latitude; this parallel lies 5 miles south of Wilsons Promontory, so some Tasmanian territory is located only 8 to 10 miles from the Victorian coast (Rodondo and West Moncoeur islands).

The proclamation of 39° 12′ South latitude as the northern boundary of Tasmanian sovereignty dates from 1825 when Van Diemen's Land became a colony distinct from New South Wales. Subsequent State mining legislation has followed the limits of the 1825 proclamation and Tasmania claims mining jurisdiction over Bass Strait as far north as 39° 12′ South latitude. Until recently this claim was only of academic interest but now plans are afoot for oil search companies to extend their operations to off-shore drilling in Bass Strait; if a successful strike is made, then Tasmanian sovereignty, the extent of the continental shelf and the limit of international waters could all become matters of dispute. (In July, 1965, natural gas was obtained by off-shore drilling in Victorian waters off the Gippsland coast.)

CLIMATE OF TASMANIA

Introduction

Since the island lies between 40° and 43½° south of the Equator, and no point is more than 70 miles from the sea, the climate is classified as temperate maritime. There is a small daily temperature range approximating 10°F at the coast and double this inland, thus indicating a slight "continental" effect.

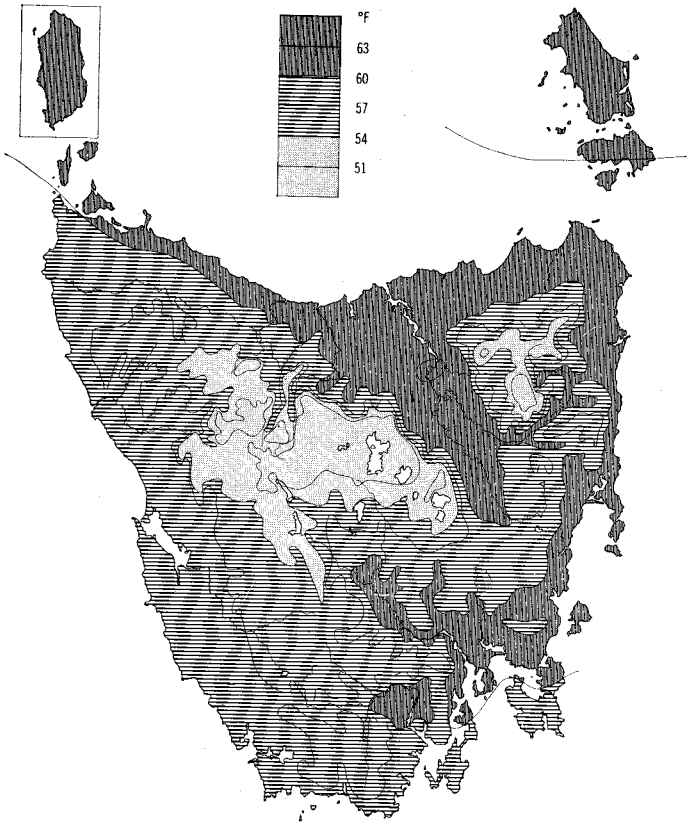
The mountainous topography, especially in the western half, causes an east-west variation which, with the general westerly wind system common to these latitudes, is the predominant feature influencing the climate of the island.

The maximum elevation of the sun is 70°-73° in midsummer and 23°-26° in midwinter. The difference between the longest and shortest days is $5\frac{3}{4}$ hours at the northern and $6\frac{1}{2}$ hours at the southern end of the island, while the period of daylight is never less than nine hours. Heat absorption and storage by the sea produce remarkably mild winters and cool summers in coastal areas.

Temperature

Temperatures at sea level are reduced by 5.4°F for each 1,000 feet of altitude, which partly explains the lower temperatures in the west of the State. Increased cloud cover leads to decreased insolation which further decreases temperatures. Thus, at 2,000 feet, temperatures are everywhere too cold to permit growth of agricultural crops in Tasmania.

Frosts are affected to a marked degree by topography. Valleys act as natural channels for the drainage of cold, dense air at night, and frost pockets



Mean Temperature - January

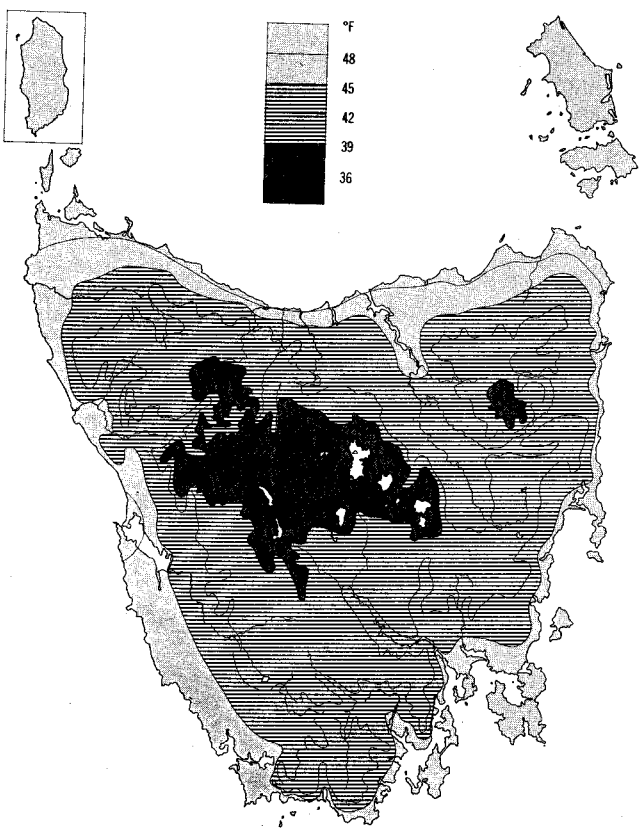
occur on valley floors. Inland centres are only frost-free in summer while the north coast, east and southeast are free after early October. Above 1,000 feet there is no frost-free month.

A further cause of higher mean temperatures in the east is the föhn effect developed. Moist air from the west is cooled as it is forced to ascend over the western and central highlands; moisture is precipitated ("orographic" rain), and the descending air mass is drier and therefore more susceptible to warming. The result is a net warming of the airstream in the eastern lowlands.

In the descriptions of temperature that follow, three averages are used, the basis of all being continuous observation over a 24-hour period yielding two extreme readings; namely a maximum and a minimum. In summarising temperature recordings for a longer period (e.g. a week, a month, &c.), it is usual to employ these averages:

(i) Mean maxima: the average of the daily maxima for the period;
(ii) Mean minima: the average of the daily minima for the period;
(iii) Mean: from formula $\frac{1}{2}$ (maxima + minima) for the period.

To avoid any possible confusion, the following terms have been used, corresponding to the above averages, namely (i) mean maximum temperature, (ii) mean minimum temperature, (iii) mean temperature.



Mean Temperature – July

The recorded extremes of temperature for Hobart are 105°F (on three occasions), and 27.7°F in July, 1895. Such readings are extremely rare, the mean maximum temperature being 69°F in summer and 53°F in winter, and the matching minimum 52°F in summer and 40°F in winter. Thus Hobart can be said to have a cool to mild, even climate, with uncomfortable extremes being the rare exception.

Rainfall

The overall pattern for Tasmania is one of precipitation from a general westerly circulation modified by topography. As the island is located on the northern boundary of the westerly rainfall regime, much of the rain falls in winter, but nevertheless the balance falling outside this period is substantial.

In the dominant west coast mountains, average annual rainfall ranges from 50 to 60 inches on the coast to 146 inches at Lake Margaret; in the north-east, from 30 inches on the coast to 50 inches on the highlands; and the north-west's rainfall ranges from 35 inches near the coast to 70 inches in the higher inland areas.

Extreme three to five-day rainfalls occur in late June on the west coast brought by strong westerlies, but the north coast and the country extending inland to the Western Tiers receive extreme rainfall in mid to late-autumn, when the wind flow is sustained (up to two days) from the north-east.

There is a distinct rainshadow area on the eastern side of the Central Plateau and parts of the Midlands receive 20 inches, and even less in some years. Totals in the east and south-east, and on the Tasman Peninsula, are higher (to 40 inches on the slopes, or even more on rain-attracting peaks), while 70 inches is probable in the uninhabited south. The shadowing effect of mountains reduces amounts in the D'Entrecasteaux area to 30 to 40 inches.

Of note is the sharp gradient in isohyets along the northern and western boundaries of the Central Plateau. This is closely linked with topography.

Rainfall is least reliable in the east, south-east, Midlands and Derwent Valley during late summer and late winter. It is wettest in late autumn and spring. In general, rainfall is least in these parts when the westerlies are strongest (late winter) or relatively absent (summer). The autumn and spring maxima are due to small cyclonic centres of pressure affecting the eastern half of the State.

Effective rainfall, which takes evaporation into account, is that amount required to start germination and maintain plant growth above the wilting point. This obtains from May to October everywhere, but in midsummer there is only one chance in two of effective rainfall being received in the coastal north and lowland areas, and one in three for the drier part of the Derwent Valley and the Midlands.

