

The AUSTRALIAN MUSEUM MAGAZINE

EDITED BY C. ANDERSON, M.A., D.Sc.



The Waterhouse Collections.

Wild Nature on the Nullarbor Plain

Chas. Barrett, C.M.Z.S.

The Secret of Sight - - Octavius C. Beale, F.R.S.Litt.

The Great Whales of Australia and Antarctica

David G. Stead

Black Australia

Professor A. R. Radcliffe-Brown, M.A.

The Freshwater Eel - - - - - Frank Walford

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THE AUSTRALIAN MUSEUM MAGAZINE

VOL. IV, No. 4. CONTENTS. October-December, 1930.

ON THE DEFENSIVE—THE BARN OWL (*TYTO ALBA*)
Frontispiece

THE WATERHOUSE COLLECTIONS 111

NOTES AND NEWS 114

WILD NATURE ON THE NULLARBOR PLAIN—*Chas.*
Barrett, C.M.Z.S. 115

THE SECRET OF SIGHT—*Octavius C. Beale, F.R.S.Litt.* 122

THE GREAT WHALES OF AUSTRALIA AND ANTARCTICA
—*David G. Stead* 123

THE MICROSCOPICAL SOCIETY OF NEW SOUTH WALES 132

BLACK AUSTRALIA—*Professor A. R. Radcliffe-Brown,*
M.A. 133

THE FRESHWATER EEL—*Frank Walford* 119

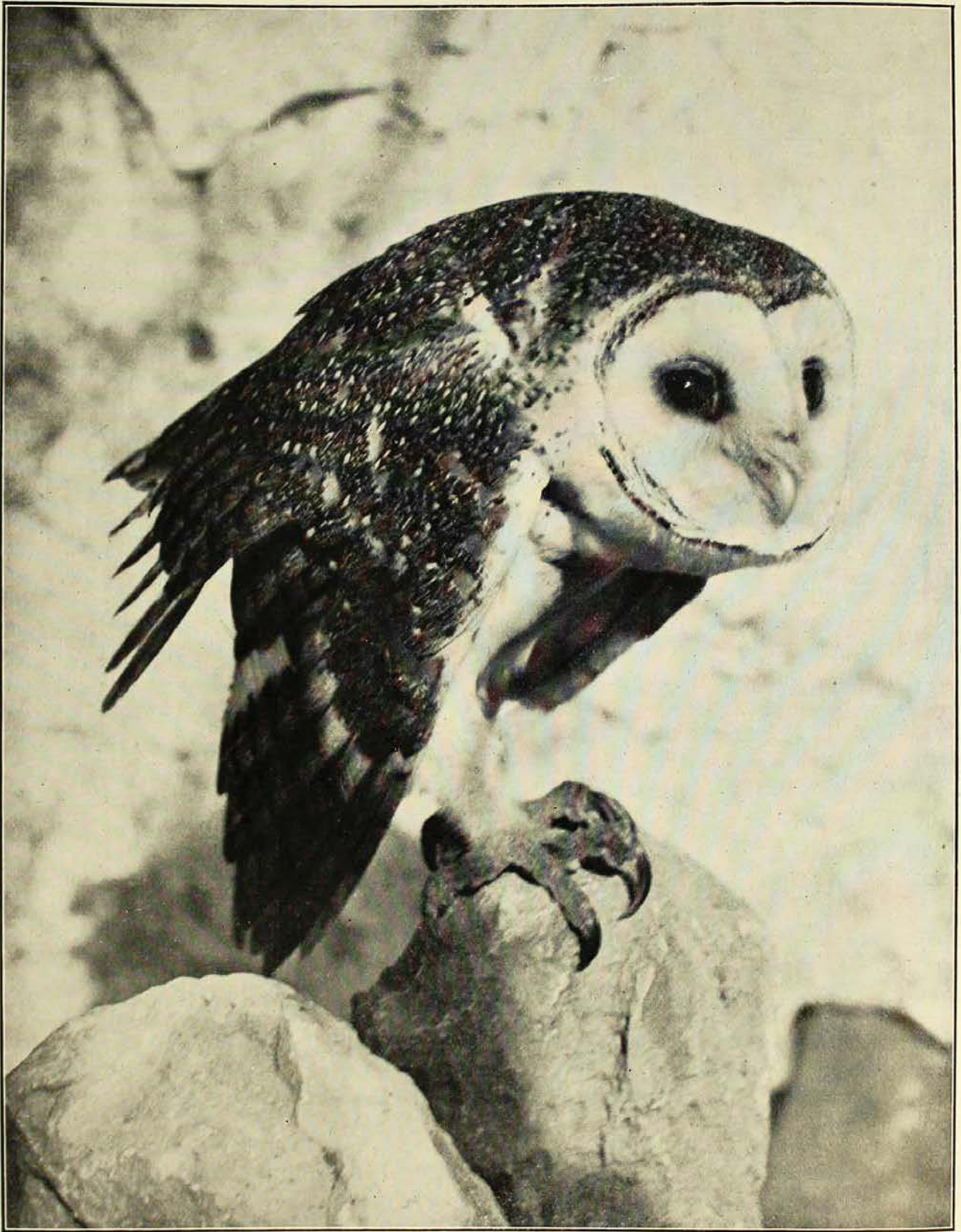
JOHN BRAZIER, CONCHOLOGIST—*Obituary* 142

REVIEWS 144

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On the defensive. A fine example of the so-called "Cave" Owl, which is not a distinct species, but only a paler-coloured Barn Owl (*Tyto alba*).

[Photo.—C. Barrett.]



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VOL. IV, No. 4.

OCTOBER-DECEMBER, 1930.

The Waterhouse Collections

BUTTERFLIES.

THE finest collection of Australian butterflies in the world is now in the possession of the Trustees of the Australian Museum. Through the generosity of the President of the Board of Trustees, Dr. G. A. Waterhouse, the Museum collections have been enriched by the addition of the whole of his magnificent collection of Australian butterflies, comprising about 50,000 specimens.

In 1893, Dr. Waterhouse first began to collect butterflies in the sunny gullies at Waverley, near Sydney, and, in the course of time, his sphere of operations was enlarged so that today he has collected in every State. In the east coast of the Continent he has travelled as far north as Cairns, while on the west side Geraldton marks his farthest north. In addition to the lowlands of the coast, the highlands of Mount Kosciusko and Barrington Tops have yielded butterflies for his collection. Besides those insects secured by his own efforts, he has acquired,

by donation or purchase, specimens from such well-known collectors as H. Elgner (Cape York), F. P. Dodd (Kuranda), L. Franzen and R. Illidge (Brisbane), G. M. Goldfinch (Sydney), and F. L. Whitlock (Western Australia), while the whole of the butterfly collection made by Rowland E. Turner at Mackay, Kuranda, and Cape York, Queensland, over a space of twenty years is also incorporated in the collection.

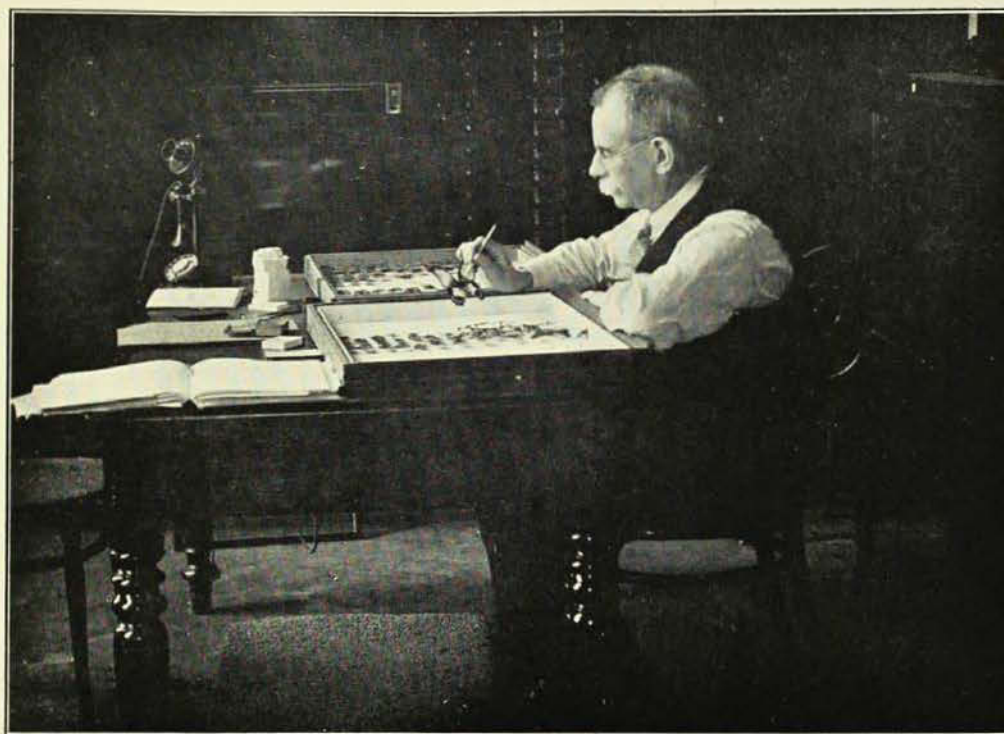
Not only as a collector is Dr. Waterhouse famed, he enjoys an international reputation as an entomologist for his valuable contributions to scientific literature on systematic entomology, on the life-histories of butterflies, as well as for his experiments in hybridizing with sub-species of butterflies of the genus *Tisiphone*. In 1914, in collaboration with Mr. George Lyell, of Gisborne, Victoria, he published *The Butterflies of Australia*, a standard work.

The main feature of the collection is the large series of specimens from many

localities, these series being extremely useful in showing the variation in species caused by geographical and climatic conditions. Of the 333 species recorded from Australia, about five only are unrepresented, and these are known only from single specimens or are doubtfully Australian. From a monetary point of view the most valuable specimens are the *types* of butterflies representing new species or sub-species described by Dr. Waterhouse and Mr. Lyell in their work, together with the specimens used to illustrate their book, all of which,

To an entomologist perhaps, the *pièce de resistance* of the collection is the five drawers of the beautiful metallic Blues of the genus *Ogyris*, whose larvæ secrete sweet liquids eagerly sought after by ants. This genus, with the exception of two or three New Guinea species, is confined to Australia, and they are particularly rare on account of their habits, but all the known Australian species are represented in the collection.

A fine series of the Bird's-Wing Butterflies of the genus *Troides* includes the large and beautiful *Troides priamus*



Dr. G. A. Waterhouse, B.E., F.E.S.,
arranging specimens in his collection at the Australian Museum.

[Photo.—G. C. Clutton.]

with the exception of sixteen specimens in the collections of the Queensland, Macleay, and Melbourne Museums, and coloured figures of specimens in the British Museum, are in this wonderful collection. In addition to the types mentioned, there are all those described by himself, except one in the Macleay Museum, Sydney, and one in the National Museum, Melbourne.

Particularly interesting are the 300 specimens representing first, second, and third generations of butterflies of the genus *Tisiphone* obtained by Dr. Waterhouse as a result of his hybridizing experiments.

pronomus from Cape York, and the smaller but no less charming *Troides priamus richmondus* from southern Queensland and northern New South Wales makes another valuable feature of the collection.

In addition to these Australian butterflies, Dr. Waterhouse has presented some thousands of Indo-Malayan specimens, including many handsome and rare species. Among these are butterflies collected in the Malay Archipelago by A. R. Wallace and acquired from the British Museum. Butterflies from India, Ceylon, to Southern Japan and from intermediate localities to Tahiti, complete what is, by far,

the largest entomological donation yet made to the Australian Museum.

The monetary value of this huge collection is estimated at some three or four thousand pounds, but its value to entomologists is so great as to be difficult to estimate, suffice it to say that it would now be impossible to form one so complete and so rich in types as this which our public-spirited benefactor has presented to the State.

A. M.

SHELLS.

THE Waterhouse Collection of Mollusca has been generously donated to the Australian Museum by Mrs. M. J. Waterhouse. This fine collection has been long known and esteemed for the beauty of the specimens, representing in many cases all the known species of a group. When the fact that this famous collection is now housed in the Museum becomes known there will be many who will desire to see it, but it cannot be placed on view to any extent at present, owing to the limited space available. For many years past attempts have been made to have the Museum extended, but so far all these have failed.

Sixty years ago a similar collection was presented to the Museum by the late Thomas Walker and has been on view until need of space for exhibiting fresh specimens of interest to the public, such as the large Sawfish, has reduced this exhibit to a few cases. Since this donation no series of beautiful shells has been acquired at all comparable with the present magnificent gift. It would be a great, if not impossible task to parallel this collection today, as there are comparatively limited opportunities for acquiring fine specimens. When this collection was made Sydney was the port of the South Sea trade, and all the trading vessels were bringing in shells, sailors and masters being encouraged by the enthusiastic collectors of the past generation. Thus the peculiar and attractive Paper Nautilus, so fragile and so hard to preserve unbroken, appears in a complete series from the smallest to the largest, all the known species

being represented, some of them new to the Museum collection, and all in fine condition.

Again the famous Harps, which have delighted conchologists for ages past, are complete, including two species new to the collection, the larger beautiful species contrasting with the delightful lines and delicate colouring of the smaller but rarer ones.

