PAP. & PROC. ROY. SOC. TASMANIA, 1937 (20TH MAY, 1938)

21

The Tasmanian Brush Opossum: Its Distribution and Colour Variations[1]

By

JOSEPH PEARSON

(Read 8th November, 1937)

Plates I-III

The present investigation was undertaken with the object of inquiring into the significance of the colour variations of the Tasmanian Brush Opossum, *Trichosurus vulpecula fuliginosus* Ogilby. The main investigation has not proceeded very far, and it is clear that elucidation of the genetical aspect of the problem will entail several years of experimental work. In the present paper the results of the preliminary inquiry are put on record, since they throw light upon the distribution and relative abundance of the two principal colour groups of *T. v. fuliginosus*.

Trichosurus vulpecula vulpecula Kerr, 1792, is found in Southern Queensland, New South Wales, Victoria, and South Australia. It varies in colour from the well-known silver-grey to the bluish-grey Monaro phase of the southern highlands and the yellow-bellied greyish animal of the north-west.

According to Iredale and Troughton (1934) there are seven varieties of the main species: one in Tasmania, three in Queensland, one in the Northern Territory, and two in Western Australia. These varieties have been partly established on colour characters, and it is found that the typical grey gives place to reddish, reddish-brown, brown, and black. I can find no exact statements as to what extent the grey individuals are found, if at all, along with the other colour variants. It would appear reasonable to believe, however, that grey was the original colour of this form, and that the melanistic departures from this colour are more recent developments.

[1] A contribution to the Biological Survey of Tasmania.

In the case of the Tasmanian sub-species *Trichosurus vulpecula fuliginosus* Ogilby, there are two main colour forms, generally referred to as 'grey' and 'black'. Although each of these main divisions exhibits within itself many colour variations there is no difficulty in distinguishing a grey from a black.

'Grey' Opossum.—In the case of the 'grey' the tail is invariably black from the tip for about two-thirds or three-quarters of its length, and the proximal part has the same grey colour as the posterior part of the body. The posterior half of the body is generally a true grey, either dark, medium, or light. In some cases the anterior half is the same colour, but more frequently there is a tawny or brownish tinge.

'Black' Opossum.—The tail is uniformly coloured dark-brown or black. The posterior half of the body usually has the same colour as the tail. The anterior half may be of the same colour as the posterior, but more frequently there is a tawny or reddish tinge.

In both greys and blacks the individual hairs are lighter at the base and darker at the tip.

Nothing is known of the genetical significance of the two colours. Wood Jones (1924) states that the melanistic variety which occurs among the ordinary grey forms in South Australia is the offspring of ordinary grey parents. Mr. Brazenor, Mammalogist of the National Museum, Melbourne, has confirmed this from his personal knowledge. In view of the interesting distributional results obtained in the course of the present preliminary investigations it would appear to be necessary to make exhaustive genetic experiments with the greys and blacks in order to determine the true significance of the colour characters.

The preliminary investigations have been pursued along the following lines:—

1. To determine what other characters, if any, are associated with the two main colour groups. For this purpose body measurements and skull measurements have been taken.
2. To ascertain the relative abundance of the two main colour groups in different parts of Tasmania.

Body Measurements

At the present stage it has not been possible to make a sufficiently large number of measurements of freshly killed animals, but advantage was taken of the open season in 1937 to measure 318 greys and 260 blacks after the skins had been pegged out and roughly cured by trappers. This method is unreliable if accurate body

measurements are required, as the pelt becomes stretched and distorted to some extent. Nevertheless, as a comparative method the measurement of dried skins probably has some value, and it is probable that the relation of the length of the tail (T) to the length of the body (L) is fairly reliable. In Table I an analysis of the results of measuring 578 dried skins is given. It will be seen from this table that $\frac{T}{L}$ varies in the greys from 47·2 per cent. to 60·6 per cent., with a mean percentage of 53·9. In the blacks $\frac{T}{L}$ varies from 48·3 per cent. to 58·5 per cent., with a mean percentage of 52·9. There is nothing in these figures to indicate that coat colour is correlated with the body measurements I have used. It is true that the number of skins measured was relatively small.