Floods

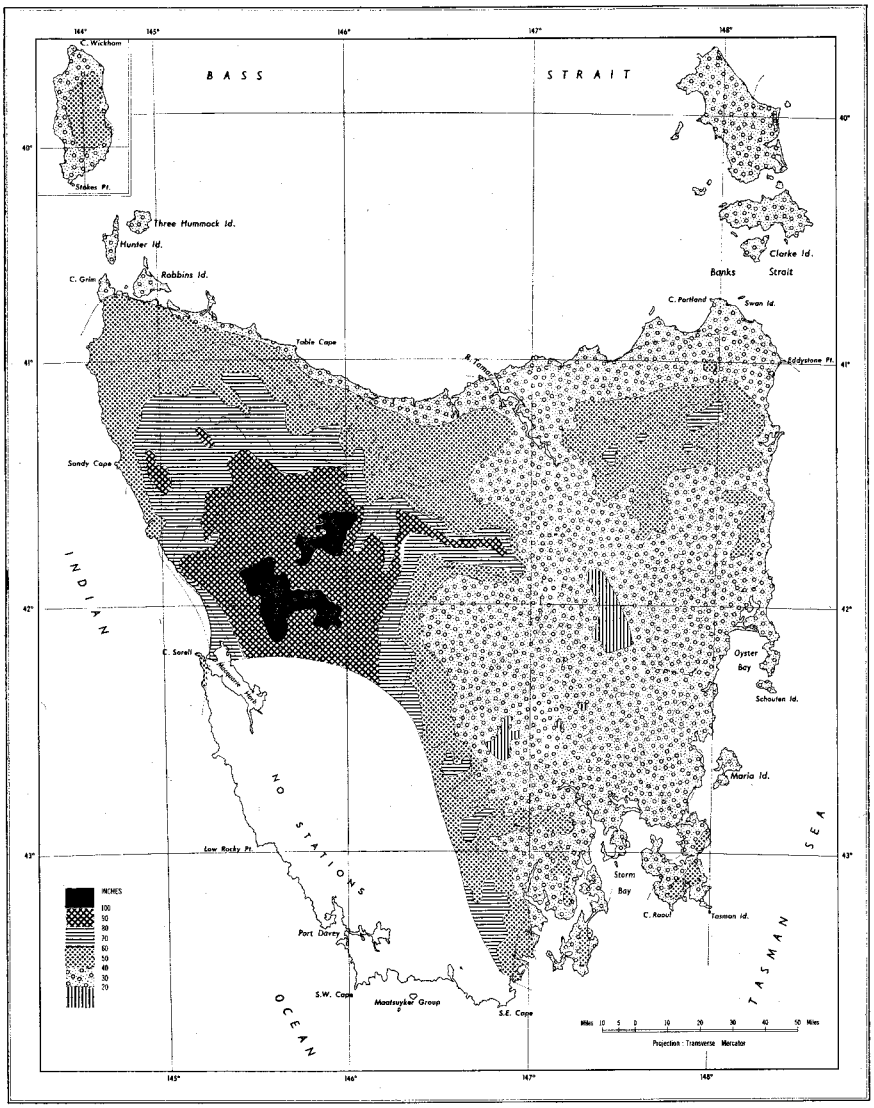
The basin of the South Esk is most likely to be flooded as the catchment area includes most of the north-east highlands, where rainfall exceeds 50 inches. As most of the river flows through flat country, flooding can be widespread.

Flooding of the Derwent can be extensive but is less frequent, while streams in the north-west, because of their smaller catchments, have localised flooding. This also applies to most southern streams, but little is known about flooding in the sparsely populated western mountains.

The most severe floods in the South Esk Basin occurred in April, 1929 and May, 1956, and in the Derwent Valley in April, 1960.

Droughts

These are not so pronounced as in the continental States and are usually confined to a particular region. 1908-1910 was a time of record drought in almost all agricultural areas, resulting in severe crop and stock losses in the east and south-east, and 1914 was even drier. 1945-46 saw severe drought conditions and, in 1951-1954, hydro-electric power had to be rationed; similar measures had to be taken for a short period during 1963-64.



Mean Annual Rainfall

Winds

Tasmania is influenced by windflow veering from north-west to south-west in all seasons of the year, with greatest strength during late winter. The wind circulation in the westerly belt is not regular, and marked variations are imposed on the average seasonal changes.

The first variation in speed is approximately weekly and is connected with the eastward passage of cells of high and low pressure. This cycle disappears when the mean speed of the westerlies decreases, a phenomenon following a broader cycle of several weeks. When the westerlies are weakest, prevailing winds are from the north-east to south-east.

Windspeeds do not become as high as in tropical storms, but gusts to 90 mph occur with the passage of cold fronts or with the formation of small, intense storms. The highest average windspeeds are associated with extensive deep depressions over ocean areas south of Tasmania.

Snow and Hail

(*a*) *Snow*: Extensive snow to low levels (below 500 feet) occurs with outbreaks of air from Antarctica less than once every two years. It is common on all highlands during July and August. There is no permanent snowline, although patches of snow can remain on the highest peaks of the Central Plateau until December.

(*b*) *Hail:* This is possible in any month, but is most likely in spring, causing damage to fruit crops, especially in the Huon Valley and Tasman Peninsula. Hail storms occur about four times per year in Hobart, and occasionally in the north and north-west.

Thunderstorms

These are most common in the north and north-west, and are associated with the lifting of warm, moist air by a cold front. Heating of low-level air during summer also produces storms. Thunderstorms are rare during winter, occurring mainly between December and February.

Humidity

Due to its maritime location, the average 9 a.m. relative humidity at all stations is greater than 50 per cent for all months of the year. In fog, the relative humidity is close to 100 per cent. This condition occurs mainly during winter. In summer, periods of high humidity in combination with high temperatures are rare.

Evaporation

Tasmania's climate precludes extremes of evaporation, and no station exceeds six inches as its highest monthly average (this obtains in the lowlands in January, when the highlands have less than four inches). In July, only a small section of the east coast has evaporation of over one inch.

Over the whole year, most agricultural areas have an average evaporation between 25 inches and 30 inches, which is in many places less than the average rainfall. This has had a podsolization effect on many soils, with consequent reduction of fertility in some areas.

The Climate of Hobart

Since 1882, the Weather Bureau has been situated near Anglesea Barracks. (New premises at Ellerslie Road were occupied in 1966.)

Temperature: Mean maximum temperature exceeds 70°F in January and February, and is lower than 60°F from May to September. There are only two or three days with maxima greater than 90°F yearly, and no two successive days have exceeded 100°F.

Mean minimum temperatures exceed 40°F in all months and readings lower than 30°F are rare on any day.

Frost: The average annual frequency of days of frost is 31, mostly between June and August. None has been recorded in January. Cold air drainage is found in the hilly suburbs, and frosts are common on the valley floors.

Rainfall: Mount Wellington induces a strong relief variation in rainfall. At the pinnacle, annual rainfall is 65 inches, and the Springs and Ferntree have 55 inches and 53 inches respectively. The Hobart Weather Bureau receives 25 inches, but some eastern shore suburbs have only 22 inches.

Monthly totals are fairly evenly distributed but with small peaks in April, October and December. The probability of rain on any day is highest during the afternoon in the spring months.

The wettest 12 months on record yielded 43.4 inches to December, 1916, and the driest, 13.0 inches to November, 1943.

Relative Humidity: Highest humidity is at the time of lowest temperature, in the early mornings during winter. As temperatures rise to 3 p.m., humidity decreases by 15-20 per cent. The seasonal variation is not great, although the average humidity during the winter months is 70 to 75 per cent and during the summer months 58 per cent. Periods of high humidity combined with high temperatures are rare.

Fogs occur about eight times per year, but are usually confined to low areas flanking the Derwent during the cooler months. In fact, Hobart experiences more hours of sunshine than Melbourne due to its relative freedom from fog.

Sunshine and Cloud: No marked seasonal variation of cloud amount occurs, but a strong dependence on time of day is evident. The average coverage is five-eighths to six-eighths. During April to September, cloud cover is greater in the afternoon, and from October to March in the morning.

A clear-cut seasonal variation in monthly average hours of sunshine also occurs, with amounts varying from 229 hours in January to 110 hours in June.

Wind: The main wind direction is west to north-west, induced by the shape of the Derwent Valley; the other is the south-east sea breeze experienced during the summer months.

Strong winds are comparatively frequent from passing storms, especially during winter and spring. The strongest gust recorded was 93 mph, in September, 1965. Strong winds from the south-east may also occur during storms.

Thunderstorms: These occur five or six times per year mainly between December and February.

Snow and Hail: Snow below 1,000 feet occurs less than once per year, but falls lying at sea level have been recorded, the latest being August, 1951. Snow is likely on Mt. Wellington during any winter month, but rarely between October and March. The two television transmitters located on the pinnacle (4,166 feet) are equipped to withstand breaks in road communication caused by snow.

Hailstorms occur four times per year, on average, mainly between September and November.

The Climate of Launceston

Launceston is located on the Tamar Estuary at the confluence of the North Esk and South Esk Rivers. Being 40 miles from the coast, Launceston exhibits a continental effect in its climate, i.e. more extreme seasonal and diurnal variations in temperature, and lower total rainfall than at the coast. Weather observations have been taken from the Pumping Station in Forster Street since 1889.

Temperature: The average maximum temperature exceeds 70°F from December to March, and only during June and July does it fall below 55°F. In January and February the average maximum exceeds 75°F.

The average minimum temperature is 50°-52°F during the summer months, below 45°F from May to October, and below 40°F during the winter months. Temperatures lower than 32°F are common during winter, the lowest recorded being 21°F.

Frost: Up to 50 days of frost can be expected in any year and these are most likely from May to August. Ten consecutive days of frost have been recorded and there have been light frosts during summer.

Rainfall: Monthly totals show a strong seasonal variation with July (3.4 inches) having double that of January, the annual total being 29 inches.

Rainfall is least reliable during summer, and is most likely to be less than one inch in February. Heavy rain is mainly confined to the colder half of the year, the wettest recorded month being August, 1936, with 10.01 inches.

In 1916 and 1946, annual falls of over 40 inches were recorded, and in 1908, 1914 and 1919 less than 20 inches. Highest intensity of rainfall occurs during thunderstorms.