Further, the Cowries, so beloved of the older collectors and still a source of delight to all, are a feast of colour and form, magnificent specimens, which would have enhanced the most famous of the great collections of the last century, when shell collecting was one of the pursuits of the wealthy and learned. The collection includes nearly all the species of this family, and is noteworthy also for the remarkable variation in some, such as the well-known Tiger Cowry, ranging from almost black to salmon red, for the well-known and famous Orange Cowry, discovered by Captain Cook just before he explored the east coast of Australia, and for the inclusion of seventeen species of Cowries from Sydney Harbour. Cowries are among the rarest shells to be found in Sydney Harbour; very few, even dead specimens, come to light over long stretches of years, but in 1895 Mrs. M. J. Waterhouse and her sons, by intensive searching, secured alive no less than one hundred specimens of Cowries, and in this number were represented no fewer than seventeen species, many of which had not been found alive before and most have not been seen alive since, though through the recent dredgings of the "Triton" some dead shells have been recovered. A curious feature of this discovery was the finding of so many species in such a restricted area, the majority being taken within a hundred yards radius at extreme low tide. Among so many noteworthy shells it is difficult to particularize, but attention may be drawn to a very fine specimen of an American cockle, which over six inches in length, ranges up to the greatest size recorded, while a very fine boring bivalve from California is also represented in its maximum growth, and was previously unrepresented in the collection.

In the collection is also a beautiful specimen of the Giant Golden-lipped Pearl shell, in its natural state, showing many coral growths and interesting associated animals attached to its upper valve; it will form an interesting exhibit for the public gallery. In most of the groups the specimens stand out on account of their perfect condition in form and colouring, and show that the donor spared no pains to obtain the choicest and largest specimens available. When the space and cases are available the donation will make a very attractive exhibit.

T. I.

ETHNOLOGY.

THE late G. J. Waterhouse some thirty or more years ago had many interests in the South Seas. He himself made several trips through the islands on trading vessels and thus had the opportunity of collecting specimens of ethnological interest. Through the good offices of his son, Dr. G. A. Waterhouse,

now President of the Board of Trustees of this Museum, some of the finest specimens contained in the collection have been presented to the Museum.

The collection contains some choice pieces from the Solomons, including a skull with features restored in Parinarium resin and inlaid with Nautilus shell, a fine inlaid club from Uji, as well as wands, bowls and canoe models similarly ornamented. An exceptionally interesting specimen is a spindle club, originally from New Ireland, which had found its way to what is now the Mandated Territory, New Guinea, where characteristic designs were carved on the shaft and head. This fine example of inter-insular trade has been described and figured in the *Records of the Australian Museum*.

Also included in the collection presented to the Museum are a number of shell ornaments from the Solomons, where the art of shell carving reached a high level, and domestic articles of various kinds from Mandated New Guinea.

W. W. T.

The Trustees have granted permission to Mr. H. O. Fletcher again to accompany the British - Australian - New Zealand Antarctic Expedition, which is returning to the South on the *Discovery* early in November. Mr. Fletcher was a member of the Expedition on the previous cruise, and Sir Douglas Mawson, leader, in thanking the Trustees, expressed high appreciation of his services during the voyage.

* * * *

Mr. T. Hodge-Smith, Mineralogist and Petrologist, was invited by the Mica Company of Australia to accompany a party travelling by motor truck from Sydney to the country north of Hart Range, Central Australia. By the generosity of a number of prominent Sydney citizens the necessary funds were obtained, and Mr. Hodge-Smith left Sydney for the interior on September 12. The grateful thanks of the Trustees are due to Sir Hugh Denison, Mr. R. C. Dixon, Messrs. Farmer & Co., Ltd., Sir Samuel

Hordern, Sir Kelso King, Mr. O. Phillips, Dr. J. R. M. Robertson, Mr. T. E. Rofe, and Mr. George Smith, who made donations towards the cost of the trip. Mr. Hodge-Smith will spend most of his time in a locality seldom visited by collectors, and it is anticipated that valuable accessions to the Museum collections will result.

* * *

Frequent requests for the loan of specimens for temporary exhibition or teaching purposes are received at the Museum, and, as far as possible, these requests are acceded to. Recently a collection of ethnological, mineralogical, and palæontological specimens was lent to the Department of Geography, Teachers' College, Sydney, for an exhibition held in that Department. A small collection of aboriginal articles was lent to Ascham College to illustrate an object lesson, and a number of specimens and diagrams, on loan to the Rangers' League, formed part of a Bushland exhibit at Messrs. Farmer & Co., Ltd.

Wild Nature on the Nullarbor Plain

BY CHARLES BARRETT, C.M.Z.S.

THOUSANDS of people have crossed the Nullarbor Plain without gaining much knowledge of its wonderful plant and animal life. Many of my fellow passengers on the Trans-Australian train, during several trips, were frankly bored when they gazed through the carriage windows upon the "limestone desert." But others displayed interest; and some there were who appreciated the treeless wonderland.

Early this year, after torrential rains had flooded wide areas of the Nullarbor, forming big lakes and small ones, the land was alight with wild flowers, while miles of greenness marked depressions where overlanding cattle might have "camped." Transformation never has been more beautiful; nor has the naturalist, who botanizes too, had richer opportunities, out in that lonely region, with its ribbons of steel, straight for three hundred miles, and their pendants, the stations and clusters of human habitations.

I was there in May, when the Washaway Lake, a dozen miles west of Forrest, was disappearing. The water was shallow and pea-soupy; poor in animal life, though the dip-net sometimes brought to light beetle and dragon fly larvæ, small crustaceans, water scorpions, and an assortment of those minute aquatic creatures that concern the microscopist.

Far out on the Plain, forty miles south of the railway, at a hole where the dingoes drink, I found clear water teeming with the pygmies of aquatic life. *Volvox* was there, rolling merrily amid hosts of *Estheria packardi*, a dainty crustacean, which like *Apus*, grows with amazing rapidity when a fall of rain has given it the chance to "live"! *Apus* I have seen, in Central Australia, thronging a pool which was almost dry a week before the rainfall. They could only have come from eggs in the pool, since *Apus* is not an overlander.

But the water-holes I visited on the Nullarbor are permanent, else dingoes would be far less abundant than they are in that region without a creek even. A mystery river came down from the north once; but, like the lakes that were formed this year, it disappeared.



This *Solanum* forms "purple patches" on the Plain. Its flowers are a beautiful rich purple colour.

[Photo.—C. Barrett.]

Aquatic life it was that lured more than one naturalist to the Nullarbor in the autumn. A botanist went in search of algæ. The harvest for all was disappointing. Taking all nature for my province, I gleaned among the wild flowers, in the blowholes and the caves, and, far south, on the high and rugged cliffs that rise from Hampton Plains.

MOTHS IN MILLIONS.

Miles on miles of plants in flower, with barren red-brown areas here and there, and islands of light green on the limestone that were bushes with clusters of orange-coloured fruits: a picture of the Nullarbor after generous rains. There were white flowers and yellow ones, crimson and purple kinds, and modest little blossoms



The way to the lowlands. This gorge, within coo-ee of the Overland Track, leads down from Hampton Tableland, practically the edge of the Nullarbor Plain, to well-timbered country. In the distance is seen portion of the high rugged limestone cliffs, which stretch east and west a distance of nearly two hundred miles.

[Photo.—C. Barrett.]

the colour of the sky. Most abundant was the Native Tobacco, whose white blossoms open widely at night to flood the air with fragrance. Millions of little brown and marbled moths were attendant on these flowers, even during the daytime. Butterflies were much less plentiful, but I noted everywhere the meadow argus and *Pyrameis*, the "painted lady," a little winged citizen of the world.

If the moths were legion, they had rivals, numerically, in the water-beetles, all of the one species, *Eretes australis*. The "lakes" and pools and shower-puddles were thronged by these pale-coloured insects with flimsy wing-covers. And, one night, at the Forrest hangar, water-beetles, lured by the powerful guide-lights, "rained" on the roof and invaded the big building. It was like a plague of Egypt! The floor of the hangar and the ground outside within the magic circle of illumination was covered in beetles, spinning on their backs, crawling stupidly about, or essaying flight only to nose-dive again or go zooming over the roof. It was an amazing moving picture of insect life. I shall not attempt to explain it. "Miracles" are wrought in the Central region: the rains are magical.

Beetle hunting out in the open was poorly rewarded, but in blowholes and caves I found species that are rare in collections, and one possibly new to science. *Brises acuticornis*, a fairly large, slow-moving brown beetle, typical of the arid inland country, on the Nullarbor is commonly a cave-dweller. It was at home in utter darkness, and many were captured on cave floors in twilight near the entrances, or where a blowhole, opening on a cave, gave a glimpse of the sky and threw a glimmering disc upon the deep grey dust and silt of ages.

Hours of seeking underground, with torchlight flashing over limestone walls and boulders and the dusty floor, where bats lay dead and *Brises* wandered, failed to yield true cave-beetles—blind insects such as are found in many caverns in Europe and America.

Under limestone blocks in the open, and also in caves, but not far from sunlight, I found *Saragus pascoei*, a tortoise-shaped, black beetle, cousin of the wonderful *S. floccosus*, which occurs on tree-trunks in northern parts of New South Wales, and bears on the upper surface a covering of flocculent appearance. *Pascoei* has no such protection; is not

camouflaged, though living so "close to the ground," it becomes neutral-tinted with sand and dirt.

Several of the Nullarbor beetles, notably *Saragus* and a species of *Helaeus*, reminded me of Sinai insects, which I met with during the Desert Campaign that freed Palestine from the Turks. Dr. P. A. Buxton, in his fascinating book, *Animal Life in Deserts*, deals with these Tenebrionid beetles. He terms them the "most remarkable black inhabitants of deserts." The majority of species are black, and nocturnal; others are diurnal. Possibly, as Buxton says, their ability to live on dry vegetable food "has enabled them to invade the arid areas of the globe." They have certainly colonized successfully the Great Palæarctic Desert, and are typical insects of our own country's arid inland regions. Here is a field for the specialist. If only one of our coleopterists would cease to be collector or systematist, and make intensive ecological studies, we should learn much more about Tenebrionid beetles!

HAUNTS OF LIFE.

All the blowholes examined were haunts of life. "Cave"-owls, as the birds are universally called by Nullarbor folks, shelter and nest in the large, deep holes, as well as in caverns. As every naturalist knows, they are Barn Owls (*Tyto alba*), or "delicate" owls, with paler plumage than is usual in their species. Beautiful and soft it is, and one could not wish to see a more charming nature picture than a cave-owl forms, perched on a rock in morning sunshine—a feathered troglodyte disturbed, and persuaded to pose before the camera.

Often, in descending a big blowhole, or exploring a cave, one puts a Barn Owl to flight, or at least wakens it. Great eyes glare at the intruder, and their owner may "chitter" shrilly at him, or, on wings of silence, go over his head—out of darkness into the light. These Nullarbor birds are intriguing. Three I saw in captivity at Madura Downs homestead, below the high cliffs that dip down from the plains.

But owls are not tenants of the smaller blowholes, so abundant north and south of



A baby Barn Owl. This species is a cave dweller on the Great Basin. It uses blowholes and caves as retreats for nesting sites.

[Photo.—C. Barrett.]

the Trans-Australian Railway—wherever you travel on the Plain. From many I took spiders and beetles, silverfish, centipedes and scorpions. Sixty miles south of the railway the first shells were found—several species, all abundant under stones and in their crannies. Snails contrive to live somehow, even where, in a rainless year, the land has a "dusty face" and no green thing grows except around the rock-holes.

SPIDER LIFE.

Spiders, of many species, abound on the treeless plain. My collection contained representatives of not fewer than ten families. Under bushes and boulders, and out in the open, spiders were at home. Trap-door species were, in most places, most numerous. One kind lived in a castle, or rather had, above its vertical burrow, a little turret built of limestone pebbles and bits of hardened clay. A clever artisan, this spider lives deep down; it was difficult to secure one.



The famous "Barking Lizard." When annoyed it assumes this comical attitude and often stalks along on stilts.

[Photo.—C. Barrett.]

Over the bare ground, in sun-dried depressions where water had lain for awhile, the gem of Nullarbor spiders ran swiftly as those shining green tiger-beetles do on salt-lake shores, and other kinds on tropic beaches. *Lampropodous scintillans* is decorated with iridescent tufts of hair on the legs—the ends of the tarsal segments. Rainbow colours make them gleam in strong sunlight, and magnified the tarsal tufts are beautiful as a cluster of elfin gem stones.

Another Nullarbor spider is *Miturga gilva*, which was found under stones. It is wide-ranging, occurring in Queensland, New South Wales, and Victoria, as well as in Western Australia. But more engaging than *Miturga* was *Ariadna thyranthina*, living in holes on the Plain. Around the "doorway" of its home, *Ariadna* spins radiating silken threads, which are attached to the burrow's inner lining. Unwary ants and other insects trip against these threads, and thus signal their presence to the lurking spider. The trip-threads are telegraph lines!