TABLE I

Body Measurements.

BRUSH OPOSSUM (GREY)

Number of Specimens	*District*	*Average Length from Snout to Base of Tail (L) cm.*	*Average Length of Tail (T) cm.*	$\frac{T}{L} \times 100$
				%
1	Port Davey	61·0	37·0	60·6
2	Mt. Barrow	58·5	35·0	60·0
3	Tasman Peninsula	63·0	35·3	56·1
41	Weldborough	63·5	35·4	55·8
75	Epping	62·4	34·5	55·3
14	Mt. Misery	67·6	36·5	55·9
21	Forrester Settlement (Scottsdale)	62·6	34·2	54·7
4	East Coast	64·2	34·7	54·0
9	West Coast Road	67·8	36·1	53·2
2	Huon	70·0	37·2	53·1
6	Swansea	63·8	33·7	52·8
55	Scottsdale	63·9	33·3	52·2
15	Mt. Roland	65·5	33·7	51·5
56	Ben Lomond	63·4	32·1	50·7
5	Dunorlan	68·5	34·5	50·5
6	New Country	63·0	31·7	50·4
3	Great Lake	67·3	31·7	47·2
	Average of 318 = 53·9%			

BRUSH OPOSSUM (BLACK)

2	Port Davey	65·0	37·0	58·5
7	Ben Lomond	59·3	33·3	56·2
14	Dunorlan	64·4	36·1	56·2
27	Forrester Settlement (Scottsdale)	62·9	34·9	55·5
21	Mt. Barrow	67·4	37·3	55·4
14	Mt. Misery	66·4	36·4	54·8
38	Epping	64·9	34·6	53·5
32	Mt. Roland	64·4	34·1	53·0
2	Great Lake	65·7	34·7	52·9
10	Brown Mountain, Runnymede	62·0	32·5	52·5
75	Scottsdale	64·7	32·7	50·6
8	Huon	70·4	35·3	50·2
4	East Coast	67·2	32·7	48·7
4	West Coast Road	74·7	36·0	48·3
	Average of 260 = 52·9 %			

Skull Measurements

In Table II certain skull measurements are given. These measurements were taken to ascertain if any correlation could be discovered between size and proportion of the skull on the one hand and coat colour and sex on the other. As only 27 skulls were examined, it is clear that too much reliance should not be placed upon these results, but the measurements serve to show, as far as they go, that in each of the characters examined there is considerable variability, and there is no indication that any particular skull character is linked with coat colour or sex.

Table II

*Skull Measurements**

	Sex	A	B	C	D	E	F
		mm.	%	%	%	%	%
Brush Opossum (Grey)							
A54/756	♂	73	56·1	43·8	20·5	56·1	78·1
A50/752	♂	81	69·1	48·1	19·9	60·5	76·5
A51/753	♂	83	67·5	42·2	19·3	56·6	72·3
A52/754	♂	91	67·0	45·0	19·8	57·1	74·7
A56/758	♂	77	66·2	45·4	24·9	58·4	72·7
A30/760	♂	84	70·2	47·6	20·2	59·5	73·8
A31/761	♂	83	69·3	45·8	20·5	57·8	75·9
A55/757	♂	85	68·2	45·3	21·2	58·8	76·5
A29/759	♂	78	69·2	46·2	21·8	59·0	79·5
A49/759	♀	87	66·6	45·4	20·7	55·7	74·7
A46/776	♀	75·5	70·2	42·4	19·9	57·6	78·0
A47/749	♀	80	68·7	40·6	21·2	56·2	78·7
A33/763	♀	72·5	69·0	44·1	20·7	58·6	78·0
A39/769	?	64·0	70·3	35·8	21·9	57·8	78·1
A36/766	?	81·0	67·9	46·9	19·7	58·6	76·5
A38/768	?	85	68·2	44·7	20·0	56·5	74·1
A35/765	?	78	71·1	42·3	19·2	57·7	73·1
A37/767	?	81	65·4	43·2	17·9	55·5	72·2
Brush Opossum (Black)							
A45/775	♂	81	69·1	45·7	21·0	58·0	75·3
A34/764	♂	79	70·9	44·3	20·9	56·3	78·5
A48/750	♂	86	68·6	43·0	19·8	58·1	74·4
A53/755	♂	87	65·5	44·8	18·4	56·3	76·4

* See next page.