Relative Humidity: Seasonal and diurnal variations are similar to those for Hobart, but the daily readings are five per cent to 10 per cent higher.

Occasions of high humidity, associated with moist north-easterly airstreams, are frequent at Launceston, and fogs may occur 30 or more times annually, mostly between May and August.

Sunshine and Cloud: Only a small seasonal variation in cloud amount occurs, and average coverage varies from six-eighths to seven-eighths in winter to five-eighths to six-eighths in summer. There is a tendency for slightly reduced cloud cover during the afternoons, especially in winter.

The monthly average number of hours of sunshine varies from 300 in January to 120 in June, and there is no interruption to the strong seasonal variation.

Wind: A marked effect on Launceston's wind regime is induced by the Tamar Valley. It is orientated northwest-southeast, and most winds conform to these directions. Speeds are roughly similar to those at Hobart, but an increase of 10 to 15 mph in the north-westerly wind occurs on summer afternoons, due to the sea breeze effect.

Strong winds are most common during the colder half of the year, but can occur at any time in association with thunderstorms.

Snow: Settling of snow does not occur in the city area, but falls on the foothills are not uncommon.

General Summary

Perhaps the most striking feature of the Tasmanian climate is the strong variation from west to east, induced by massive distortions in the physiographic scene. Aspect, altitude and slope determine effectiveness of insolation, frequency of frosts and exposure to winds, which, in turn, affect local temperatures and rainfall. These are closely related to changes in vegetative types and in all land use patterns with the exception of mining.

Mean Monthly Temperatures and Rainfall at Selected Stations

The tables that follow give temperature and rainfall data on a monthly basis for six selected stations—Hobart, Burnie and Swansea, all situated on the coast, Oatlands and Launceston, situated inland, and Zeehan, situated in the west.

Mean Monthly Temperatures (Degrees Fahrenheit) and Rainfall (Inches) at Selected Stations

(For definition of mean temperature, see earlier section under "Temperature")

Hobart (Altitude 177 feet)

Month	Mean Temperature (°F)				Rainfall (Inches)			
	1962	1963	1964	Av. (*a*)	1962	1963	1964	Av. (*a*)
January	62.5	63.9	60.7	61.7	1.36	0.88	0.50	1.67
February	62.5	59.9	58.7	61.3	0.54	1.04	6.72	1.85
March	61.4	59.1	57.5	59.1	1.39	1.13	2.15	2.03
April	55.5	54.5	56.0	54.7	1.65	0.40	1.12	2.46
May	50.4	47.1	51.1	51.1	2.59	1.29	1.94	2.02
June	51.0	45.5	47.1	47.1	2.43	1.11	2.24	2.58
July	47.4	45.6	45.3	46.4	2.29	3.66	2.46	1.85
August	46.5	46.6	48.5	47.9	3.71	1.47	1.94	2.10
September	49.5	50.9	52.1	51.1	3.84	1.62	2.19	2.10
October	51.0	58.3	53.9	53.6	2.95	1.16	1.21	2.82
November	56.7	56.5	56.2	56.6	0.91	1.24	1.83	2.27
December	60.1	60.6	56.1	59.5	1.73	0.51	3.76	2.53
Year	54.5	54.0	53.6	54.2	25.39	15.51	28.06	26.28

(*a*) Averages are based on the 30 year period 1931-1960.

Launceston (Altitude 266 feet)

Month	Mean Temperature (°F)				Rainfall (Inches)			
	1962	1963	1964	Av. (*a*)	1962	1963	1964	Av. (*a*)
January	65.3	64.7	62.2	63.5	1.66	2.56	0.46	1.63
February	62.8	62.1	62.2	63.4	1.20	1.32	5.88	1.95
March	62.7	61.4	58.1	61.0	0.99	1.52	2.91	1.59
April	57.0	53.5	57.2	55.2	1.25	0.15	1.05	2.45
May	50.1	48.1	50.3	50.8	3.34	1.05	2.39	2.86
June	49.7	44.5	46.0	46.3	4.49	0.95	4.93	2.78
July	46.8	45.2	43.0	45.3	1.78	3.68	3.18	3.39
August	46.5	46.2	47.8	47.4	3.30	3.38	2.60	3.14
September	49.5	50.6	50.7	50.7	1.36	4.30	3.50	2.54
October	51.3	57.7	53.3	54.5	4.25	2.47	2.12	2.67
November	57.1	58.6	56.7	58.3	1.40	1.34	1.46	2.19
December	62.8	63.4	56.9	61.7	0.87	1.13	1.66	1.96
Year	55.1	54.7	53.7	54.9	25.89	23.85	32.14	29.15

Zeehan (Altitude 579 feet)

Month	Mean Temperature (°F)				Rainfall (Inches)			
	1962	1963	1964	Av. (*a*)	1962	1963	1964	Av. (*b*)
January	59.1	60.8	52.9	57.6	2.43	2.08	9.18	5.20
February	57.1	57.4	53.8	57.8	6.68	3.98	8.48	4.95
March	57.2	55.3	53.5	56.2	9.47	4.97	6.13	6.00
April	52.5	50.7	53.9	51.9	4.05	2.00	4.55	8.42
May	49.8	45.3	47.5	48.9	9.43	3.07	12.16	9.74
June	48.9	44.3	45.5	45.2	21.78	4.18	8.04	9.93
July	46.0	42.9	44.2	44.6	10.03	9.50	16.05	10.57
August	45.1	45.1	45.9	45.7	11.16	11.58	20.48	11.04
September	48.8	46.7	48.5	48.2	9.53	3.94	11.20	8.67
October	49.5	53.4	49.3	50.4	8.30	3.94	7.17	8.73
November	54.6	50.3	51.7	53.0	7.40	7.95	5.60	7.29
December	57.3	53.1	52.6	56.2	2.53	4.01	11.42	6.22
Year	52.2	50.4	49.9	51.3	102.79	61.20	120.46	96.76

Oatlands (Altitude 1,418 feet)

Month	Mean Temperature (°F)				Rainfall (Inches)			
	1962	1963	1964	Av. (*a*)	1962	1963	1964	Av. (*a*)
January	61.5	60.1	57.7	58.2	0.94	1.69	0.43	1.37
February	59.7	55.6	54.8	58.2	1.19	0.82	6.08	1.86
March	58.1	57.7	52.5	55.5	1.20	1.23	1.37	1.55
April	51.1	51.3	51.6	49.9	1.82	0.49	1.23	2.25
May	46.0	43.1	46.8	46.0	2.76	1.38	1.19	1.96
June	46.3	41.0	42.6	42.4	1.99	0.83	3.40	1.99
July	43.3	40.9	40.8	42.0	2.50	2.07	2.21	1.73
August	41.9	44.3	44.5	41.5	3.06	1.52	1.51	1.86
September	45.3	46.8	46.6	46.2	1.59	1.84	2.03	1.58
October	46.7	53.7	49.2	49.0	2.89	1.25	1.58	2.42
November	52.3	52.6	51.9	52.7	0.81	1.37	1.16	2.18
December	57.2	57.3	51.5	56.0	0.69	0.57	3.22	2.51
Year	50.8	50.4	49.2	49.8	21.44	15.06	25.41	23.26

(*a*) Averages are based on the 30 year period 1931-60.
(*b*) Average is based on 29 year period.

Burnie (Altitude 24 feet)

Month	Mean Temperature (°F)				Rainfall (Inches)			
	1962	1963	1964	Av. (*a*)	1962	1963	1964	Av. (*a*)
January	(*b*)	62.1	59.2	60.4	(*b*)	2.81	1.04	1.57
February	62.1	60.3	60.7	60.9	2.28	1.41	5.59	2.00
March	61.9	59.6	57.5	59.2	3.71	2.05	3.46	2.17
April	55.3	55.0	57.7	55.2	0.46	0.24	2.65	3.15
May	52.8	51.1	51.7	51.9	4.54	0.71	4.40	3.75
June	50.7	49.1	48.4	49.4	5.99	2.33	6.93	4.55
July	49.7	47.9	47.0	47:9	2.33	11.57	7.12	5.14
August	48.5	48.8	48.8	48.3	4.67	5.45	4.52	4.64
September	50.1	50.7	49.9	49.8	2.30	5.69	6.62	3.26
October	51.3	55.8	52.1	52.5	4.09	2.67	3.06	3.71
November	55.7	55.7	55.6	55.1	3.29	1.72	2.26	2.91
December	(*b*)	59.7	54.3	58.1	0.45	2.05	1.72	2.44
Year	(*b*)	54.6	53.6	54.1	(*b*)	38.70	49.37	39.29

(*a*) Averages are based on the 30 year period 1931-1960.

(*b*) No record.

Swansea (Altitude 25 feet)

Month	Mean Temperature (°F)				Rainfall (Inches)			
	1962	1963	1964	Av. (*a*)	1962	1963	1964	Av. (*a*)
January	61.7	63.7	60.4	61.5	2.98	2.37	0.41	1.65
February	62.2	60.9	58.1	61.8	0.81	1.88	7.33	2.15
March	62.3	58.6	55.5	59.7	0.67	1.20	2.04	2.25
April	55.9	54.3	54.8	55.3	1.06	0.12	1.68	2.28
May	50.5	47.8	49.6	51.5	1.66	2.39	0.97	2.06
June	51.5	46.3	48.2	47.9	0.82	0.65	2.71	2.36
July	48.3	47.0	46.2	46.9	3.53	3.30	1.00	1.71
August	47.5	45.8	49.2	48.3	3.20	0.96	1.05	1.70
September	50.4	50.5	51.4	50.7	0.95	1.10	1.33	1.64
October	51.7	55.4	51.5	53.6	2.08	2.18	2.23	2.33
November	54.7	55.3	53.4	56.7	0.92	1.71	1.09	2.20
December	56.9	59.5	55.6	59.3	1.00	1.10	4.11	2.58
Year	54.5	53.8	52.8	54.4	19.68	18.96	25.95	24.91

(*a*) Averages are based on the 30 year period 1931-1960.