At a long-deserted bore, south of Loongana, I discovered all manner of "small deer." A log yielded giant cockroaches; ant colonies were disturbed by the overturning of rusty petrol tins and old wooden boxes. Beneath a bit

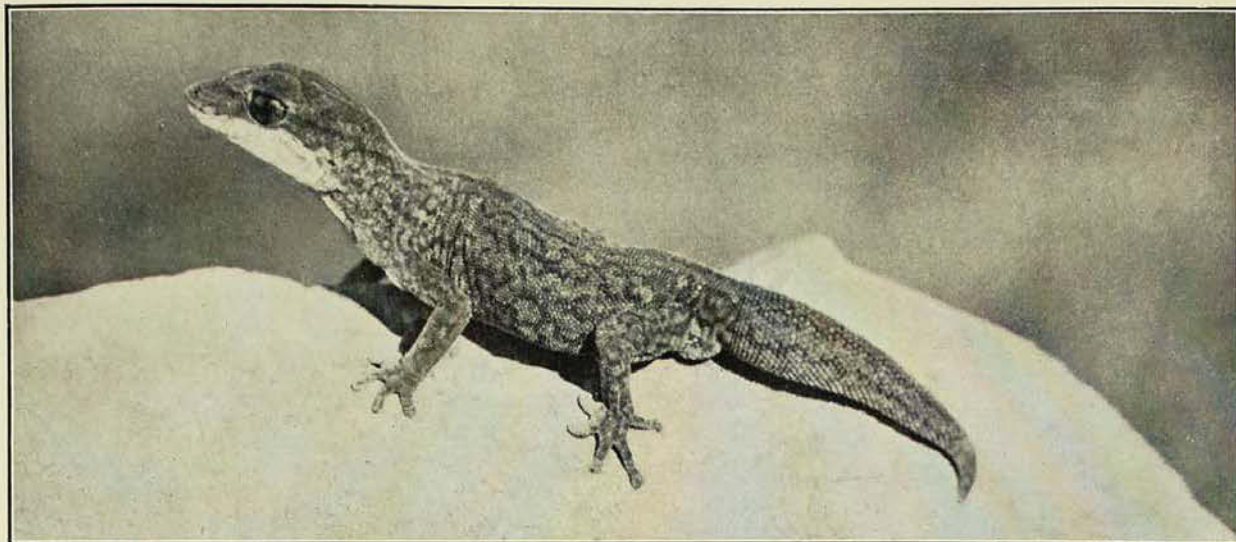
of rotted sacking lived a family of web-spinners, those curious insects of which we know so little. My collection contained two forms, one probably undescribed.

Ant life was less abundant than expected; lacking in many localities. Still, about twenty species were collected, two being new to science. Honey ants I did not see. Termites, several species, were plentiful in places. As for flies—they are the plague of the Plain. Even in May, while the sun was in the sky, the attentions of flies were almost intolerable. They are not worse in Egypt!

"BARKING" LIZARDS.

There are snakes on the Nullarbor, but rarely did I see one. Lizards, of course, are far more numerous, and get good hunting among the saltbush and lesser plants and the innumerable boulders. Little fellows mostly, quick upon their ways, though some kinds are leisurely and easy to capture.

Oddest of all the lizards on the Nullarbor, excepting only *Moloch horridus*, which keeps more to the sandhill country than the Plain, is the "barking" Gecko (*Gymnodactylus milicisii*). It is never more comical than when annoyed, for it stands on tiptoes then, and strikes an



A small lizard of the Plain (probably *Gehyra variegata*).

[Photo.—C. Barrett.]

attitude—a lizard on stilts! The barking, for which it is famous, is a subdued sound, such as a very young puppy might make when suffering from a cold. A game little reptile this gecko is, springing at a hand held near it, and biting bravely. Sometimes two or three “barkers” were discovered under the same stone.

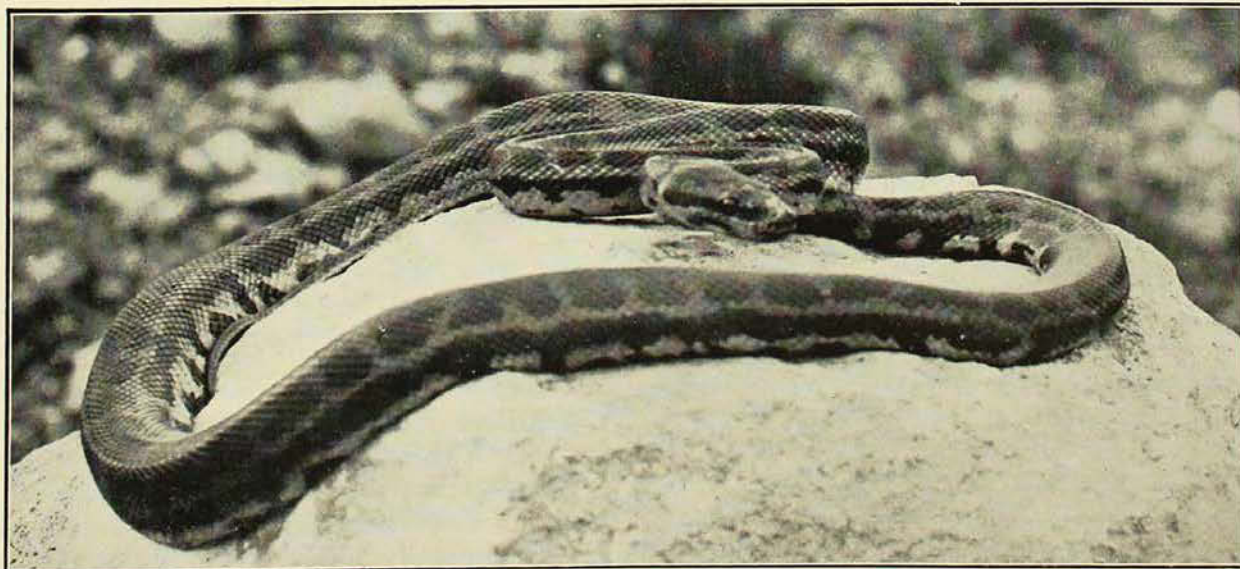
The genus *Amphibolurus* was represented by the Rusty Dragon (*A. rufescens*), variable in coloration from brick-red to

rusty-brown; and the Painted Dragon (*A. pictus*), handsomest of all our smaller lizards, when richly coloured: all specimens do not have the blue and yellow and red markings brilliant.

Another small lizard was attractively freckled: a study in fawn and brown-grey.

HOME BUILDERS.

House-building Jerboa-rats (*Leporillus conditor*) are so plentiful on the Plain that scores of their stick-homes may be



Carpet snakes are not uncommon among the boulders of the high cliffs that dip down to Hampton Plains—sixty to seventy miles south of the Trans-Australian Railway.

[Photo.—C. Barrett.]

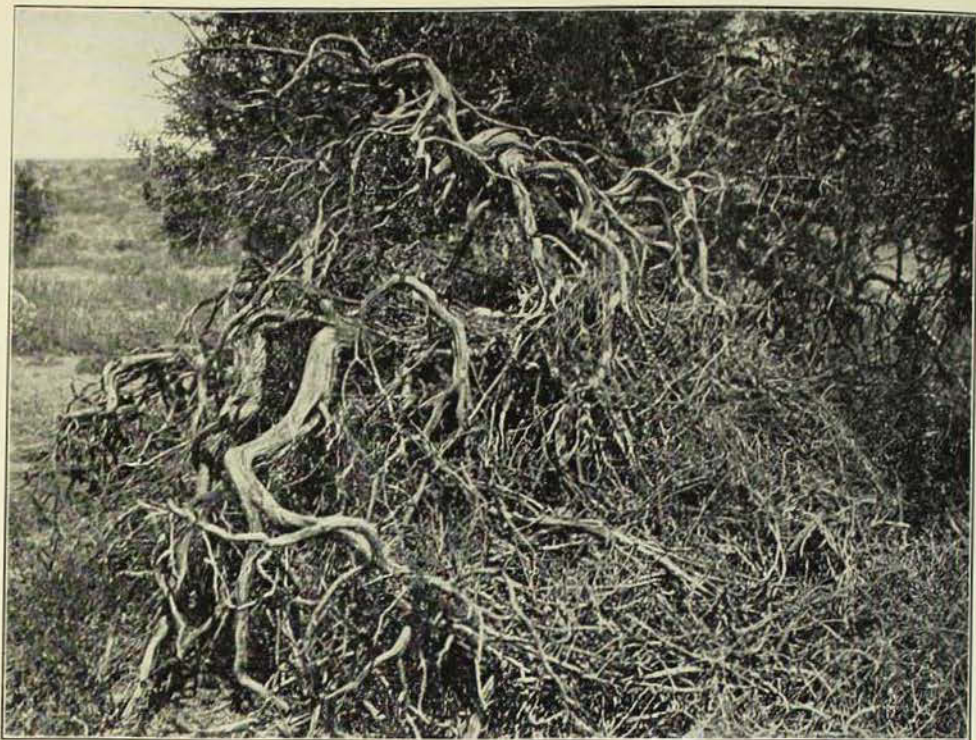
seen in the course of a day's journey. In one donga I counted five; while another had three; but often the "houses" were isolated.

The habits of *Leporillus* have been well described already in this MAGAZINE, by more experienced naturalists than the writer of these rambling notes. I can add nothing original, though my travels took me to spots unvisited before by a naturalist. Where the trees begin, on Hampton Tableland into which the Nullarbor merges, far south of the Trans-line, not a Jerboa-rat home was seen. These mammals are dwellers on the Plain. Many a dome of sticks was found in a rabbit-warren, with two or three bolt-holes round about it. Rarely was one of the home-builders observed: they are of retiring habits, at least when intruders come curiously prying into their manners and customs.

Rats and mice and bandicoots are inhabitants of the Nullarbor. Doubtless new kinds await discovery. I heard, for instance, of a striped marsupial, a bandicoot whose description doesn't tally with any given in the books on Australian animals. The man who observed it is well informed, a good field naturalist, who could name all the birds of the Plain, and most of its mammalian fauna, too. He declared that rich harvests would reward an expedition to the south-western portion of the Nullarbor; and maybe he's right. We are far from knowing everything about wild life on the treeless plain.

UNDERGROUND SECRETS.

Discoveries in the underground world of the Nullarbor some day may startle all Australia. Hundreds of caves await exploration, if one believes half that is told or conjectured. Certain it is that



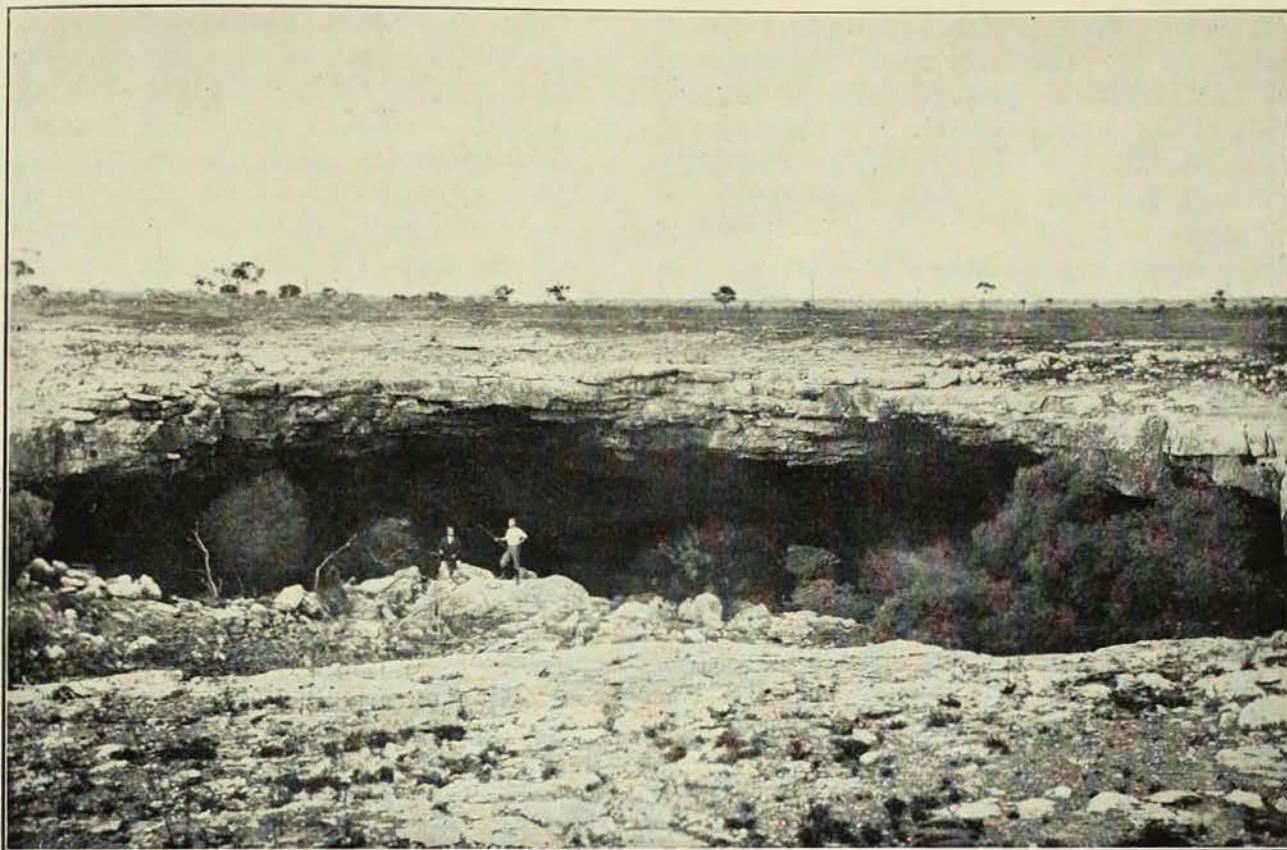
A typical stick-nest built by the native rodent, *Leporillus conditor*, with the eggs of a Striped Hawk in a depression on top. Note how the sticks are interlaced with the gnarled branches of the shrub.

[Photo.—E. le G. Troughton.]

many large caves, and a network of small ones, exist in that region. None hitherto examined is very notable from the spectacular point of view. Jenolan has little cause for worry. Her sister, Nullarbor, is unlikely to be a rival in beauty of jewelled chambers and glittering "shawls" and shrines.