TABLE II—*continued*

SKULL MEASUREMENTS: BRUSH OPOSSUM (BLACK)—*continued.*

	Sex	*A*	*B*	*C*	*D*	*E*	*F*
		mm.	%	%	%	%	%
A40/770	♀	83	67·5	43·4	19·3	57·8	73·5
A41/771	♀	76	70·0	44·7	20·4	58·4	73·7
A43/773	♀	82	66·5	46·3	20·7	56·7	75·6
A42/772	♀	88	69·3	46·6	20·4	54·5	77·3
A44/774	♀	81	67·9	44·4	21·0	56·8	74·1

*A = Basal length.
B = Zygomatic breadth (across the posterior ends of the Jugals).
C = Length of Nasals along middle line.
D = Greatest breadth of Nasals.
E = Length of palate (from the delicate bar forming the posterior boundary of the Posterior Palatine Foramen to the anterior end of the Pre-maxilla).
F = Along median dorsal line, from the posterior edge of the Sagittal Crest to the point of intersection of a line joining the Lachrymal foramina.
B-F are expressed as percentages of the basal length (A).

RELATIVE ABUNDANCE OF THE TWO COLOUR GROUPS

The figures of the Brush Opossums captured in the open seasons of 1934 and 1937 have been analysed. 58,407 records for 1934 and 47,528 for 1937 have been examined. These are summarised in Table III.

It will be seen that the main Bass Strait islands (Flinders Group and the King Island Group) have 100 per cent. greys. On the main island of Tasmania an interesting state of affairs is presented. This can best be appreciated by an examination of Plate I, in which the figures of Table III are plotted.[1] It is seen that the highest percentage of greys is to be found on a strip extending from the East Coast to the Central tablelands, and also in the isolated Tasman-Forestier Peninsula. From this central zone the percentage of greys gradually decreases, and we find a remarkably low percentage of greys in the two remotest districts, viz., in the region north of the Arthur River in the north-west corner of Tasmania, and in the Huon district in the south. No specimens have been recorded from the Arthur-Pieman Reserve, but I have been assured by Mr. Wigg, of the Animals and Birds' Protection Board, that there are no greys in that area. On his authority I have labelled the reserve 'all black' in Plate I. No information is available for the south-west corner of Tasmania, but it is reasonable to assume that there would be a low percentage of greys in that region.

[1] Separate maps for 1934 and 1937 are not given, as it was found that the results of these two years agree in a marked manner, and the distributional map given in Plate A, though dealing with the combined years 1934 and 1937, might be taken for either of these years.