It is realised that mean temperatures alone can give a misleading picture. The following table shows the mean maximum and mean minimum temperatures for four months in 1964, and indicates the actual departure from the normal, in Hobart, Launceston, Zeehan, Devonport, Oatlands and St. Helens. (Devonport is located on the north-west coast, St. Helens on the east coast.)

Temperatures (*a*) from Selected Stations, 1964

Station	Maximum Temperatures		Minimum Temperatures		Mean Temperatures	
	Mean for Month (*b*)	Departure from Normal	Mean for Month (*c*)	Departure from Normal	Mean for Month	Departure from Normal
JANUARY						
Hobart	69.5	—1.0	51.5	−1.3	60.5	−1.1
Launceston ..	73.8	−1.7	50.6	−0.9	62.2	−1.3
Zeehan	58.9	−8.3	46.9	−1.0	52.9	−4.7
Devonport ..	68.0	−2.3	51.0	−0.5	59.5	−1.4
Oatlands	68.3	−1.6	47.0	+0.5	57.7	−0.5
St. Helens	73.5	−1.4	50.2	−1.3	61.9	−1.3
APRIL						
Hobart	62.0	0.0	50.0	+2.6	56.0	+1.3
Launceston ..	66.4	+1.2	48.0	+2.9	57.2	+2.1
Zeehan	60.8	+1.2	47.0	+2.8	53.9	+2.0
Devonport ..	62.6	−0.9	48.5	+1.4	55.5	+0.2
Oatlands	58.9	0.0	44.3	+3.4	51.6	+1.7
St. Helens	64.5	+0.2	48.8	+3.4	56.6	+1.7
JULY						
Hobart	51.2	−1.5	39.4	−0.7	45.3	−1.1
Launceston ..	51.9	−1.7	34.1	−2.9	43.0	−2.3
Zeehan	49.3	−1.8	39.2	+1.2	44.2	−0.4
Devonport ..	53.0	−1.1	39.6	+1.0	46.3	−0.1
Oatlands	47.0	−1.5	34.7	+0.3	40.8	−0.7
St. Helens	55.1	−0.4	36.3	−0.8	45.7	−0.6
OCTOBER						
Hobart	61.2	−0.4	46.6	+1.0	53.9	+0.3
Launceston ..	62.6	−2.0	43.9	−0.4	53.3	−1.2
Zeehan	57.9	−0.4	40.8	−1.7	49.3	−1.1
Devonport ..	59.1	−1.2	44.8	+0.6	51.9	−0.4
Oatlands	57.6	−0.7	40.8	+1.2	49.2	+0.2
St. Helens	62.2	−0.7	44.5	+0.7	53.3	0.0

(*a*) Temperatures in degrees Fahrenheit. (*b*) Average of maximum daily temperatures for month. (*c*) Average of minimum daily temperatures for month.

Meteorologically, Tasmania is divided into nine districts, with fairly well defined land use patterns appropriate to each. The following table shows rainfall totals for the past 10 years, and 30 year averages, for each of these districts.

Rainfall of Tasmania in Districts (inches)

Period	Agriculture, Dairying and Mixed Farming		Grazing (Mainly Sheep)		Fruit Growing, Grazing, Forestry		Dairy Farming	Mining	Grazing
	Northern	King Island	Central Plateau	Midlands	Derwent Valley	South East	East Coast	West Coast	Flinders Island
1955 ..	52.85	41.83	49.59	23.37	26.00	28.03	33.44	96.84	31.88
1956 ..	56.42	49.07	64.92	32.01	36.35	41.91	51.47	111.77	40.32
1957 ..	33.67	37.94	40.49	20.81	24.87	30.60	26.89	96.08	18.14
1958 ..	43.28	40.55	55.66	27.32	41.18	42.30	37.88	108.31	33.97
1959 ..	29.51	27.53	38.27	17.46	20.69	22.85	30.41	80.51	26.29
1960 ..	41.50	46.37	55.15	26.00	27.55	32.05	37.90	91.79	30.23
1961 ..	29.91	34.55	33.83	15.38	18.61	21.67	28.17	76.69	30.46
1962 ..	37.60	35.48	47.17	20.07	29.93	30.12	29.96	105.99	37.07
1963 ..	33.65	30.79	30.74	14.94	17.94	19.69	24.40	73.26	26.99
1964 ..	50.44	45.49	57.47	26.56	30.98	32.05	36.65	115.97	37.45
District Average (*a*)	38.80	36.96	50.63	22.64	27.94	29.24	32.91	97.92	29.95

(*a*) Annual averages based on period 1931-1960.

(*The Section on Climate was written from data made available by the Bureau of Meteorology.*)

GEOLOGY OF TASMANIA

Time Scale

In the section that follows, the geology of Tasmania is described with frequent reference to geological periods; accordingly a time scale is shown to define the succession of these periods:

Time Scale of Geological Periods and Eras (*a*)

Time in Millions of Years		Period	Era
Range	Deviation Possible		
0– 1	..	Quaternary (*b*)	Cainozoic
1– 11	..	Pliocene (*c*)	
11– 25	..	Miocene (*c*)	
25– 40	..	Oligocene (*c*)	
40– 60	..	Eocene (*c*)	
60– 70	..	Paleocene (*c*)	
70–135	± 5	Cretaceous	Mesozoic
135–180	± 5	Jurassic	
180–225	± 5	Triassic	
225–270	± 5	Permian	Palaeozoic
270–350	±10	Carboniferous	
350–400	±10	Devonian	
400–440	±10	Silurian	
440–500	±15	Ordovician	
500–600	±20	Cambrian	
Pre 600	..	Pre Cambrian	..

(*a*) Source: Principles of Physical Geology, Arthur Holmes, 1965.

(*b*) *Holocene*, from now back to approximately 11,000 years ago; *Pleistocene* from 11,000 years to one million years ago.

(*c*) *Tertiary* period, from *Paleocene* to *Pliocene* inclusive.

The following account commences with rocks and formations of Precambrian origin and finishes in our own period, i.e. *Holocene:*

Precambrian System

The oldest rocks occur mainly in the western half of the State and occupy approximately one fifth the area of the island. They are of the Precambrian era and are divided into two groups. One division consists of those rocks which have been penetratingly deformed. Such deformation has been accompanied by a regional metamorphism converting the pre-existing rock-types to horizons of deformed conglomerate, quartzite, schistose quartzite and phyllite interlayered with mica, garnet, and albite schist with amphibolite. The other division, which at localities where both are adjacent is the upper and probably the younger, consists predominantly of comparatively unmetamorphosed sequences of interbedded quartz-rich sandstone, siltstone and mudstone. In the unmetamorphosed Precambrian rocks near Burnie occur intrusions of dolerite which have been dated at 700m. years old.

At some localities, for example to the east of Rocky Cape, the presence of large-scale current bedding and good sorting in the unmetamorphosed sandstone suggest a well-worked, shallow-water environment of deposition. In other areas, such as Burnie, the monotonous repetition of thin, poorly sorted but graded sandstone layers, with well-developed sole markings and small-scale current bedding, is typical of sediment dumped by turbidity currents where normally mud accumulated.

The most spectacular large contortions in the Precambrian are the recumbent folds of many miles extent encountered in the unmetamorphosed sequences of the north-west sea coast. However, in the rocks of the metamorphosed assemblages, even the microscopic features have been determined by complicated deformations.

Successions including volcanic rocks at Corinna, tillite at King Island and dolomite at Smithton, Jane River, Savage River, Tim Shea and Hastings, are possibly Precambrian. The thicker dolomite accumulations may be of the same age and perhaps represent the youngest Precambrian deposit. Economically important mineral deposits, such as tin at Renison Bell and Mt. Bischoff, are associated with dolomite and adjacent quartz sandstone, which accumulated in a comparatively stable, well-worked shallow water area. These deposits reflect a marked contrast in depositional environment to the younger Cambrian rocks.

Cambrian System

Fossiliferous Cambrian rocks, which have yielded trilobites of some 550m. years age, are of turbidite sequences thousands of feet thick, and comprise the Dundas Group. These sedimentary rocks are indicative of unstable deepening basins of deposition. Vulcanism occurred a number of times during the period. Cambrian rocks occupy a meridional belt from Elliot Bay on the south-west coast, through Rosebery to Waratah; smaller meridional belts from near Smithton on the far north-west coast to some 20 miles inland; and from Ulverstone on the north coast to Gunns Plain some 30 miles to the south.

In the north Pieman region in western Tasmania, there occurs a substantial unit of some 8,000 feet of volcanic rocks—Mt. Read Volcanics—which are of keratophyre, quartz porphyry and quartz feldspar porphyry associated with massive or schistose pyroclastic rocks, tuffaceous slate and ash beds. It appears likely that it may in part be Lower Cambrian and in part equivalent to Middle

Cambrian in age. The Mt. Read Volcanics at Lyell, near Queenstown, have been an important host to copper mineralisation, and substantial lead-zinc-copper ore deposits occur within it at Hercules and Rosebery.

Cambrian igneous activity is believed to include granite emplacement at Mt. Darwin and in the Murchison Gorge. Basic and ultrabasic rocks, which range in composition from quartz-mica gabbro to dunites, occur as slightly transgressive sills and rare dykes in Cambrian and Precambrian rocks. An interesting occurrence of serpentinite near Adamsfield is overlain by conglomerate, sandstone and siltstone composed of serpentinite detritus with placer deposits of chromite and osmiridium.