But Nullarbor has mystery caves, and few have been thoroughly explored. Not a dozen people have even looked into Dingo-donga, the Cave of Bats, where I spent a few hours searching for eyeless beetles and the like. The donga, from which the cave is entered, itself is wonderful: a vast hole seems to have been punched out of the limestone. It is large enough to hide a battalion of soldiers, or to be an arena for circus sports.

Dingoes frequent the dongas, and camp in some of the caves. The Nullarbor indeed is Dingo land. Trappers do well out there. One told me that he averaged £15 a week, and often made £20; peak periods were even more remunerative. He sets hundreds of traps over a wide range. Stone structures, that might be



Dingo Donga. This cave, a haunt of small bats—the main chamber is only partially explored—has secrets to reveal.

[Photo.—C. Barrett.]

relics of a lost Stone Age race, are familiar objects on parts of the plain. They are quite modern. Trappers build them, placing their poison-baits against the hinder of three walls, and hiding the

traps in the open “doorway.” Pelts are worth £2 each, bonus money. Is it strange that dingo trapping has become a thriving trade with dozens of men, and the week-end sport of many others?

The Secret of Sight

Translated from *Das Echo*, by MR. O. C. BEALE, Trustee, F.R.S.Litt.

The following short article is a literal translation from the German, and contains a startling significance for those who have studied Professor Sir Jagadis Chunder Bose's amazing works, *The Motor-Mechanism of Plants*, *Plant Autographs and Their Relations*, and *The Nervous Mechanism of Plants*. These contain no mere guesses, or hypotheses, but demonstrations by chemical, electrical, and mechanical apparatus that provide actual objective records which he may read who runs.

THE human eye has often been compared with photographic apparatus. Through shutter and lens the light rays enter and are refracted so that the sensitive plate yields a sharp image. The iris of the eye represents the shutter, and the retina,

which, besides its tiny rods and cones, possesses a mysterious substance named the visual purple, represents the sensitive plate.

In one very important feature, however, the eye is superior to the photographic

plate, inasmuch as by means of this visual purple, it is sensitive also to colours, whilst the plate can obtain only the values of light and shade. In this visual purple we have, therefore, a specially important substance which may yet solve the riddle of sight.

The latest researches into the photochemistry of the eye, as recently reported upon, bring us nearer to an understanding of this process, which may well be described as the most important in the human organism. When, for instance, the visual purple in the eye of a frog is more closely examined, the observer is surprised at the paling of the carmine red colour and its final change to complete pallor. As the light strikes upon it the visual purple alters its colour; it becomes bleached as do all colours that are not "true." But the visual purple possesses the faculty of regeneration, that is to say, it attains once more its original colour without the intervention of any external influence. Taken into the dark, the purple which has faded through illumination becomes again carmine red.

Involved in this is a chemico-physical process, for probably the tiny rods and cones of the retina influence the alteration in the visual purple, serving to conduct to the optic nerves and the brain the impulses thus received. In order to study the regeneration of the visual purple the attempt has been made to produce colour solutions of this substance. By enormously painstaking and prolonged labours, Professor Weigert, of Leipzig, and the Japanese savant, Nakashima, have obtained a gelatine solution in which the visual purple can be dissolved.

These gelatine plates, in which the fine subdivision of the colour material retards in a remarkable degree the physico-chemical processes, permit a study of the optical processes as in photographic plates. Unlike what happens in the eye, wherein every moment pictures are "photographed" and "developed," the process here becomes in a measure drawn out, and by the aid of the most delicate apparatus even measurements can be carried out of the separate phases of illumination. This introduces an entirely new epoch in the research into the processes of sight. Thereby, too, the investigations of Professor Kögel, of Karlsruhe, into the processes which take place in the retina are more exactly explained; they present a great similarity to the assimilation of carbonic acid by plants.

In the case of the plant it is also a colouring matter, chlorophyll, that performs the chief rôle in the process. The Professor, by smearing a visual-purple solution on simple bromide of silver plates, attempted to make the gelatine layer more sensitive to certain colour tones, but without success. The silver-bromide plate proved to be non-receptive, but, on the other hand, a silver-iodide plate became sensitized by the visual-purple solution, that is to say, became more receptive. This non-sensibility is probably a question of oxygen transference. Professor Kögel regards sight as a kind of breathing process and, indeed, a photochemical cell-breathing. This process in an organism is quite easy to understand, inasmuch as the retina being richly supplied with blood vessels, possesses in the blood an excellent carrier of oxygen.

The Great Whales of Australia and Antarctica

By DAVID G. STEAD.

[In the following article Mr. Stead shows that the southern whales are an important source of wealth, and that at the present time they are plentiful. It is obvious, however, that with modern methods of whaling their numbers will be rapidly reduced unless international measures are taken for the supervision and regulation of whaling in Antarctic waters.—EDITOR.]

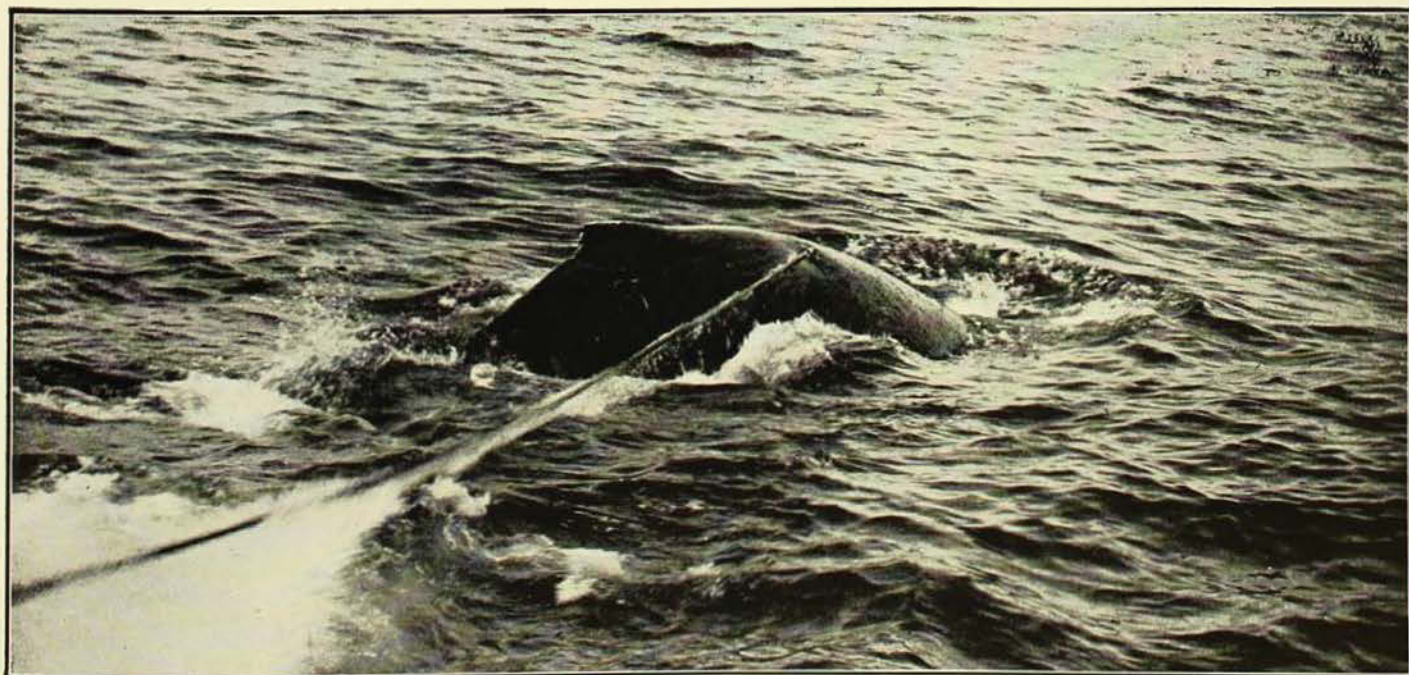
THE success attending recent whaling operations in the waters of Antarctica, notably in the Ross and neighbouring seas, and on the north-west coast of Australia has directed attention to the subject of whaling more than ever before in our history. The almost inexplicable thing has been, however, that Australians should have been content to allow people from distant lands to snatch up the vast store of sea wealth lying at their own doors.

Away back in the "eighteen-forties," two kinds of whales were obtained—the great Sperm Whale or Cachalot (the "Moby-Dicks"), and the Southern Right or Black Whale. During that period the world fleet of whalers numbered over eight hundred sail! Most of these were from America, and sailed, at least

nominally, out of Sydney Harbour. Yet the total catch (as far as oil is concerned) of the whole of that vast fleet was not as great as that of just a very few of the great modern factory ships now operating in southern seas.

During the operations of these old-fashioned sailing whalers they very often encountered immense schools of finbacks or rorquals, but these they were unable to capture, partly because of their strength and speed, and partly because they sank immediately after being killed, there being no means of sustaining the mighty carcasses in the water until they could be flensed or treated at the ship's side.

So things went on until, in 1868, a Norwegian, Svend Foyn, after years of experiment, devised the "grenade harpoon," fired from a special gun, from



Humpback Whale at moment of "sounding." The harpoon has just entered the beast causing almost instantaneous death. Off Point Cloates, Western Australia.

the bows of a sprightly steam chaser vessel. This device is the great factor in all modern whaling operations in the world, and to the inventor is owing the wealth, running into many millions of money, that has been taken, chiefly in southern seas, and principally from the finback whales. From the decline of old-time whaling till about twenty-six years ago, whaling in the Southern Hemisphere, except a little under antiquated conditions, was scarcely thought of. Then began an invasion of Antarctic waters by the Norwegians with up-to-date methods. At South Georgia and nearby waters the progress was so great that in 1911 alone no fewer than 7,000 whales were killed. In the following year this total was eclipsed and other areas also yielded marvellous catches. Prior to this I had been recording the annual visitations of whales to Australian waters, having, in 1905, enlisted the sympathy of lighthouse keepers and other observers from whom I received monthly reports. These records indicated the presence of certain finback whales, especially the fat Humpbacks, at definite seasons simultaneously on both sides of the continent, the whales sojourning in our waters from June until October. During the first part of this period they journey northward and in the latter part return to the southern regions. A great difference was noted, however, in the area covered in a comparison of eastern and western Australian waters. Whereas on the east the whales appeared to concentrate, or to converge, at a point about the latitude of Jervis Bay on the coast of New South Wales, those on the western side travelled as far north as Point Cloates, right inside the tropic of Capricorn, before beginning to disperse. I have not space to go into the question of the causes of these migrations, but merely stress the fact of the annual movements of these great whales. Of course, the whales are frequently found north of the points mentioned, but those are regarded as the concentration points.

AUSTRALIAN OPERATIONS.

The interest of Norwegians in whaling in Australian waters was enlisted just

prior to the Great War, and some trials made with one of the newly devised factory, or mother, ships, within sixteen miles of Point Perpendicular, Jervis Bay, resulted in the capture of 525 whales. During the same period the Norwegians also experimented on the southern and western coasts of Australia, where whales were found to be plentiful, notably in the vicinity of Point Cloates, on the west. Then came the war, which put a stop to all whaling operations in these seas.

Immediately the war was over, the great trek southwards set in, and Antarctica became the new El Dorado for the seekers of sea wealth. Then came the Ross Sea, which, during the last few years, has yielded immense returns, one vessel alone securing about one million pounds' worth of oil in the last three years. In the meantime, the Australian resources began again to pay tribute, and during the last four seasons a total of nearly 3,500 whales has been taken from one spot, Norwegian Bay, immediately north of Point Cloates in Western Australia; 1,036 of these were taken last year. The Ross Sea operations are carried on from the floating stations (factory ships), but the work in Australian waters was performed in conjunction with a land station, which is one of the most successful in the world. There is every indication that a similar station might be established in the vicinity of Jervis Bay. Whether for a land or a floating station, the whales are captured by gunboat whalers or chasers armed with the great harpoon guns. The harpoon weighs about one hundredweight and has an explosive head. To the haft of the harpoon is attached the heavy rope which holds the whale to the chaser. After death the whale is reeled in to the side of the vessel, air is pumped in to sustain the carcass at the surface, and it is towed, with others, to the factory, where it is flensed, that is, the blubber is stripped off for treatment in the steam digesters. Land stations are more economical in that they are more readily able to utilize the whole of the carcass, oil being extracted from every part and whalemeal or guano made from the dried flesh and bones.