TABLE III

Distributional Records

	1934		1937		%
	Grey	*Black*	*Grey*	*Black*	*Greys*
Bass Strait Islands	5697	—	3775	—	100
Great Lake District	3124	445	1486	152	88·5
Tasman and Forestier Peninsulas	896	183	—	—	83·1
St. Marys District	1069	256	1523	348	81·4
Tunbridge-Ross-Campbell Town	1627	364	1729	395	81·4
Hamilton-Ouse-Dee	1846	470	937	177	81·0
Cradle Mt.-Western Tiers	244	59	—	—	80·5
Oatlands District	1081	305	3820	1042	78·6
Westbury-Deloraine-Mole Creek	1842	554	2754	736	78·3
Bothwell-Apsley District	990	255	1298	486	75·4
Ben Lomond-Mathinna-Fingal	481	246	1328	397	73·6
Lake Leake-Bicheno-Swansea	1459	503	1147	425	73·5
Copping-Campania-Runnymede	351	146	2334	907	72·0
Cressy-Epping-Evandale	1577	505	1412	623	71·5
Nile-Epping	1100	388	1423	623	71·5
Avoca District	3715	1644	905	242	71·0
New Town-Bridgewater (North Hobart)	1755	740	—	—	70·3
Cleveland-Conara	59	25	—	—	70·1
Newnham District (Launceston)	543	238	—	—	69·5
East Tamar-Piper's River-Bridport	317	183	155	33	63·6
Little Swanport-Buckland	569	262	—	—	68·3
West Tamar District	797	399	168	56	68·0
Mt. Barrow-Lilydale	507	257	124	60	66·8
Middlesex-Moina-Lorinna	748	416	—	—	64·0
Kempton-Tunnack	180	81	272	176	63·6
Meander District	515	297	—	—	63·4
St. Helens-Ringarooma-Pioneer	1489	892	1437	833	62·9
Lindisfarne-Rokeby	52	31	—	—	62·5
Boobyalla-Gladstone-Anson's Bay	272	157	524	376	59·9
Hayes-Brighton-Mt. Direction	341	206	53	70	58·8
Eldon Range-Franklin River-Zeehan	1389	841	396	447	58·0
Tunnel-Scottsdale	859	605	978	816	56·4
Latrobe-Kimberley-Harford	340	271	62	72	53·0
Nietta-Sheffield	487	510	934	822	51·6
Fentonbury-Macquarie Plains	223	212	—	—	51·5
Gunn's Plains-Sprent-Nook	235	304	—	—	43·6
Collinsvale-Uxbridge	73	178	203	333	35·0
Adamsfield-Florentine River	189	362	—	—	34·4
Ellendale-Fitzgerald-Uxbridge	269	514	68	144	33·8
Wynyard-Ulverstone (back country)	304	622	551	2061	24·1
Waratah	79	238	11	67	22·8
Calder-St. Valentine's Peak	13	64	—	—	16·9
North and East Sides of Huon Estuary	120	895	107	634	12·9
South and West Sides of Huon Estuary	113	891	80	609	11·4
Rocky Cape-Black River-Myalla	42	326	3	73	10·1
Huonville-Fern Tree	49	561	—	—	8·0
Yolla-Henrietta-Preolenna	1	20	—	—	4·8
Montagu-Marrawah-Smithton	47	411	3	1293	2·9
Total	40,075	18,332	32,000	15,528	
	58,407		47,528		
	105,935				

1934		1937	
Grey	*Black*	*Grey*	*Black*
68·6%	31·4%	67·3%	32·7%

General Considerations

It is perhaps premature to venture an explanation of this very interesting distribution of the two main colour forms of the Tasmanian Brush Opossum.

If the present depth-contours of Bass Strait are any indication of a former land connexion between Tasmania and the mainland of Australia, we can envisage that connexion as having followed the Wilson's Promontory-Flinders Island line. If the floor of Bass Strait were raised about 30 fathoms there would be a narrow strip of land connecting Wilson's Promontory with the north-east corner of Tasmania (see Plate III).[1] King Island would be connected with the north-west corner of Tasmania, and would be separated from the Wilson's Promontory-Flinders connexion by an enclosed basin having a narrow inlet at its north-west corner into the Bight. Such a land connexion would have enabled the grey Brush Opossum of South-Eastern Australia to reach the Tasmanian land-mass at its north-eastern corner. This agrees in the main with the character of the present distribution of the Brush Opossum in Tasmania. The melanistic type, so rare on the mainland, is also rare at the presumed point of entry of the species into Tasmania (i.e., at the north-east corner), but becomes increasingly abundant in a westerly and south-westerly direction. Thus, in Flinders Island only greys are found; on the east coast the greys predominate; in the extreme north-west and south-west the greys are very rare.