Ordovician System

Ordovician rocks 440-500m. years old may attain a maximum thickness of 7,500 feet, and are well represented on the sites of the Cambrian meridional belts along the West Coast Range, and in the Dial Range in the Ulverstone area from where it extends south. Ordovician successions are unknown in the far north-west, but part of the Mathinna Beds of the north-east may be of this age.

Beds of the Ordovician System usually rest on the Cambrian unconformably, although conformable relationships have been reported. Reconstruction of the land surface during the accumulation of the basal Ordovician deposits along the West Coast Range, indicates that the eastern margin of the earlier Cambrian trough continued to rise with steep tilting of the Cambrian rocks, giving rise to changes of slope adequate for the rapid accumulation of wedge-shaped fanglomerates. Following these basal fanglomerates at some places disconformably, and at other localities conformably, is a unit of up to 2,400 feet thick known as the Owen Conglomerate. The Owen Conglomerate consists of siliceous conglomerate which gathered as continental alluvial fans against a Precambrian highland to the east. However, marine beds within the top part of the unit indicate the encroachment of the sea into the area. Flanking the West Coast Range is the fossiliferous Gordon Limestone which was formed in shallow, warm seas. The widespread occurrence of the limestone, which is younger than the Owen Conglomerate, indicates that the seas at this time were at their most extensive. The geological history of the Ordovician rocks in the Devonport area is similar to that of the West Coast Range. The Gordon Limestone, which ranges in age into the Upper Ordovician, is followed conformably by Silurian rocks.

Silurian—Devonian System

In central and western Tasmania, the Silurian and Devonian rocks constitute the Eldon Group ranging in age between 375 and 440m. years. The group shows a distribution closely associated with Ordovician occurrences. Some 5,000 feet of sandstone and mudstone accumulated in the Zeehan area whereas 12,000 feet were deposited near Queenstown. In general, the coarser sedimentary rocks of the Eldon Group appear to have accumulated in a well-worked shelf area in shallow seas, whereas the finer beds collected in quieter waters and perhaps reflect relative changes in sea levels and elevations of the land of the source area.

Underlying extensive areas in north-east Tasmania are the Mathinna Beds which contain marine fossils and are regarded as probably of Silurian-Devonian age. Two types of sequence have been noted—one originally of mudstone as at Bangor where slate has been quarried, and the other of interbedded mudstone and thin turbidite sandstone layers varying considerably

in composition. The former sequences are believed to be the older and are of material normal to the basin of deposition, whereas, during the accumulation of the younger successions, the settling of mud was frequently interrupted by turbidity currents depositing sands.

No rocks have been identified with certainty as belonging to the Silurian period in the Devonport area, but quarrying at Eugenana has exposed important terrestrial cavern fillings in Gordon Limestone which, from a study of their spore content, have been referred to the Middle Devonian. The importance of this deposit is in the fact that the beds show no tectonic disturbance, although the caverns occur in folded Gordon Limestone and blocks of distorted enclosing rock occur within the deposits. It is therefore evident that there was a notable deformation of the rocks before Middle Devonian times. This period of deformation, which was very widespread, is known as the Tabberabberan Orogeny.

Tabberabberan folds of regional scale form an arc from Queenstown in western Tasmania, where they trend north to south, to the Sheffield area where they are directed east to west approximately parallel to the north coast. Locally, these broad structures are obscured by other fold and fault trends. In north-east Tasmania, the Tabberabberan Orogeny is represented by NNW trending folds.

Granite Emplacement and Associated Ore Deposits

Apart from a number of minor basic dykes, many granitic masses were emplaced in the rocks after the Tabberabberan Orogeny. The commonest is a coarse grey granodiorite, which forms the largest mass in the State at Blue Tier in north-east Tasmania, whereas red potassic granite, as at Coles Bay in eastern Tasmania and Mt. Heemskirk in western Tasmania, is the least common.

In general, with the exception of the granites of Mounts Darwin and Murchison, the granites of Tasmania appear to be Upper Devonian-Lower Carboniferous in age; that is, very approximately 350m. years old. They are characterised by cross-cutting relationships with the country rock, fairly sharp margins and narrow metamorphic aureoles, although extensive mineralisation is associated with their emplacement. At King Island, introduction of material into the metamorphic aureole of a granodiorite body has resulted in scheelite occurrences within originally impure limestone and mudstone of possibly Precambrian age. Cassiterite-wolframite vein systems are associated with granite intrusions at the Aberfoyle and Storys Creek district in north-east Tasmania. Tin-bearing sulphide bodies occur in association at Mt. Bischoff, Renison Bell and Mt. Cleveland in western Tasmania, while galena-sphalerite lodes in the Zeehan and Dundas areas of western Tasmania and in the Round Mount area near Sheffield appear to be related to granite intrusions. Cassiterite occurs within the granite at Blue Tier. The gold-quartz reefs occurring in the Palaeozoic rocks at Beaconsfield, Lefroy and Mathinna in north-east Tasmania are not obviously related to the granite occurrences.

Permian System

Prolonged erosion of the rocks followed the emplacement of the granites and continued until late Carboniferous or early Permian times. During the Permian, there was extensive glaciation of the area and many thousands of feet of deposits accumulated, with a marked unconformity between them and the underlying distorted older rocks. The Permian beds consist of fresh-water sequences separated by marine deposits.

Permian times opened about 270m. years ago with an ice centre in western or north-western Tasmania where tillite accumulated. Studies of types of erratics, and of the striae on glaciated surfaces, demonstrate that the tillite material originated from the ice erosion of these areas. Although basal tillite is absent from north-eastern and eastern Tasmania, basal units include fragments derived from western Tasmania. Basal Permian beds are followed by the Quamby Mudstone in which the distribution of coarser layers shows that north-eastern Tasmania was land, and many islands, particularly around Cradle Mountain, existed in a quiet basin of deposition which was fed by material from eastern and south-eastern Tasmania, as indicated by the existence of shore line deposits at Maria Island. Quiet deposition was occasionally disturbed by turbidity currents which deposited the sandstone layers within this dominantly mudstone sequence. The calcareous Golden Valley Group follows and shows a regional decrease in grain size to the WNW demonstrating an easterly source for these clastic deposits where the seas became shallower. Turbidite incursions occur and are represented by pebbly layers. Marine conditions, indicated by the fossils recovered, persisted throughout the Lower Permian but gave way to a dominantly fresh water environment during the formation of the Mersey Coal Measures.

The Mersey Coal Measures covered both earlier Permian highland areas and the sea-floor. Apart from thick accumulations near Avoca, Elephant's Pass, Wyld's Craig and near Hobart, there is a regional decrease in thickness to the west, south and east from Devonport. The fresh-water environment, indicated by common plant fragments, appears to have been a wide sandy coastal plain with some river channels, lakes and swamps in which collected material resulting in deposits of coal, as at Preolenna, Barn Bluff, Mount Pelion and Latrobe, and coaly layers at Barn Bluff, Preolenna, Nook and near Lilydale. Fossil occurrences show that marine incursions occurred from time to time at Hobart, Wyld's Craig, Oyster Cove and Maria Island.

The following marine calcareous sequences, which comprise the Cascades Group, are more widespread than any of the older Permian rocks for they extend almost to the north-eastern part of the island. In this succession, quartz sand and erratics, dropped from floating icebergs, become more prominent in western and north-western Tasmania whereas, to the south and east of Hobart, limestone passes into the Grange Mudstone. Silt accumulation of the Malbina Formation followed the Cascades Group in the Hobart area on a relatively deep sea floor. Pebbles of western derivation were dropped from icebergs contaminating the silt deposits, and occasional turbidity currents from probably a northern direction deposited sands. The Malbina Formation was succeeded by the deposition of a thick marine mudstone sequence, the Ferntree Mudstone.

Permian marine conditions once more gave way to a fresh-water environment during the formation of the Cygnet Coal Measures. Sandy plains extended across much of Tasmania except in the north-east and far north-west during these times. Lakes and swamps with peat formations occurred in the north-western and south-eastern parts. Although the Cygnet Coal Measures are widely distributed, they are discontinuous, due to erosion prior to the deposition of the younger Triassic deposits.

Triassic System

Up to 2,000 feet of rocks represent the fresh-water lake and river sedimentary deposits of Triassic times (from 180 to 225m. years ago). East of a line between Ida Bay in southern Tasmania and Poatina in the Western Tiers, a disconformity occurs between rocks of the Permian and Triassic Systems. The

discordance may be represented by either Permian boulders occurring in the basal Triassic conglomerate, or by differences in dips of the beds. To the west of the Ida Bay-Poatina line, there is a transition, representing continuous deposition, between concordant Permian and Triassic deposits, and similar conglomerate horizons occur within the sequences of both systems.

Commonly the base of the Triassic sequences is represented by up to 50 feet of granule conglomerate and quartzose sandstone, with usually an argillaceous cement. Large-scale current bedding, indicative of a shallow water environment of deposition, shows in many cases a supply of material in the west and north-west. The lower 200 to 1,350 feet of Triassic successions are dominated by well-sorted, medium-grained quartzose sandstone, which is usually clean in that it has but little cement. The lower sandstone sequences contain lenticular beds of conglomerate, some of rounded quartzite pebbles and others of clay pellets, mudstone bands, carbonaceous lenses and mica-rich layers. Shallow-water sedimentary structures are common, and include large-scale current bedding and mud-cracks.