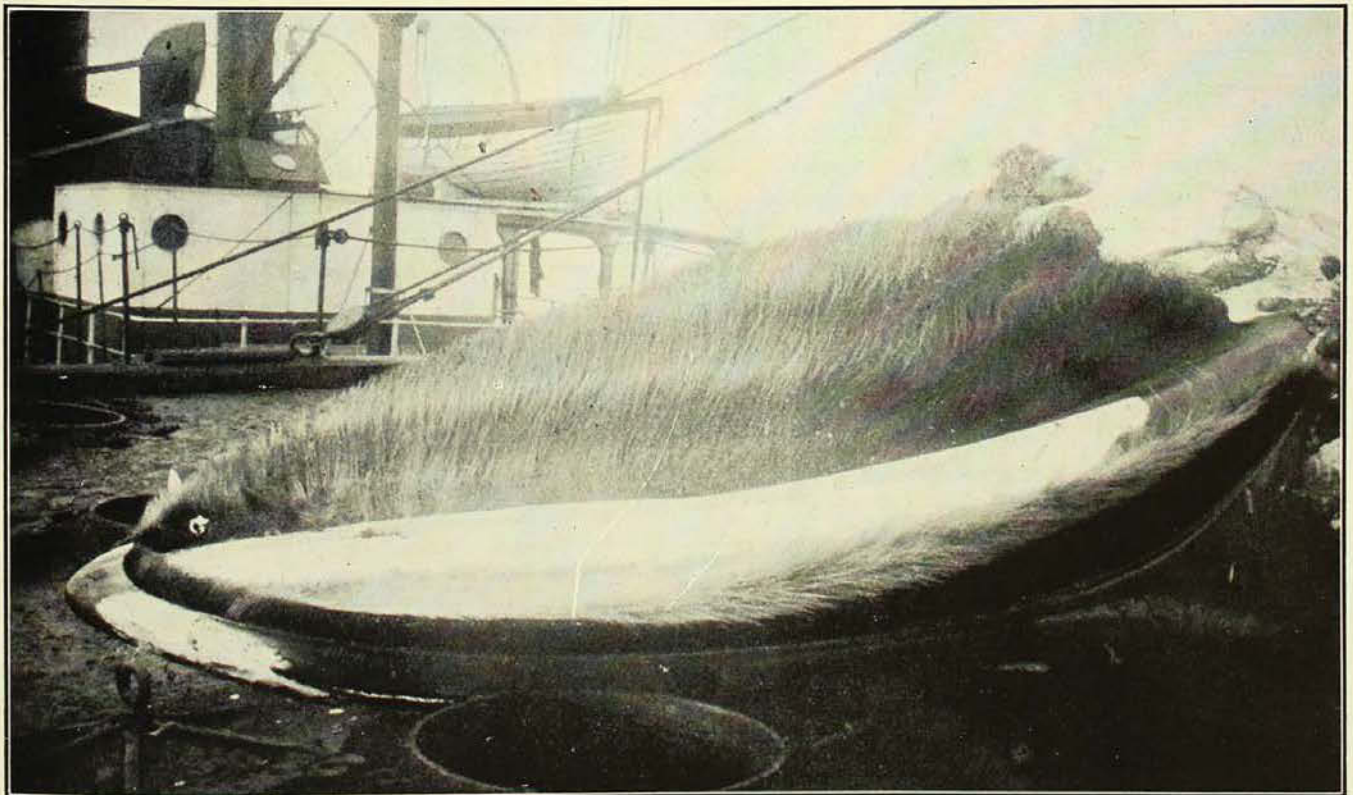
THE WHALES THEMSELVES.

The great natural group of whales, including the dolphins and porpoises, forms the division of animals known as Cetacea. Cetaceans are warm-blooded, air-breathing, fishlike mammals, but in nowise related to fishes. Unlike that of a fish the tail is set horizontally. The only other "fins" are the pectoral flippers and the dorsal fin. The latter is practically only an extension of the skin and is not possessed by all species (it is absent in the Right Whales), but in some, for example, the Killers, it is very high indeed. The pectoral flippers are of particular interest, for they are homologous with the arms or forelegs of the terrestrial mammals; undoubtedly, all whales are of terrestrial origin.

The cetaceans are divided into Whalebone Whales or *Mystacoceti*, and Toothed Whales or *Odontoceti*. The largest existing species belong to the former group, but in both groups are to be found whales which are commercially sought.

The Whalebone Whales received their common name because of the presence of

large numbers of laminae or plates of baleen or "whalebone," which depend into the mouth from the upper jaw. These plates vary greatly in number in the different species, reaching as high as 400 sheets to the side in the Greenland Whale. In length, likewise, there is the greatest variation, ranging from eighteen inches up to as much as fifteen feet. In texture also there is a very great diversity, the fringed edges in some being very heavy and coarse, while others are like hair. The baleen plates are very thin and close set, but not touching each other, so that a free passage is left between them for the passage of water while feeding. The bases of the plates are wide, and from here they taper regularly all the way to the lowest point. The plates are set obliquely, so that the inner edge is well ahead of the outer, somewhat like the gills of a fish, so as to expedite the passage of water. Were it otherwise the open mouth of the whale would simply be a water trap forming an obstruction to the leviathan's passage. The outer edges of the baleen are more or less straight and quite smooth, but on their inner edges



A side view of the brush-like ends of the whalebone plates in the mouth of a Humpback whale. The head is upside down and the lower jaw has been removed.

[Photo.—David G. Stead.]

the fibres of which they are composed are frayed or fimbriated so as to present an even hairy surface over the entire upper part of the mouth, except the palate which is of an extraordinarily soft and yielding smoothness. These frayed ends of baleen make an exceedingly efficient hair-sieve to strain out the food.

FOOD AND FEEDING.

The Whalebone Whales subsist usually upon the tiniest pelagic organisms, collectively known as plankton, particularly a small shrimp-like animal known as *Euphausia*. These organisms are so small that it amazes one to think it possible for such a vast creature to succeed in capturing them. To open one of the great stomachs containing, say, one hundred to one hundred and fifty gallons of plankton, to search through the baleen, the tongue, and the palate over which all the food has passed and not to find even one of these organisms is ample testimony to the efficacy of the baleen strainer.

The baleen plates are very short anteriorly, becoming gradually longer until the longest is reached at, roughly, two-thirds of the distance from the point of the snout to the opening of the gullet. From here they diminish, and we find a few separated hairs of baleen on each side of the gullet entrance.

When feeding, the whale swims along with jaws extended, the baleen plates bridging the gap on each side but not in front. Thus a kind of tunnel is formed, open at the anterior end and with the gullet closed.

This mouth "tunnel" is larger inside than at the entrance. As fast as the water runs in at the snout it is passed through the baleen sieves on each side, the contained organisms becoming entrapped by the frayed-out baleen fibres. This process is probably continued until the sieve is clogged with the food-organisms, which gradually collect in a comparatively dense mass posteriorly, when the mouth is closed and the contents swallowed.

COMMERCIAL WHALES.

The commercial whales found in the waters of Australia are identical with

those of the Antarctic regions, though the distribution in quantity is different in the two regions. The principal kinds are as follows:

(a) Whalebone Whales: Blue Whale or "Sulphurbottom"; Common Finback Whale, Black Finback or "Finner"; Humpback Whale; Pollack Whale, Fish Whale, or "Seihval" of the Norwegians; Little Pike Whale or Piked Whale (the "Grampus" of Eden fishermen); Southern Right Whale or Black Whale.

A small mystacocetid whale known as the Pigmy Right Whale (*Eubalæna marginata*) is also occasionally seen; this rarely exceeds a length of twenty feet.

(b) Toothed Whales: Sperm Whale.

There is also a very interesting form known as the Pigmy Sperm Whale (*Kogia breviceps*). This attains only about eight or nine feet in length, however, and cannot be looked upon as a commercial kind. The great Killer or Killer Whale (*Orca*), and the various species of dolphins, including the great Blackfish Whale or "Bottlenose" (*Hyperoodon*), are also members of this section, but they are not hunted in these seas.

Blue Whale or Sulphurbottom (*Balænoptera musculus*).—There is no doubt that the Blue Whale of our southern seas is identical with that of the North Atlantic. The very suitable name Blue Whale was given to this kind by the father of modern whaling, Svend Foyn, and is in general use by all whalers. In colour the body is of a general bluish grey, flecked with cloudy lighter patches, very light underneath, frequently with a tendency to a yellowish or sulphur-like tint, and darker on the back.

The Blue Whale is the largest of all living animals, and, as far as we know, it is the bulkiest creature that ever existed on this planet. It exceeds a length of 100 feet, and there is one trustworthy record (by an experienced whaler) of about 130 feet. One that was cast up at Twofold Bay, New South Wales, in its efforts to save its 45-foot baby, measured 98 feet. The average of those captured on the coast of New South Wales in 1912 and 1913 was about 70 feet, though some were about 85 feet

long. Compared to the Right Whale, this species is of rather slender build; but there is much variation according to the season and the condition of the whale. Those found on the Australian coast are not so stout as those in the colder Antarctic waters.

Its small dorsal fin is set far back over the tail, and is variable in shape. The tail shaft is very highly compressed, so that the dorsal and ventral edges form almost an acute ridge.

All the finback whales, Blue, Common Finback, Humpback, Pollack, and Pike, have strongly marked ridges and furrows on the throat and belly, called the "corduroy." The skin between the ridges is more or less extensible, allowing great expansion in taking deep breaths of air on coming to the surface after sounding or during gestation. In the Blue Whale the corduroy is very fine. This corduroy begins from near the point of the lower jaw and ends at the anal opening, thus covering the whole of the lower surface underlying the tongue, the thorax and the abdomen.

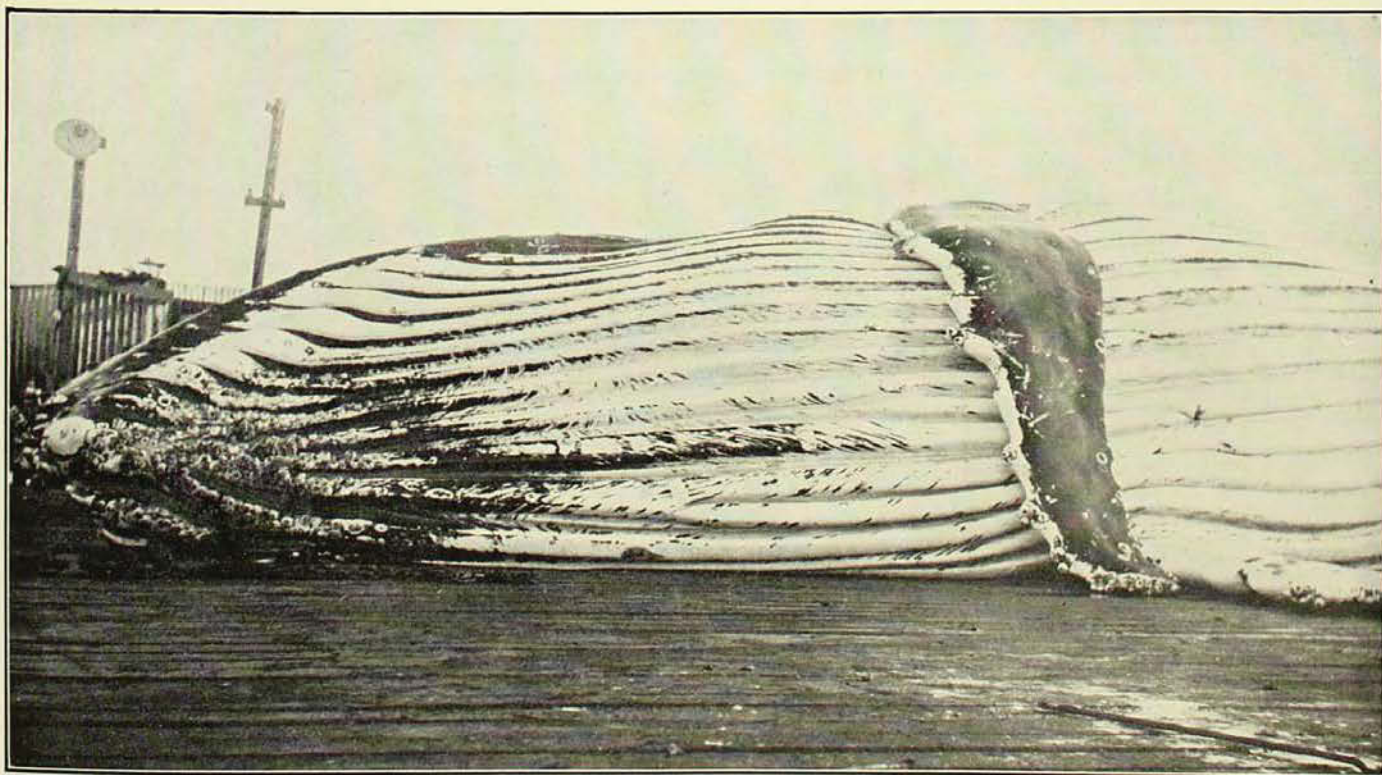
In the Blue Whale the blowholes are situated in a depression slightly below

the general level of the back. The whalebone is thick and black or blue-black throughout, including the frayed bristle-like ends. The palate is very narrow and prominent, of a shining black and remarkably soft to the touch. The tongue is of a uniform deep slaty blue.

None of the finback whales can stay under water for a very long time as compared with the Right Whale and the Sperm. Experience in these and other seas indicates that the Blue Whale usually disappears for from eight to ten minutes between "blows," although I am informed by one highly experienced whale shooter that he had seen one off the coast of Japan which submerged for twenty-eight minutes.

Each of the large whales may be recognized at a distance by the expert whaler, because of essential differences in the "spouts." The Blue Whale has a somewhat broad vertical spout about eight to ten feet high.

It is not usual to find female Blue Whales of less than about 70 feet in length containing young. These are large at birth and appear to attain to about



Belly and Throat of Blue Whale. Note the wide corrugations of the corduroy. Also the growth of large Acorn Shells or Barnacles and the great flipper.