A difficulty to the acceptance of this hypothesis, however, presents itself. At the time the Bassian isthmus existed King Island was presumably linked up with the north-west corner, and should have shared with that area in the possession of a preponderance of blacks. In point of fact, however, King Island, like Flinders Island, possesses no blacks.

King Island, then, with 100 per cent. grey, is strikingly different from the north-west corner of Tasmania, which has nearly 100 per cent. black. Does this point to the fact that these two regions were not connected, as the present contour of the sea-bed between King Island and the North-West Coast would lead us to suppose? In spite of the deep water between King Island and the mainland and between King Island and Flinders Island, is it likely that King Island received its Brush Opossums direct from the mainland or through a connexion with Flinders Island?

An alternative suggests itself. If we are forced to the conclusion that the Bass Strait depth-contours give a correct indication of the shape of the former land-mass, it may be that when the grey form reached Tasmania it spread over the whole country

[1] The same effect would be produced by the lowering of the sea-level by the same vertical distance. Edgeworth David (1924, p. 139) stated that in the last Pleistocene glaciation the sea-level was lowered by 200 feet owing to the locking up of enormous volumes of sea water, which went to form some eleven millions of square miles of Pleistocene ice-sheets.

as a grey animal, and that only at a subsequent period, after King Island had become separated from Tasmania, did the melanistic form assume importance and gradually supplant the greys in certain districts. There does not appear to be much support for this view, and in spite of the King Island problem I prefer the view that the blacks became more abundant as the Brush Opossum migrated farther and farther away from the point of entry.

At the present stage of the investigations it would appear unprofitable to attempt to arrive at any solution of this very intriguing problem. The outstanding difference between the entire absence of blacks from King Island and the predominance of blacks in the north-west of Tasmania furnishes an enigma which appears difficult to explain in the light of our present knowledge.

The greys and blacks can hardly be designated geographic races specially adapted to the particular district in which they are found, since they live side by side in nine-tenths of the Tasmanian area. Nevertheless it is true that the blacks gradually increase in proportion towards the west and south. This state of affairs cannot be explained at present by the environmental conditions prevailing in the different parts of Tasmania, though no doubt an explanation will ultimately be found when we know these conditions more accurately. Two important factors, namely, elevation and rainfall, do not seem to affect the issue. A comparison of the maps given on Plates I and II would seem to indicate that there is no correlation between the relative abundance of greys and blacks in different parts of Tasmania and the incidences of elevation and rainfall. It is true that, generally speaking, a higher percentage of greys is found in the drier eastern districts, but this generalized statement will not bear close analysis, since the highest percentage of blacks is found in the north-west corner and the Huon district where the rainfall is not abnormally high.

Nevertheless it is interesting to note that Shull (1936) has drawn attention to the fact that many mammalogists believe that relative humidity affects coat colour, and it is thought that darker races are produced in more humid regions.

Neither do elevation contours offer any explanation of the interesting relative distribution of greys and blacks. This will be clearly realized by an examination of Plate I with Plate II, fig. 1.

Although the greys and blacks are so clearly defined there are so many grades of greys and blacks that it would appear that we are not dealing with two simple allelomorphs based upon one pair of genes. It is possible that there is one chief pair and several modifying pairs of genes. The genetic explanation of this problem promises to be a complicated one, and this aspect will not be dealt with in the present preliminary survey. It is proposed to carry out breeding experiments in the hope that more light will be thrown upon this interesting problem.