The upper part of Triassic sequences is often represented by some 60-600 feet of clean sandstone consisting of rock fragments, including those of volcanic origin, as well as of quartz, feldspar and mica. Often thick shale and coal horizons are associated with the sandstone sequences, and it is evident that deposition of transported carbonaceous and inorganic material in a number of small lakes, which varied their position, resulted in the formation of lenticular coal seams of very variable thickness. The thickest recorded coal seam is 18 feet and as many as eight seams occur in some districts. The coal is of economic interest and has been mined in such areas as Avoca-Fingal-St. Marys and Hamilton.

Abundant plant remains have been recorded from Triassic rocks, and vertebrates, including reptiles, insects and some brachiopods have also been noted. Studies of megaspores have shown that deposits at St. Marys are of the uppermost Triassic and that passage deposits of Lower Jurassic times exist.

Dolerite and Syenite Intrusion

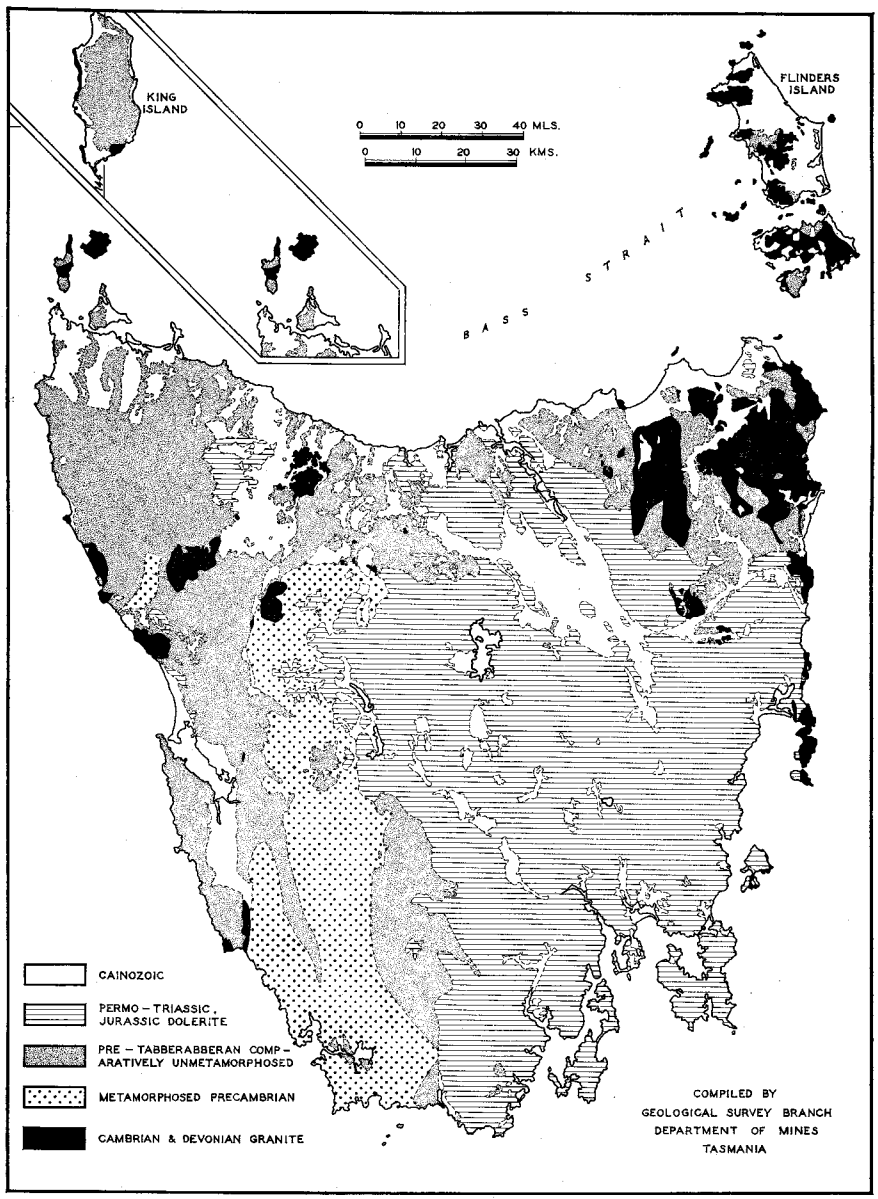
A thick mass of dolerite which has intruded Triassic and older rocks, underlies the Central Plateau and caps most of the highest mountains in Tasmania. The dolerite mass is of gently inclined interconnected sheets of about 1,500 feet thickness but near-vertical dykes are found. A study of the fine-grained chilled dolerite margins of a number of sheets indicates that the original undifferentiated magma was uniform. The period of igneous activity has been dated at 165m. years, which is of the Middle Jurassic period. Away from the contacts, the dolerite is usually medium-grained, but coarse pegmatitic segregations are found within several hundred feet of the upper margins of the intrusions. Associated with these basic igneous rocks are acid differentiates which have abundant quartz and potassic feldspar, such as the granophyre at Red Hill near Snug in southern Tasmania, and in the Great Lake sheet.

The form of the dolerite occurrences suggests a number of coalescing shallow cone sheets which appear as inclinations dipping at about 40° below the Permian rocks, whereas, in the Permian, dips are at 25° or less, and are as little as 10° within the Triassic. The cones centre on a number of points.

Syenite stocks and related dykes intrude the Jurassic dolerite and Permian sedimentary rocks near Port Cygnet, and they have been dated as 100m. years old, which is of the Middle Cretaceous period.

Tertiary System

Towards the end of the Mesozoic Era some 70m. years ago, Tasmania was a part of the Australian continent and had a low relief. Tertiary times began when marsupial animals and flowering plants appeared, and block faulting gave Tasmania its present day shape. The faulting caused troughs of a trend commonly between North West and North in which are preserved thick sequences of non-marine Cainozoic rocks. Fault activity has continued and historical evidence predicates present-day movements.



The separation of Tasmania from the Australian Mainland is believed to have been completed between 25 to 40 m. years ago, since isolated occurrences of marine limestone of that age occur near the coast in north-western Tasmania between Granville Harbour and Wynyard, on King Island and in the Furneaux Group.

Thick non-marine Cainozoic sequences have been preserved in a number of troughs, and dating has depended on palynological evidence, for although plant remains are common and varied, animal remains are rare. In the Launceston area some 900 feet of clay, sand and gravel with bands of lignite accumulated, and the earliest deposit appears to be between 40 to 70m. years old. The trough is believed to have been filled over a long period of time under predominantly shallow water conditions since large-scale current-bedding and other shallow water features occur. In the Derwent trough, hundreds of feet of mudstone, sandstone and coarser rocks comprise the sequence, and palynological evidence suggests the deposits are younger than 40m. years. Some of the sedimentary rocks overlie basalt. In the Macquarie Harbour trough, over 700 feet of clay, lignite, silt and unconsolidated sand and conglomerate have been reported. Two carbonaceous horizons occur containing plant remains, suggesting an age, from 1 to 11m. years old.

Basalt is extensive, particularly in north-western Tasmania, and Tertiary clay, silt, sand and gravel are often preserved beneath it. These sub-basalt sediments, together with the river deposits of more recent times, may contain gold and tin minerals of economic interest as in north-eastern Tasmania. The basalt outpourings have been related to some 30 volcanic centres, and most examples exhibit rugged topography diverting and displacing river systems. Of interest is the occurrence of inter-basalt fossil forests in the Macquarie Plains-Glenora area.

Erosion Surfaces and the Quaternary System

There are a number of major erosion surfaces. The youngest, which is at 300-900 feet above sea level, cuts rocks some 20m. years old but is overlain in places by deposits probably not much older than 25,000 years. The oldest surface at some 3,900-4,400 feet is possibly Cretaceous in age. Tabular land forms dependent on erosion-resistant rocks resulted from the block faulting of subhorizontal Jurassic dolerite and Permo-Triassic rocks, that are drained along rectangular patterns, which have been determined by joint and fault lines.

During Pleistocene times, the regional snowline now absent even above 5,000 feet, lay between 3,000 and 4,000 feet rising from west to east. Plateau glaciers occurred at the north-western section of the Central Plateau, the West Coast Range between Drys Bluff and Great Lake, between Great Lake and Bradys Lookout, Ben Lomond, and on the King William Range. At the head of the Linda Valley, wood found in glacial varves has given a radio carbon date of 26,480 $\pm$ 800 years. Elsewhere in the State, glacial ice was formed in cirques rather than on plateau surfaces, and the most spectacular of the cirque-cut mountains are Frenchman's Cap, Mt. Anne, Mt. La Perouse, Federation Peak and the Frankland and Arthur Ranges, where horn peaks, aretes and glacial troughs occur.

Down to 2,000 feet, soils and land forms in Tasmania are related to periglacial and glacial processes of Pleistocene times. However, periglacial features are still active and result from semi-perennial snow accumulations, which are usually above 3,800 feet.

Streams too small for the valleys which contain them are common, especially in south-eastern Tasmania. The large valleys probably resulted from the great volumes of water carried during Pleistocene times.

The present-day coastal platform is made up of a number of levels reflecting older sea levels. However, post-glacial seas appear to have reached a level about only two to six feet higher than the present sea.

Mining in Tasmania

A history of Tasmanian mining and a description of present mine output is contained in Chapter 7, "Primary Industries—Non-rural".

(The geological section was written by Emyr Williams, B.Sc., Ph.D., F.G.S.)

THE FAUNA OF TASMANIA

Historical—Study of Tasmanian Fauna

Introduction: Apart from certain of the more conspicuous groups, the fauna of Tasmania is comparatively little known. The groups of animals which are large, easy to observe and those which impinge upon human activities are fairly well understood from the taxonomic standpoint, but much remains to be done in the ecological field in relation to these species.