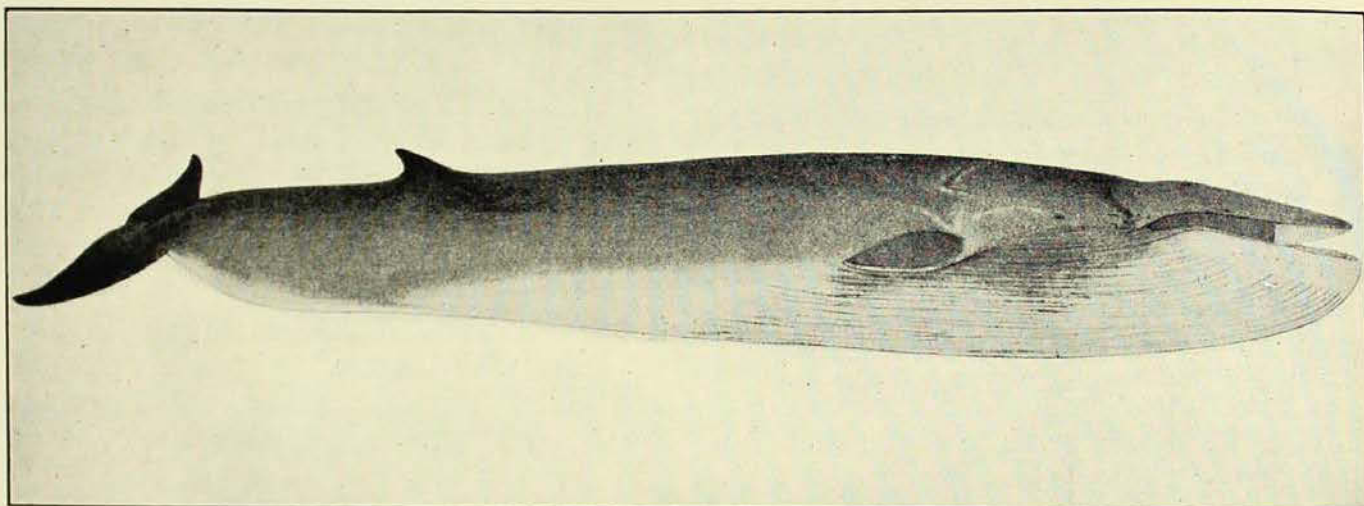
60 feet in length in not more than three years, perhaps less.

The Blue Whale is the species mostly sought by the Antarctic whalers, just as the Humpback is the most profitable in Australian waters. About 20,000 whales per annum, chiefly Blues, have been taken in Antarctic waters during the last few years. If the whale is large and in good condition it will yield 80 to 100 barrels. Enormous cargoes of oil have been brought back in recent years, as much as 116,000 barrels being brought in one ship.

The whole of the head, trunk, and tail in this whale is of a deep blackish or blue-black colour, hence the name of Black Finback so often applied to the species.

The palate of the Common Finback is very prominent, narrow and is creamy-white to flesh-coloured over the greater portion, becoming blackish posteriorly. The tongue is bluish-grey, with whitish or flesh-coloured patches.

As in the Blue Whale, the usual time between "blows" is from about eight to ten minutes, with an extreme of about



Common Finback, or "Black Finback," Whale (*Balænoptera physalus*).
[After True.]

Common Finback Whale or Black Finback (*Balænoptera physalus*).—In general shape this whale is very similar to the Blue Whale, but is still more elongate or fishlike. Though growing to a very great size, it does not attain anything like that of its gigantic relative, and from about 65 to 70 feet seems to be the usual length. The body is exceedingly slender and has rather fine lines, so that for this giant may be claimed a certain elegance of form not usually associated with whales. The pectoral fins are small as in the Blue Whale, and the dorsal fin is rather high. The tail fin is beautifully shaped and fishlike—about 15 to 18 feet across! The ridges of the corduroy are not so narrow nor so numerous as in the Blue Whale, but very much narrower than in the Humpback. Each ridge is fairly square in section.

fifteen minutes. The "spout" is about the same height as that of the Blue Whale, but is narrower. In both species about eight to fifteen breaths are taken before the animal again sounds.

As to food, it is interesting to note that all specimens examined by me had the same species of small crustacean in the stomach as have the Blue Whales. This is normal, but the Black Finback is known to swallow fishes at times, mostly herrings apparently, and my friend Captain Ellefsen, an experienced whaler, tells me that he has taken from one as much as five to seven barrels of the fish known as the Capelin (*Mallotus villosus*). There are also records in literature of a somewhat similar nature.

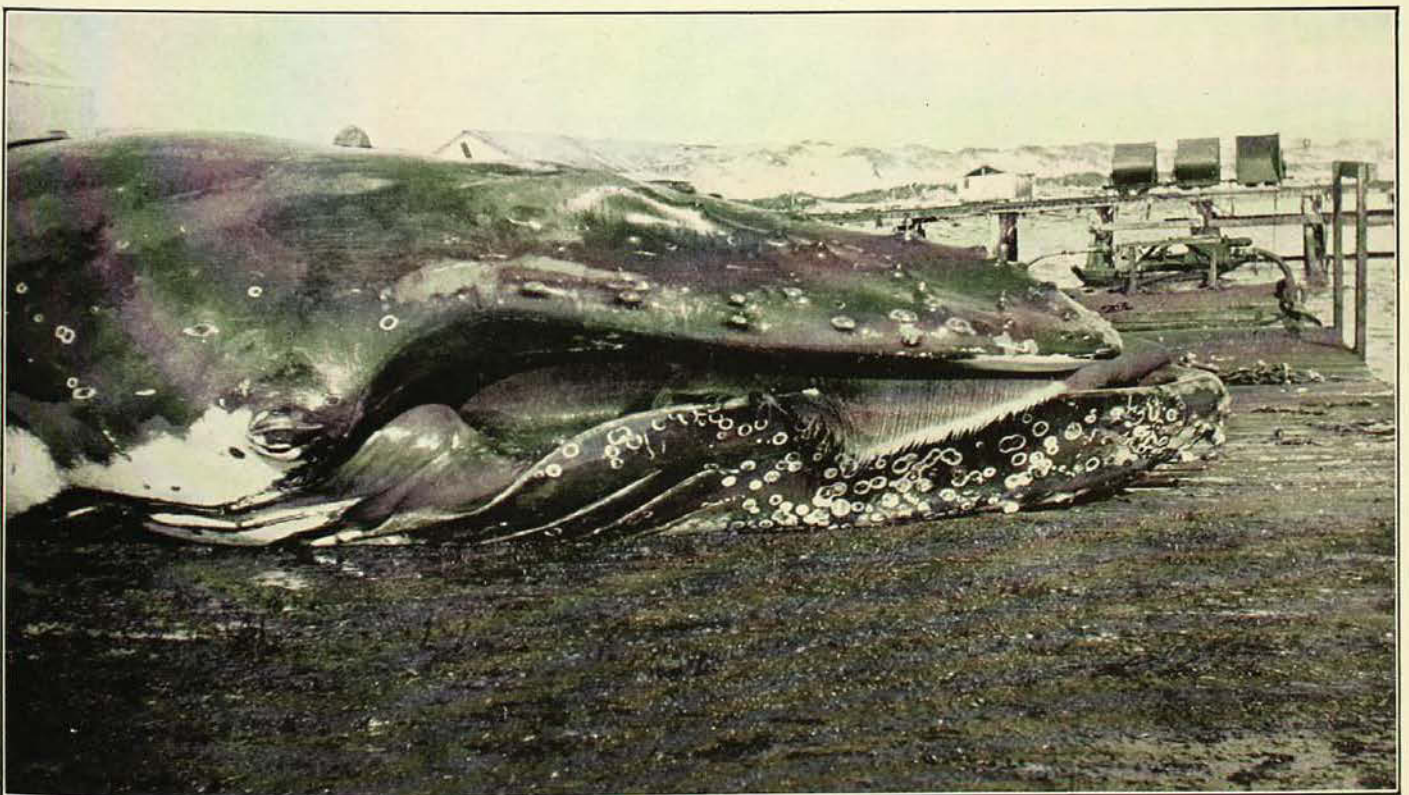
This whale is very abundant in many parts, but is not so much sought after as is the more valuable Blue. It is of

importance to mention, though, that this kind is the most valuable for providing whale beef, which is taken from the sides of the great tailshaft. It is excellent meat, suitable for stewing and for pies, and not a bit oily as some might imagine.

Humpback Whale (*Megaptera nodosa*).—Although not one of the very largest of the commercial whales, this species is the most important occurring regularly in Australian waters. I have already referred to the capture of 1,036 of the species at the Australian Whaling Company's station at Norwegian Bay, near Point Cloates, north-west Australia, during last season. These were taken from about mid-June until the first week of October by only four chasers, giving some idea of the extraordinary concentration of one species at this point. Of those taken in experimental cruises in the vicinity of Jervis Bay also the bulk were Humpbacks. There are at present enormous natural stocks of this species in southern waters, and they are remarkably rich in oil considering their size. With an average of 40 to 45 feet in length,

the yield of oil is about 38 to 40 barrels per whale in Australian waters—say £200 worth of oil per whale.

The Humpback is of massive build, the blubber thick, and the oil of good quality. The head is peculiarly flat and obtuse. The corduroy ridges are very broad and correspondingly few. The pectoral fins are of enormous size in the Humpback, and are certainly the most outstanding feature, reaching to one-third of the total length of the animal. Apart from the tumorous swellings, caused apparently by parasitic barnacles (*Coronula*), there is a series of knobby protuberances along each pectoral fin; these corresponding with the digital and other bony joints of the limb. The Humpback seems almost to be proud of its land animal ancestry, maintaining as much of their features outwardly, as possible. The dorsal fin is low and very thick at the base, erect and somewhat falcate or sickle-shaped, with the front margin usually concave near the middle, giving the fin a peculiar hooked appearance that is very characteristic when the whale



Head of a Humpback Whale showing the tongue and whalebone. Observe also the skin scars and ring-like maculae left by the large barnacles, and the tumorous swellings.

[Photo.—David G. Stead.]

is seen at the surface. Sometimes the blubber at the base of this fin is greatly thickened in the form of a hump. The humped appearance is accentuated by the bending of the body as the cetacean dives. The tail flukes are broad, with concave anterior and convex posterior borders. The tail fin has not the elegant shape of that of the Black Finback. On various parts of the head and lips are numerous tumour-like growths. While some of these are probably caused by the barnacles, it has to be remembered that the Humpback fœtus shows some similar swellings. There are also a number of low smooth swellings on some of the softer portions of the body, and these likewise appear to be the result of parasitism.

In none of the whales is there such an extreme range of variation as is to be found in the Humpback. This applies to both form and coloration. Some are stout and some are slender, while the shape of the tail and flippers is variable. In colour there is a complete range from almost uniform black to some that are nearly three parts white. Normally they are black on the back and white mottled with black on the belly.

The whalebone is short and the plates broad in this whale. The skull is very broad and of heavy build.

On the lips of each Humpback examined by me have been, plainly visible, a number of short bristle-like hairs, evidence of the terrestrial origin of these animals.

The largest of these seen by me was 55 feet in length. There is one ancient record giving a length of 88 feet.

In sounding, the Humpback does not go very deep, and usually stays under about six or seven minutes, with an extreme of about ten to twelve minutes. About seven to ten mighty breaths are taken before sounding again. The "spout" is very broad and about six feet high in these latitudes.

Because of its abundance and regularity of occurrence, the Humpback is undoubtedly the most valuable commercial whale on the Australian coasts.

SPOUTING.

The popular notion about the whale spouting up a kind of continuous water-

spout is, of course, quite erroneous. Furthermore, if one examines the anatomy of the whale and remembers that it is a warm-blooded air-breathing animal, such an idea is seen to be ridiculous and cannot "hold water" for a moment. The whale comes to the surface to breathe after feeding for some time just beneath the surface, or far beneath the surface in the case of the Sperm Whale. Immediately upon reaching the surface, or just as it is arriving, it blows out the accumulated volumes of lung vapours or "breath." This may blow up some water at the start with the air, but otherwise it is simply the heavy vaporous breath that is being exhaled. In cold latitudes particularly, this is quite steamy, just as human breath is on a frosty morning, and so it shows up as a watery cloud, which has been confused by so many travellers and artists with a stream of water. The fact is that the whale could no more blow out a stream of water than we could from our nostrils.

The Great Sperm Whale (*Physeter macrocephalus*).—This great animal, sought after since the earliest days of whaling, is, apart from commercial considerations and size, possessed of little in common with the great whalebone whales. Its mode of living is essentially different, and the possession of large conical teeth in the comparatively small lower jaw gives it a different aspect to any other commercial whale. The head is relatively, and actually of enormous size, being commonly more than one-third of the entire length of the animal, and is high and squarish, the profile being bluff and squarish, rounded off at the summit and below on each side. Very few of the illustrations of the Sperm Whale convey anything like a proper idea of the shape of this remarkable head, which is usually shown as far too wide and square at the snout. Viewed from above the latter is seen to be somewhat like a rounded wedge, which, though high at the extremity, is fairly narrow. The snout projects far beyond the end of the lower jaw. The latter is armed with a formidable array of conical teeth, and, when closed against the upper jaw, fits in such a manner that the projecting part of the snout appears

continuous with that of the lower jaw. The blowhole is single and is situated on the left side, at the summit and extremity of the snout. In shape it is somewhat similar to an italic "f."

The Sperm Whale, like the Black Whale, has no dorsal fin, but there is a series of low humps, from which a certain amount of spermaceti like that of the head cavity is obtained. The throat has two grooves externally, no doubt to allow expansion when swallowing large squids, calamaries, or cuttle-fishes, which form its food. The pectoral fins are short and stout. The tail is different in structure to those of the other large cetaceans, being very deeply cleft behind so that one fluke lies partly over the other.

The Sperm Whale is of a uniform black, with greyish or whitish patches beneath.

This whale does not attain such a great length as the mighty Blue Whale; but it is massive in build and of great strength. Of thirty examples taken in Australian waters the average length was about 54 feet. The greatest measured 59 feet, and from it was taken an immense piece of the valuable ambergris, mentioned later. From the thirty Sperms were obtained no less than 2,360 barrels of oil, or an average of about 79 barrels per whale. Out of this total a quantity of 600 barrels was the valuable head oil. Some of them gave 30 barrels of head oil alone and a number averaged 75 barrels of blubber oil! Some of the heads were enormous, that of the 59-foot specimen weighing at least 30 tons.