ACKNOWLEDGEMENTS

I am indebted to Mr. E. O. G. Scott, B.Sc., of the Queen Victoria Museum, Launceston, for assisting me in measuring the skins of Brush Opossums; to Messrs. Wilcox, Mofflin Ltd. and Neale Edwards Pty. Ltd. for offering facilities for examining skins and for giving valuable information regarding the distribution and colour varieties of the Brush Opossum; to Mr. A. L. Meston, M.A., for procuring opossum skulls; to Mr. E. le G. Troughton, of the Australian Museum, Sydney, to Mr. E. W. Brazenor, of the National Museum, Melbourne, and to Mr. H. H. Finlayson, of the University of Adelaide, for their help in regard to the colours of the mainland sub-species of *Trichosurus vulpecula;* to Mr. P. Wigg, of the Tasmanian Animals and Birds' Protection Board, for advice on the habits and distribution of the Brush Opossum; to Capt. Pearse for making the charts which illustrate the present paper; to Mrs. Lord and Mr. R. Boswell, of the Tasmanian Museum and Art Gallery, for assisting me in the arduous work of analysing over 100,000 opossum records; and to the Commissioner of Police for Tasmania for placing at my disposal the records of Brush Opossums captured during the 1934 and 1937 open seasons.

REFERENCES

DAVID, SIR T. W. EDGEWORTH, 1924.—Geological Evidence of the Antiquity of Man in the Commonwealth, with Special Reference to the Tasmanian Aborigines. *Pap. Roy. Soc. Tasm.* 1923. pp. 109-150.

IREDALE, T., and TROUGHTON, E. le G., 1934.—A Check-list of the Mammals Recorded from Australia. *Memoirs of the Australian Museum, Sydney,* No. 6.

JONES, F. WOOD, 1924.—The Mammals of South Australia, Part II. pp. 196-203.

SHULL, A. F., 1936.—Evolution. *McGaw Hill Book Co., New York.*

PLATE I

Map of Tasmania showing relative distribution of Brush Opossums.

The large figures indicate the percentage of greys in different zones. The smaller figures mark the percentage of greys at individual stations.