The invertebrates have been little studied and much remains to be done in groups such as the earthworms, while the nematodes are almost unknown. Some of the groups which have been investigated in the past are badly in need of taxonomic revision in relation to modern developments in this discipline.

Perhaps one of the reasons for this ignorance of our fauna lies in the fact that there have been no large collecting expeditions operating in Tasmania, and much of the descriptive taxonomic work has been the result of either sporadic short expeditions or the long-time plodding of individuals.

Early Expeditions: Many of the early expeditions to Australia visited Tasmania, e.g. Furneaux (1773), Cook (1777) and D'Entrecasteaux (1792 and 1793). All of these made collections of varying importance but the material collected was either marine in origin or else coastal in nature. It is unfortunate that many of the taxonomic types of these early expeditions have been lost or mislaid. The early zoological investigations were largely undertaken by the French when Baudin, with Peron and Maugé, followed the D'Entrecasteaux expedition in 1802. Darwin visited Hobart in 1837 and, incidentally, was not impressed with Mt. Wellington. The French followed again in 1827 and 1839 when d'Urville called here, and this latter navigator started the great stream of Antarctic expeditions which have used Tasmania as a jumping-off point and as a place to test their gear. The results of their efforts on our coasts were incorporated in the reports of the various expeditions.

The greatest of the marine expeditions, that of the *Challenger*, dredged in the waters of Bass Strait and this expedition, together with the several Antarctic expeditions, furnished the basis for much of our knowledge of the Tasmanian marine fauna.

Royal Society: A strong stimulus to zoology was given by the very early formation of the Royal Society of Tasmania, which has published a journal continuously since 1849 and, through this medium, has communicated the work of local scientists to other workers. The regular meetings of the Society gave the added stimulus of discussion and criticism of work. Indeed the Royal

Society of Tasmania gave even further impetus to science as a whole by opening a Museum in 1844 (which ultimately became the Tasmanian Museum), and one cannot praise too highly the impact that this young Society had upon the community.

Zoologists in Tasmania: The visits of private individuals all brought much of value to our knowledge of the zoology of Tasmania and perhaps the most noteworthy of the early visitors was John Gould who utilised his stay to collect information about the birds and mammals of Tasmania, and to produce monumental and artistically beautiful books on these animals.

The development of the colony from 1850 saw the appearance of a number of local workers, some amateur, whose tradition is still continued today. Johnston, Morton, Petterd, May, Scott (father and son), Lord, Littler, Sharland, Nicholls (father and son), Couchman, Flynn, V. V. Hickman, Pearson, Evans, all have contributed to our knowledge of the groups in which they found their interest.

The full development of these efforts resulted in the publication of reference works: Lord & Scott (1924) on vertebrates; Littler (1910) and Sharland (1945) on birds; May on Mollusca (1921, 1923 and 1958). In addition to these, both the Tasmanian Museum and the younger Queen Victoria Museum in Launceston are publishing handbooks on certain special groups, e.g. Davies (Whales and Seals), Guiler (Marsupials).

Throughout this century, naturalist organisations have played their own valuable part in the collection and identification of material and the Tasmanian Field Naturalists Club has conducted field camps since 1909.

Conclusion: The above review does not claim to be comprehensive but paints a picture of early expedition interests being replaced about 1850 by a strong local activity which continued into the present century, but has now shown a tendency to be channelled into laboratory studies of our fauna.

It is ironic that more is known of many of our introduced species since these, especially the vertebrates, have impinged upon human activities as pests and this necessitated a study of them so that controls could be applied.

Thus, the initial stimulus to Tasmanian zoology came from the early scientific exploring expeditions while the Antarctic expeditions of the late nineteenth and early twentieth century reinforced this stimulus. In the intermediate period, the local scientists, gaining strength from the establishment of the Royal Society of Tasmania with its journal and library, founded much of our present knowledge.

Freshwater Zoology

The zoology of freshwater is still based upon Smith's *Naturalist in Tasmania* (1909) together with more recent work by Nicholls on the Crustacea, Clark on the freshwater yabbies, Powell on the plankton of Lake St. Clair, and Nicholls, the younger, on the freshwater environment and fisheries of the State.

Mountain Shrimp: Nicholls' work upon the distribution of the ancient form *Anaspides tasmaniae*, the mountain shrimp, showed that this animal lived in mountain streams and tarns on the central massif of Tasmania but was absent from the Ben Lomond area of the north-east. Since this latter region is very similar in geological formation and in its climate to the central Highlands, we must look to other sources for the explanation. In fact, beyond the efforts of Nicholls, little has been done to investigate the ecological background of

Anaspides using modern techniques. In recent years, a giant form of *Anaspides*, specifically indistinguishable from *tasmaniae*, has been found in a lake near the upper reaches of the Huon River.

Anaspides is a representative of the order Syncarida, a primitive group of crustacean. Two other syncarids occur in Tasmania, namely *Paranaspides lacustris* and *Micraspides calmani*. *Paranaspides* is smaller than *Anaspides* and is found in the Great Lake and associated waterways, while *Micraspides* is the smallest of the group and is found in bogs on the west coast.

A most interesting group of crustacea which is common in many places is the *Phreatoicoidea*. These belong to the order Isopdoa but have the external shape of an amphipod. Over twenty species have been recorded in areas ranging from mountain tops to sea level.

Yabby: The large yabby, *Astacopsis gouldi*, occurs only in the northern streams and may reach a weight of 9 lbs. and measure 16 inches in length. Specimens of this size are rarely caught nowadays. The yabbies of other streams are smaller and are representatives of four other genera and some thirteen species.

An unusual freshwater medusa, *Craspedacusta sowerbyi* has been recorded in Tasmania and this species, together with a sponge, *Spongilla fluviatilis* add further interest to the fauna.

Fish: The fishes of freshwater are dominated by introduced species, namely brown and rainbow trout, perch, tench and carp. The native galaxiids, however, are still common, especially in the smaller creeks and are represented by about 12 species. The blackfish, *Gadopsis marmoratus*, is found in rivers flowing into Bass Strait and in the Arthur River flowing to the west coast. It spread into the latter system due to the capture of a stream by the Arthur system. The species has been introduced into southern rivers. The cucumber herring, *Prototroctes maraena* and the freshwater flathead, *Pseudaphritis urvillii*, are other noteworthy species.

The importance of angling has led to intensive surveys of rivers and streams and the continuation of this work will yield important results in freshwater zoology, not only in relation to fish and fishing but also to more academic aspects.

Amphibia: It is appropriate at this stage to consider the amphibia. The Leptodactylidae and Hylidae are the only families recorded in Tasmania. The former is represented by the genera *Crinia* (3 sp.), *Limnodynastes* (3 sp.) and *Pseudophryne* (1 sp.), and the latter, by the genus *Hyla* (3 sp.). Only two species appear to be endemic. The diet, development and distribution of most of the species is poorly known.

Marine Zoology

The marine fauna is somewhat better known than the terrestrial but nevertheless there are many groups still undescribed. The Mollusca, largely due to May and Petterd, are well known as are the Fishes; the Crustacea are partially known, but outside these groups there are many gaps in our knowledge.

The Tasmanian marine fauna forms a province, the Maugean, sharing its species with the coasts of southern Victoria. Species from New South Wales are found here but many of them are not of comparable importance in this

State, e.g. the large beds of "cunjevoi", *Pyura praeputialis*, are not nearly as well developed in Tasmania. The kelps, *Macrocystis pyrifera* and *Sarcophycus potatorum*, are characteristic of exposed coasts in Tasmania.

The shores are under the influence of the East Australian current which washes the east coast while the west receives waters from the Australian Bight and the westerly drift. Each of these water masses brings its characteristic fauna and many plantonic or pelagic subtropical or warm temperate species appear on our coasts, perhaps the most interesting being the turtles. These reptiles are stranded only on west and south coast beaches. Another interesting and spectacular form is the mollusc *Argonauta nodosa* which is stranded in large numbers on Flinders Island after protracted westerly gales.

Whales: Tasmania is fortunately placed with regard to whale strandings and many interesting and rare species occur here from time to time. The pygmy right whale, *Caperea marginata*, has been found stranded in Tasmania on 14 occasions and must occur in our offshore waters, as do the rare goose-beaked whale, *Ziphius cavirostris*, strap-toothed whale, *Mesoplodon layardi*, and right whale dolphin, *Lissodelphus peroni*. One specimen of Blainville's beaked whale, *Mesoplodon densirostris*, was recovered from a west coast beach in 1964 and this is the only Australian record of the species south of Townsville, Queensland.

Whales are not an uncommon sight in our seas and humpback whales, *Megaptera novaeangliae*, rorquals, *Balaenoptera acutorostrata*, and sperm whales, *Physeter catodon*, are to be seen about the coasts. In addition, fur seals are present as resident breeders and antarctic visitors, such as elephant seals and leopard seals, are not unusual.

Terrestrial Fauna

The terrestrial fauna is not rich by continental Australian standards but it furnishes several interesting points.

Snakes: The snakes are all of continental species, namely the tiger snake, *Notechis scutatus*, the copperhead, *Denisonia superba* and the whipsnake, *D. coronoides*. The tiger snake is very variable in colour, and as the yellow markings may be obscured, is frequently called the black snake. Several of the islands of the Furneaux Group, particularly Chappell Island, support large *Notechis* populations and varieties of subspecific rank may exist on the closely adjoining islands. Sea snakes are rarely recorded.

The snakes are widespread and this applies to much of our fauna, though the richest habitat by far is the sclerophyll forest. Here the Tasmanian terrestrial fauna reaches its peak of diversity and abundance and it is here that the greatest impact of the fauna upon human affairs takes place.