The Sperm Whale feeds almost exclusively upon the large cephalopodous mollusca belonging to the group of cuttle-fishes or calamaries, the giant squids. In all examined, the stomachs have contained nothing but cuttle-fishes up to six feet in length of body. The longer tentacles of these ran from ten to fifteen feet in length. Those that are vomited bear no signs of mastication. The heads of all Sperm Whales taken by the whalers in every sea bear marks, scorings, and scratchings, caused by the struggles of these great squids; these are particularly noticeable about the bluff muzzle. These cuttles are known to grow to a great size,

and there does not appear to be any valid reason for supposing that the immense examples that are occasionally recorded in various parts of the world are exceptions. Tales of struggles between great calamaries and the Sperm Whale are to be obtained from any experienced whaler, and it is probable that such mighty combats are quite common, but that they are generally far removed from the surface. In this connection it is of special interest to note again the position of the blowhole on the snout. It is right at the extremity of the snout, which itself protrudes far beyond the end of the lower jaw. I suggest that this condition (both of blowhole and snout) has evolved as a direct consequence of the great cetacean preying upon these long-armed calamaries armed with their dreadful suckers. If the blowhole were situated far back at the summit of the head, as in the whalebone whales, it would be directly over the jaw and would be liable to be interfered with by the sucker-headed arms of the giant cuttles during the combats so as even to cause suffocation. For the same reason it is a distinct advantage to have a high head with a great circumference, because if the head were very shallow anteriorly, as in the whalebone whales, the long arms of many of these calamaries might be wrapped right round both jaws, thus effectually muzzling the lower jaw. An additional advantage also must be gained by the specific gravity of the head being so lessened by the presence of the head oil that movements are freer at whatever depth it feeds. It should be remembered that the Sperm Whale has already enough blubber to cause it to float; therefore, it only has to exercise a slight effort in the direction of maintaining its equilibrium. Now the oil in the head-case acts like the immovable oil globule in certain pelagic or floating fish eggs, tending to keep that side uppermost with a minimum of swimming effort. The series of humps containing the spermaceti, on the dorsal line, also perhaps act as a buoy in the same way, thus leaving the Sperm Whale peculiarly free to follow the pursuit of his favourite food without expending much energy in maintaining the equilibrium of an enormous and certainly ungainly body,

and apparently a very cranky body too, from a sailorman's point of view.

There is no doubt that Sperm Whales generally feed at a considerable distance from the ocean surface, but how far cannot perhaps be said with certainty. A number of old whale-men are convinced that they get most of their food at a depth of 200 fathoms (1,200 feet). Certainly they are known to sound to that depth.

The spout of the Sperm Whale is thick and short, about three or four feet high, and is projected forward from the end of the snout at an angle of about 45 degrees. The whale usually disappears for from forty-five to fifty minutes between blows, although one has been brought under my notice in which the time was seventy-five minutes. While at the surface it usually blows or breathes from thirty to thirty-five times, though observed to blow up to as many as forty-eight times between soundings.

Occasionally when wounded, this mighty beast will turn and charge the chaser. One steel vessel of 120 feet in length on the New South Wales coast had the side considerably dented amidships by the charging of one of these great "Moby-Dicks." But—the whale died!

PRODUCTS OF WHALING.

Briefly, the important products are whale oil, spermaceti, ambergris, baleen

or whalebone, whale-meat meal, whale beef, whale guano or fertilizer, bone-meal, bones, and ivory. Of these, the oil towers above all else; 1,600,000 barrels, valued at £8,000,000 sterling, were obtained during the last season in the Southern seas alone. Spermaceti is the principal constituent of the head or "case" oil of the Sperm Whale, being present to some extent also in the blubber. Ambergris, a substance that is literally worth its weight in gold, is obtained from certain sick Sperm Whales, and is a biliary concretion found in the intestines. One piece taken from a whale in our waters weighed no less than 352 lb. and brought over £12,000 in London. Whale-meat meal is a dried flesh meal used for cattle-food mainly. Whale guano is a meal made up for fertilizer purposes, as is bone-meal to some extent, although this also is used as an animal food. The whalebone, which used to be one of the principal products of the old-time whaling, is not of great value now, though latterly there has been an increase in its importance. Whale beef is cut off the fresh whales, divided into strips and frozen for domestic use; it is an excellent table food, as I can personally testify. The great bones are used in certain industries, while ivory is got from the tusks or teeth of the lower jaw of the Sperm Whale.

THE MICROSCOPICAL SOCIETY OF NEW SOUTH WALES.

THIS Society now holds its monthly meetings in the Lecture Hall of the Museum, where also its library is housed.

The objects of the Society are to promote the study of all branches of microscopy and to provide a meeting place where its members may assist each other by lectures and discussions on subjects of common interest. Excursions are arranged and the preservation and systematic classification of specimens are encouraged.

In recent months the following lectures have been presented to the members:

"Sea Shore Life," by Mr. W. Boardman.

"Chemiluminescence," by Mr. E. Wills.

"Methods of Staining and Mounting Wood Sections," by Mr. M. B. Welch, B.Sc., A.T.C.

"The Structure of the Human Eye," by Dr. Burnville Waddy.

"Cœlenterata and Their Allies," by Mr. W. Boardman.

A members' open meeting was held on September 4; and on October 2, Miss A. M. Rainbow addressed the members. On November 6, Mr. B. L. C. Stoyles will deliver a lecture entitled "The Microscopy of Dentistry."

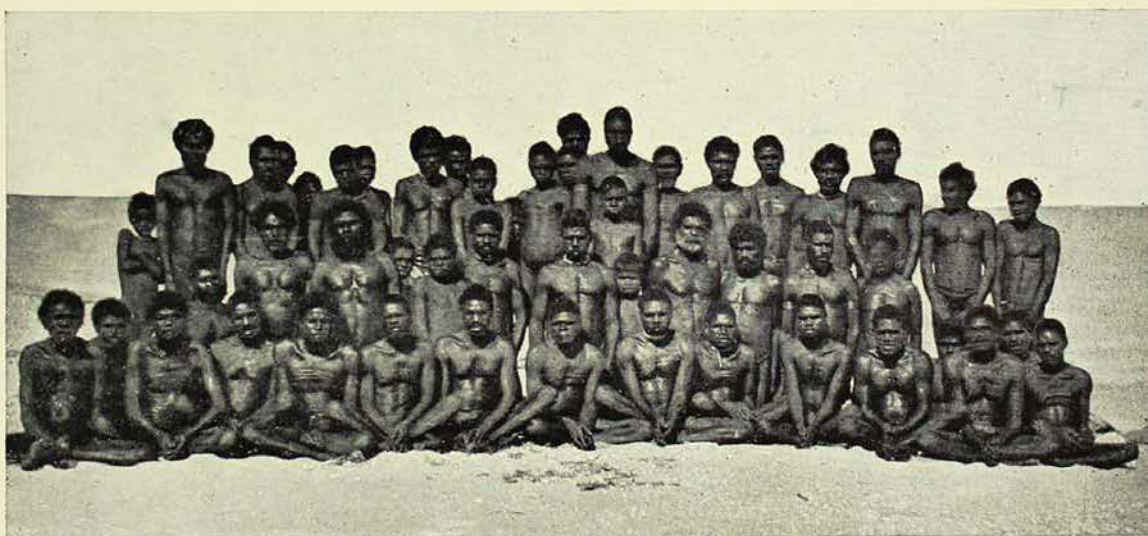
Black Australia

By A. R. RADCLIFFE-BROWN, M.A.,
Professor of Anthropology, University of Sydney.

[The following article is based on a lecture delivered at the Australian Museum on July 24. It was prepared from notes taken during the lecture and the manuscript was submitted to Professor Radcliffe-Brown for revision before being printed.—EDITOR.]

WHEN the white man first came to Australia the aboriginal population probably reached the total of 300,000, certainly not less than 250,000. Now only about 60,000 are left, and New South Wales has less than 1,000 full bloods, yet this remnant is of the highest importance to science, for to the anthropologist the Australian aborigines

contrary, became separated from other land masses at an early date; consequently, its animal inhabitants are primitive. For example, the mammals of Australia are mainly monotremes (egg-laying mammals), or marsupials, these being the earliest to make their appearance. Before higher forms were evolved Australia became isolated and inaccessible to higher



Examples of the Charlotte Bay District natives, North Queensland—Cape Melville men.
[Photo.—Dr. W. E. Roth.]

are perhaps more interesting than any other people. He regards them as human documents from which most important information may be obtained.

ISOLATION OF AUSTRALIA.

Australia is, and for long ages has been, the most isolated portion of the earth. For many millions of years the main land masses of the globe have been situated in the Northern Hemisphere, and, moreover, the chief continents of the Northern Hemisphere have long been more or less connected. Australia, on the

mammals, with the exception of bats, which can fly, and rats and mice, which are able to use methods of transportation not available to other mammals.

We do not know with certainty where man made his first appearance on the earth; probably it was in Asia. From its original home, wherever it was, the human species gradually spread, and in time Asia, Europe, and Africa had their human inhabitants. There was at that time no land bridge connecting America with the other continents, and man did not reach the American continent until

late, perhaps only 25,000 or 30,000 years ago. It seems that Australia was not populated until even later. We do not know when man first reached Australia, but it seems that our island-continent was the last portion of the earth to be inhabited by the human species, which first made its appearance here perhaps 20,000 years ago.

Man came to Australia from Asia, and perhaps he had to cross the sea, though it is possible that he came by land, for between Asia and Australia there are chains of volcanic islands, and land movements, elevations and subsidences seem to have taken place in this region in the past, so that the aborigines may have been able to reach New Guinea by a land bridge. From New Guinea, which was at one time joined to Australia, the aborigines moved into Australia itself, and spread over the whole country. It is possible that the climate of Australia and its geographical features were then different from what they are today. There is evidence that when man and the dingo, which is generally supposed to have entered the country at the same time, reached Australia, the central area was well watered and carried abundant animal life, for in this region we find the fossil remains of large extinct marsupials such as *Diprotodon*. But the climate gradually changed and became more arid, a change which is possibly proceeding very slowly at the present time. The Australian thus became isolated more or less from evolutionary influences. Yet there was a slow drift of cultural influences from the north. The *ground* stone axe is not known from Tasmania or the south-west portion of Australia, hence we conclude that the original human inhabitants of Australia did not grind their axes, but that this art was introduced later from the north, through New Guinea. Thus the separation was not so complete as to prevent a slow infiltration of new ideas from the north. Nevertheless, the Australian blackfellow has, on account of his isolated position, been compelled to develop a special culture, differing in certain ways from that of other races. He has a special environment, and this has given rise to a distinctive culture.

AUSTRALIAN CULTURE.

Australia is an inhospitable region. In other parts of the world during the last eight or ten thousand years man has learned how to domesticate animals, and how to cultivate plants such as rice and wheat. But Australia has no useful native animals which can be domesticated, no plants worthy of cultivation. Opossums and kangaroos can be kept as pets, but they cannot be used as beasts of burden, nor can they be milked. Thus the Australian aborigines have, over a long period, developed their own civilization, a comparatively primitive one, along very special lines, and, therefore, they present an interesting problem for the anthropologist.

Civilization is the mechanism by which a people becomes adapted to a given environment at a given level of culture, and the task of the anthropologist is to discover what civilization is, how it works, grows, and develops under a particular set of circumstances. Our own ancestors of 20,000 years ago were in much the same stage of civilization as the Australian aborigines are at present. These ancestors we know from their bones, their tools, their ornaments; we know something of their technology and their art, but of their morals, their religious beliefs, and generally their spiritual life we know nothing. It is from this point of view that the blackfellow is such an immensely important human document.

Until the last three or four years no systematic attempt had been made to study the spiritual side of aboriginal culture, and now, unfortunately, much of the material for this study is gone for ever, for in large areas of Australia the aboriginal population has disappeared.

FOOD SUPPLY.

The basis of civilization is material culture, that is, technology and the means by which subsistence is procured. The material culture of the blackfellow is not the lowest recorded, for the earliest men were in an even worse condition in a material sense. But the Australian aborigine was dependent on what nature offered him, and was forced to obtain his food from day to day by hunting, fishing,

and collecting the natural products of the soil. Under similar conditions we should die in a few days, but, by virtue of his special adaptive mechanism, the black-fellow was able to survive, and in some

parts of Australia he is still living exactly as his ancestors did.

The aborigines make use of practically every plant and every kind of animal that is edible, and it is readily understood



North Queensland aborigines fishing. The man standing is holding in his right hand a boomerang-womerah which is used to throw the spear when fishing. It is peculiar to the Bloomfield district.

[Photo.—Dr. W. E. Roth.]

that their menu is a varied one. Water lilies are an important source of food wherever they are found, for the roots, the stems, and the seeds are utilized. Cycads such as the Burrawang (*Macrozamia spiralis*) have a nut-like fruit, the kernel of which, eaten without preparation, is highly poisonous, but the blacks know how to treat it by pounding, maceration, and washing so as to produce a nutritious food. There are few animals, large or small, which the aborigines do not make use of to augment their food supply. We ourselves esteem oysters as food, but the aborigines eat not only shellfish of various kinds, but caterpillars, grasshoppers, and other insects, as well as lizards, snakes, and other animals which white men would regard as repulsive. Grass seeds, too, are used as food. It is no mean task to provide the afternoon meal for a family by collecting, rubbing, winnowing, grinding, and cooking grass seeds, yet the aboriginal woman, who has a busy life, frequently does it.