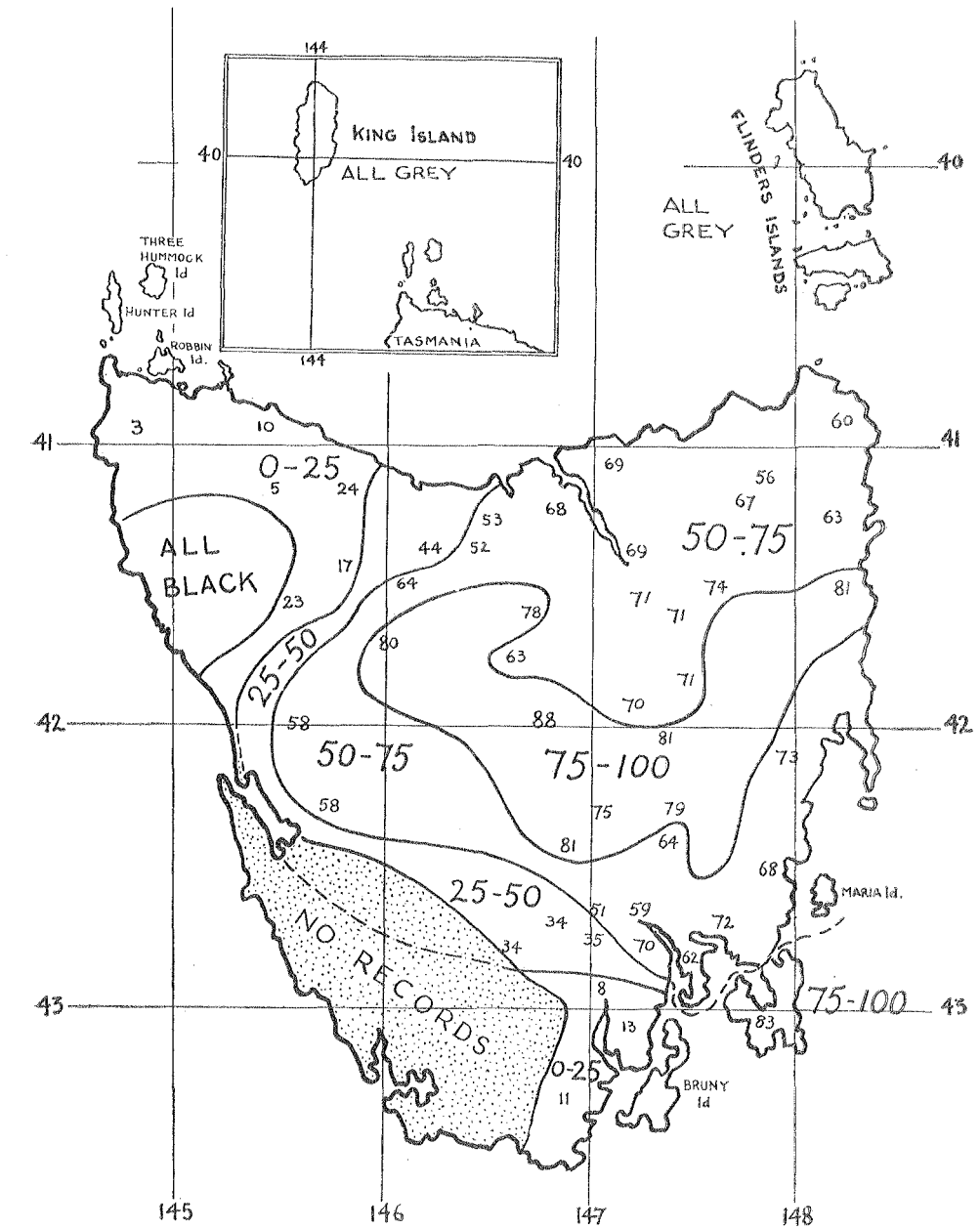

144
KING ISLAND
40
ALL GREY
40
144
TASMANIA
THREE HUMMOCK Id
HUNTER Id
ROBBIN Id.
FLINDERS ISLANDS
ALL GREY
40
41
3
10
0-25
5
24
60
41
69
56
67
63
68
53
50-75
ALL BLACK
17
44
52
69
64
71
74
81
23
78
71
25-50
80
63
71
70
42
58
88
81
42
50-75
75-100
73
58
75
79
81
64
68
MARIA Id.
25-50
34
51
59
72
34
35
70
62
NO RECORDS
43
8
75-100
43
13
83
0-25
11
BRUNY Id
145
146
147
148

PLATE II

FIG. 1.—Elevation contours in Tasmania.
FIG. 2.—Distribution of rainfall (in inches) in Tasmania.