Invertebrates: Many of these land groups are imperfectly known. Some detailed work has been carried out by Turner and Couchman (Lepidoptera), Lea (Coleoptera), Hardy (Diptera) and Hickman (Araneida and Phalangida) but such groups as the Oligochaeta (Spencer, 1895) have not been investigated for many years.

Birds: The birds are now all identified and new records of occasional stragglers or visitors only can be expected. Fourteen species are purely Tasmanian, and some others may be shown to be geographical races of continental species. The native hen, *Tribonyx mortieri*, is the most noticeable of the endemic species and is to be found in open situations where it may reach such numbers as to become a pasture pest. The green rosella parrot,

Platycercus caledonicus, is a common bird, especially on the coastal scrub of the west coast. The yellow wattle bird, *Anthochaera paradoxa*, black jay, *Strepera fuliginosa* and black magpie, *Strepera arguta*, are other conspicuous and noisy members of the avian endemic fauna. The remaining endemics are dwellers of thick scrub and, as they are small in size, are not noticeable to the average observer. In addition, there are eleven species of introduced birds.

Much work is being carried out on birds and the black swan, *Cygnis atrata*, Cape Barren goose, *Cereopsis novaehollandiae*, yellow wattle bird and the native hen have been singled out for more or less intensive study. The Cape Barren goose inhabits the Furneaux Group and the population fluctuations have been observed by aerial counts since 1957.

Seabirds: The seabirds are worthy of mention as Tasmanian islands are the site of the only Australian breeding colonies of the white-capped albatross, *Diomedea cauta*, and there are three colonies of the gannet, *Sula serrator*. Mutton-birds, *Puffinus tenuirostris*, abound on various islands. Many of the seabirds of the Antarctic and sub-Antarctic seas are found off the coasts of Tasmania and some of these are washed ashore from time to time. Penguins of species known on Macquarie Island are rare visitors to our south-eastern beaches, though there is one resident species, namely the fairy penguin, *Eudyptula minor*.

Migrations: Long migrations are a feature of some of our seabirds and species such as the Arctic tern, *Sterna macrura*, Arctic skua, *Stercorarius parasiticus* and the mutton bird all make trans-equatorial migrations. This habit is not confined to marine birds as the golden plover, *Pluvialis dominicus*, snipe, *Gallinago hardwicki*, little stint, *Erolia ruficollis*, sharp-tailed sandpiper, *Erolia acuminata* and the curlew, *Numinius madagascarensis*, also move to the northern hemisphere for breeding. All the latter are waders and there would appear to be a considerable movement of these birds to Siberia, Japan and Alaska but the double-banded dotterel, *Charadrius bicinctus*, is believed to move to New Zealand for breeding, a most unusual west-east route.

Mammals: The mammals of Tasmania are represented by all three major phylogenetic groups. The Prototheria consist of the platypus, *Ornithorhynchus anatinus* and the echidna, *Tachyglossus setosus*. The latter differs specifically from the continental species by the possession of shorter spines and more fur. There are 20 species of Metatheria (Marsupialia), of which one, the sugar glider, *Petaurus breviceps*, was introduced from the continent. Seven of the remaining species are endemic but only two of these, the Tasmanian tiger and the Tasmanian devil, are not closely related to continental forms. The Eutheria are represented by the native rodents (5 species) and the six species of bats. None of the latter is common. In addition to the native Eutheria, there are a number of introduced species which have now become established as part of our fauna. These are the rabbit, hare, mouse, brown rat, black rat, feral cat, fallow deer and perhaps the ferret. It is proposed to discuss these species in a later issue of this Year Book.

The greatest interest in the terrestrial fauna has been in the mammals and the birds. The mammals are utilised for meat and fur production, as well as for sporting purposes. The brush possum, *Trichosurus vulpecula*, ringtail possum, *Pseudochirus convolutor*, wallaby, *Wallabia rufogrisea*, pademelon or scrub wallaby, *Thylogale billardieri*, and the water rat, *Hydromys chrysogaster*, are all killed for their fur during prescribed open seasons.

Shooting is provided by the wallaby and pademelon, and the introduced deer, rabbit and hare. These species provide the meat resources derived from the wild fauna of the State.

Wallaby: The wallaby is found over much of the sclerophyll forest where there is sufficient cover for the animal to hide during the day. The pademelon (scrub wallaby) is found in thicker parts of the scrub. Both these species leave the scrub at night to feed in adjoining open areas or paddocks. At present, the population of both these species is high and there is a 12 months' open season for both shooting and snaring. Particularly dense concentrations of *Wallabia* exist in the north-east and the pademelon is very numerous on the western coastal strip.

Kangaroo: It is noteworthy that the large kangaroos of the continent of Australia are represented here by only one species, *Macropus giganteus*, the Forester kangaroo. This species has a somewhat tenuous hold, its largest population being in the Gladstone-Cape Portland area of the north-east, a region which is scheduled for intensive agricultural development. Fortunately, the Forester has spread to areas on the eastern side of the Midlands and is numerous thereabouts.

Whilst discussing the kangaroos, it is necessary to mention the smaller macropods found here, namely the bettong, *Bettongia cuniculus* and the potoroo, *Potorous tridactylus*. The former of these is the scarcer and is found in open forest lands with scrub and on the fringes of the forest, whereas the potoroo is a denizen of the thicker scrub. Indeed, the distribution of these two species forms an ecological parallel with that of the wallaby and the pademelon.

Possum: The two species of possum show ecological differences in habit, the larger brush possum spending more time on the ground than the almost strictly arboreal ringtail. The latter species suffers very severely from natural population cycles. About 1951-52 the numbers of this animal fell catastrophically, and they were only recovering in 1963-64. There is no open season at present on ringtails. The brush possum occurs in a number of colour phases of which the cream and silver are the most rare. Grey and rufous are the common colours together with black, the latter being found in the more humid parts of the State, e.g. southerly aspect gullies.

Carnivores: The carnivorous marsupials are well represented both in species and numbers. The native cat, *Dasyurus quoll*, is common throughout much of the State, except on the west coast where it tends to be replaced by the larger and more savage tiger cat, *D. maculatus*. These two species, together with the Tasmanian devil, are pests of poultry yards. The Tasmanian devil, *Sarcophilus harrisi*, was once considered to be rare in Tasmania but now is very numerous and is almost in plague proportions in some parts of the country, particularly the west coast and north-east regions; it is now spreading into areas where it had not been seen in living memory, e.g. Tunnack in the lower Midlands. The Tasmanian devil performs a valuable service in the bush as a scavenger.

Thylacine: The last species of large carnivorous marsupial, the thylacine or marsupial wolf (Tasmanian tiger) is the largest of the marsupial carnivores and is undoubtedly the rarest, being one of the twelve rarest species in the world. In the early colonial days thylacines were found all over the State. Unhappily they developed sheep-killing habits; a bounty of £1 ($2) per head (a pup was worth $1) was paid in 1888 and this resulted in the destruction of over 2000 thylacines. The numbers declined and by 1908 the species was becoming scarce and by 1914 few were to be seen. The population decline was assisted by habitat destruction and alteration. It has been suggested that their decline was also hastened by disease, since it is clear from the available data that the areas in which thylacine were most vigorously hunted were the last

places from which they disappeared. If hunting were the sole factor responsible for their decline, then this would not be true. Evidence of the continued, if precarious, existence of the species was collected by a Tasmanian Government-sponsored expedition in 1963-4, which, however, failed to capture a specimen. Until more is known of the habits of the species, it is very difficult to plan a programme for its conservation and rehabilitation.

Other Marsupials: The other ground-dwelling marsupials are the wombat, *Phascolomys ursinus*, barred bandicoot, *Perameles gunnii* and the short-nosed bandicoot, *Isoodon obesulus*. The barred bandicoot lives in open plains or at the edges of open woodland whereas *Isoodon* is found in thicker scrub. Again there is the parallel in habit with the kangaroo and pademelon.

The smaller species of marsupial, the marsupial mice and pigmy possums, are little known at the present time but are believed to be more common than was formerly recognised. The same observations apply to some of the native rodents.

Monotremes: Both the platypus and the echidna are common, the latter being found in sclerophyll forests, and the former in the lakes, rivers and creeks.

Conclusion

Although the Tasmanian marsupial fauna is not rich in species, it is very rich in its numbers of individuals, due in part to the absence of any large eutherian predators, such as the dingo or fox. This richness in numbers contrasts very strongly with the situation in continental Australia where the pattern is one of species constantly becoming scarcer and even of many species having become extinct since white settlement. Our relative freedom from animal introductions is an important factor in this and contrasts strongly with the situation in other countries, notably New Zealand, where introduced species are of pest proportions.

Tasmania is fortunate in that there exists an extensive system of sanctuaries and national parks within which the animals can remain undisturbed. In recent years, it has been recognised that the reservation of habitat is the most important feature of conservation programmes. It is unfortunate that our habitat with the greatest range of species and wealth of numbers, namely the sclerophyll forest, is the very region where the greatest agricultural development is taking place. It is even more unfortunate that there are few sanctuaries which contain large areas of this favourable environment. As a conservation measure, a policy of reserved areas has been commenced whereby land is declared to be reserved for wildlife. Such areas, although not sanctuaries, are to provide a habitat for all times.

The fauna of Tasmania, while not having the richness of its counterparts in other States, nevertheless, on account of its insular environment, is suited to conservation programmes. These are being attempted and will be continued into the future.

(The section on Fauna was written by E. R. Guiler, B.Sc., Ph.D., F.Z.S., M.I. Biol., University of Tasmania.)