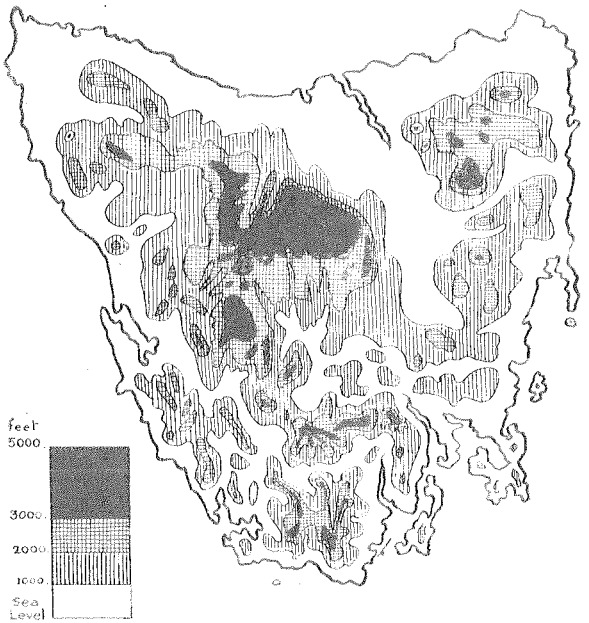

feet
5000
3000
2000
1000
Sea Level

Fig. 1

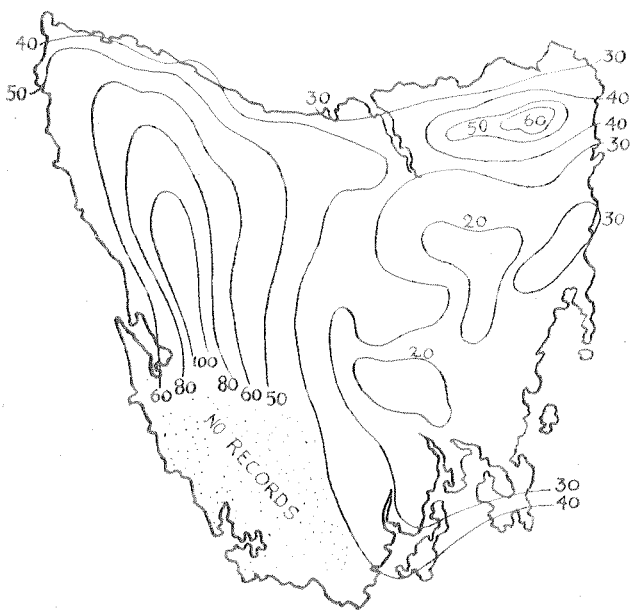
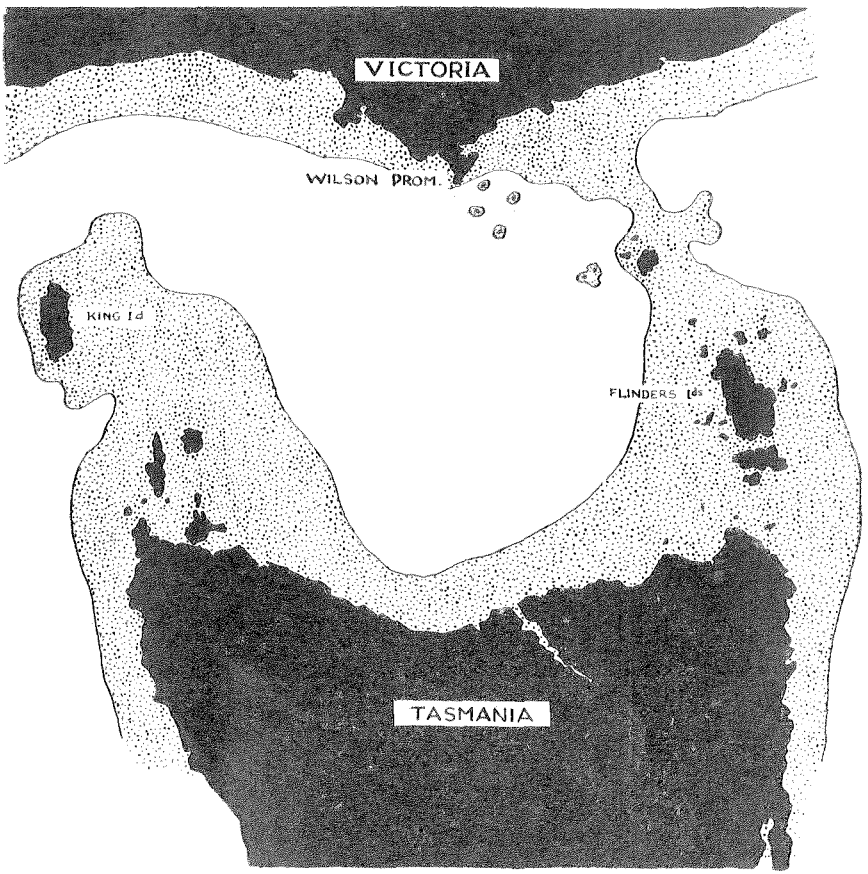

40
50
30
30
40
40
30
50
60
20
30
30
100
60
80
80
60
50
NO RECORDS
30
40

Fig. 2

PLATE III

Map of Bass Strait showing the present land outline (black), and the increased area (dotted portion) which could be produced by raising the sea-bed by 31 fathoms, thus indicating a probable former land connection between Tasmania and the continent.


VICTORIA
WILSON PROM.
KING Id
FLINDERS Id
TASMANIA