HUNTING WEAPONS.

For hunting, the aborigine had only primitive equipment, his main weapons being the spear and the throwing stick. The simplest kind of spear is a long pointed stick, but this can be improved and developed by the addition of a sharp point formed of stone, or barbs of stingaree spines. There are very many different kinds of spears used by various tribes, each region having its own special type. These spears are not always thrown by hand, a spear-thrower being in common use. This instrument has a handle at one end and a peg at the other, and, when it is being used, the peg is fitted into a concavity in the end of the spear, the double leverage thus obtained resulting in greater accuracy and at least doubled momentum. It is probable that the spear-thrower was not invented by the Australian aborigine; he brought it with him, or it was introduced later. It was used by the Eskimos and by the Magdalenian people of France and Spain 20,000 years ago.

The throwing stick is made of heavy wood and is pointed at one end and roughened at the other. When an

aboriginal family is on the move the woman carries the child and the luggage. The man has his spears, spear-thrower, and perhaps his shield in his left hand, and his boomerangs are carried in a belt round his waist or disposed somewhere on his body. In his right hand is his throwing stick ready for use. If a bandicoot or a wallaby crosses the path, by a twist of his wrist the black hurls his throwing stick, and, if the throw is a good one, the animal is stunned or killed and a good meal assured. The throwing stick is used more than the spear, particularly for small game. The blackfellow has elaborated this useful implement in various ways so that there are many varieties of throwing sticks. The boomerang is an elaborated and special kind of throwing stick, and some are so constructed that they have a spiral flight and return close to the spot from which they were thrown. But not all boomerangs return and the most useful kinds do not. Hunting boomerangs and fighting boomerangs are not returning. Indeed, the returning boomerang is more a toy than a useful instrument, though it may be used to throw into the midst of a flock of ducks.

The blackfellow also uses nets for fishing and fowling, as well as snares, and indeed any device he can think of which will enable him to secure game.

NATURE KNOWLEDGE.

But what he uses most of all is his knowledge; he lives on his wits. He has a very profound and intimate knowledge of animal and plant life in his own territory, and this knowledge is a vital necessity. This explains the importance of the old men of the tribe. One will sometimes find a tribe which has been carrying a crippled old man for years, travelling perhaps fifteen miles per day. The esteem in which old men, and to a less degree old women, are held by the aborigines is on account of their knowledge, for survival may depend on knowing that there is a source of food of a certain kind at a certain time and place. The old men are learned in the ways of animals and know where food plants and other plants will be found, for the blackfellow observes early in life and his fund of useful knowledge grows

with years, so that in his old age he becomes the tribe's greatest asset.

LAND OWNERSHIP.

The Australian natives have a very rigid system of land ownership, and their most important law is the prohibition of trespass. A trespasser can be put to death, and he fully recognizes that to enter the territory of another group *without permission* may cost him his life. But permission may be readily obtained, for the blackfellow is very hospitable. A group may consist of thirty to fifty or more individuals, and these own an area of land and all it contains, rocks, plants, minerals, water, and animals.

The aboriginal man inherits the land of his father. In it he is born, in it he lives and dies, and after his death his spirit dwells in it. There is thus an intimate bond between the blackfellow and the land of his birth. If he is away from his own territory and falls sick he wants to go home, for he does not wish to die and be buried in strange territory.

Before the advent of the white man every inch of territory was owned by some group of natives, and each group knew every corner of its own country. But in times of plenty the members of neighbouring groups would be invited to pay a visit. Thus when the Bunya Bunya pine, which grows in large quantities in southern Queensland, was ripe, visitors from perhaps a distance of five hundred miles would congregate on the Bunya Mountains there to feast on the nuts, and to enjoy themselves, fighting, dancing, and performing religious ceremonies, which were their chief amusements. The importance of territory and local life is shown right throughout the lives of the aborigines, and thus was created a system of civilization adapted to the environment. The ownership of land passed from father to son, the women coming from outside. The control of group life was in the hands of the men, women being subject. That again was probably, almost certainly, due to environment. The men, and particularly the old men, were the most important members of the group, because of their experience and knowledge.

This dominant position was maintained by their practical knowledge and knowledge of religious affairs and magic, which play an important part in the life of the Australian aborigine.

SOCIAL ORGANIZATION.

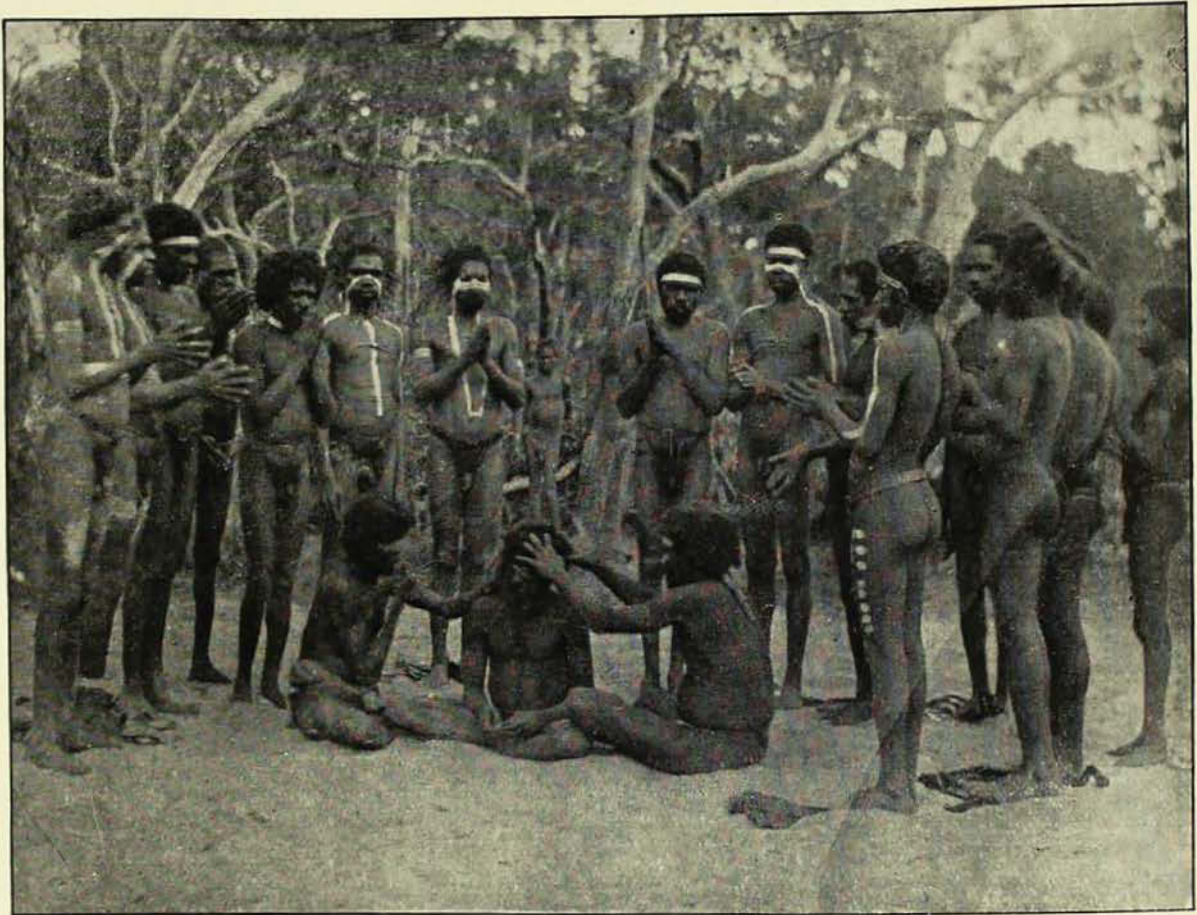
Thus was developed a type of life which enabled the blackfellow to survive and flourish, and by natural evolution a system of morality, of laws, of art, and of religion was developed, that is, a type of civilization. For civilization is a natural product, which is just as interesting and beautiful as, though more complicated than, other natural products.

The blackfellow's system of civilization or social organization was very nicely adjusted, in fact it was too delicately balanced, for, when any part of it was interfered with or destroyed, the whole collapsed, and that is the reason for the blackfellow's disappearance or pauperization. The African negro, too, has his own social organization, but that is a sturdier thing and has not fallen to pieces in the same way.

When we examine the customs and ceremonies of the Australian aborigines they may at first strike us as meaningless or even as absurd. But if we regard them as part of a system they become significant and understandable. Their religious beliefs and ceremonies, which are the crux of their civilization, are, when carefully studied, found to have a definite relation to their environment and mode of life. There is, for example, the cult of the sacred animal and sacred place, perhaps a water-hole, a rock, or an arrangement of stones. An aborigine will tell us that this place is sacred, say, to the kangaroo, and the men of the group, the kangaroo men, will decorate themselves with feathers and paint and perform ceremonies there, and will explain that as a result there will be plenty of kangaroos. Others will in the same way make plenty of emus or bandicoots. Can we say that these totemic ceremonials are absurd? We ourselves pray for rain, and the aborigine sings and dances in order to bring rain and food. These ceremonies have a special relation to his life as a whole, and have been developed

in response to his needs and desires, just as our own customs have been. Among the blackfellows there is a strong attachment to their environment and a spiritual life which subordinates the individual to the community and links the members of a group for the common good.

are still alive will be gone, and with them will go much precious knowledge, so that it is very essential that the study of this primitive civilization should be pursued with vigour in the next few years in those parts of Australia where the study is still possible. Not all Australian tribes are alike; there are striking



Dance of the Body-louse of the Koko-yimidir Blacks at the Nolvor River, North Queensland.
[Photo.—Dr. W. E. Roth.]

The time has already gone by when complete studies of the Australian blackfellow could be made. For considerable parts of Australia we shall never know very much about the life of the natives, for, even if there is still a remnant living, the old men who could give valuable information are dead. The culture of of the Australian natives is bound to disappear in another half century; even if the blackfellow himself does not become extinct his customs and languages will. In five years' time many old men who

differences though there is a general resemblance, and these differences are of great importance to the scientist, for it is by comparative study that general conclusions are reached. Our descendants three or four hundred years hence will set a high value on any records of the lives of our aborigines that we may be able to make, and will possibly consider us very stupid because we missed our opportunity to make more complete records.

The Freshwater Eel

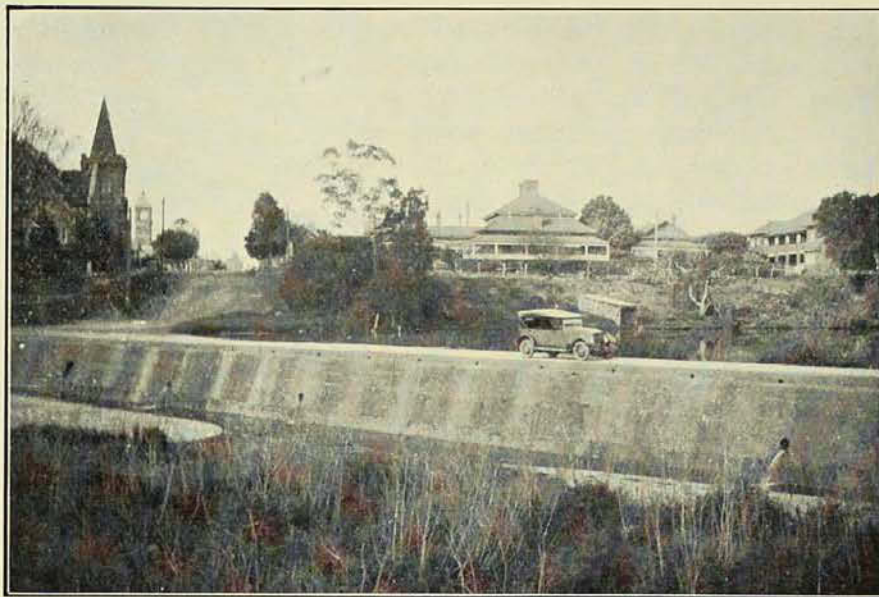
By FRANK WALFORD.

A RIVER is a highway to its denizens. To man it is an obstruction which must be bridged to furnish communication between its banks. The simplest form of bridge, provided the water be shallow, is a dam, and our forbears, in 1810, connected the two sides of the Parramatta River, at the point where Marsden Street now crosses it, with a weir. This structure contains pipes to discharge normal surplus waters, while a "fresh" escapes by the simple expedient of flooding across the flagged causeway of the dam.

This weir has proved a great convenience to man, but it has created a difficult obstacle for eels and other fishes, also shrimps, which are wont to migrate to the freshwater reaches of the river. I propose to relate a few facts about the passage of one aquatic creature, the Long-finned Eel (*Anguilla reinhardtii*, Steindachner) across this weir.

It is possible that the elvers of this eel migrate over the weir annually. The meagre information at my command seems to suggest this, but it is impossible to speak definitely at this stage. I first observed them making the passage towards the end of January last year. From the termination of that migration I have maintained a close watch on the weir and its surroundings, but failed to detect the presence of young eels again until approximately the same date this year.

Last year, compressed within the space of two months, there were successive "waves" of migration. This year there has been but one migration, though I suspect that others will follow in due course. Somewhat hastily, perhaps, with



The weir at Parramatta. The elvers migrated up the river in the foreground and made their way up the damp surface of the weir, through the discharge pipes, into the upper waters.

[Photo.—W. A. Rainbow.]

the meagre data at my disposal, I have adopted a tentative hypothesis that fairly heavy rain is an essential prelude to a migration. Only time and patient observation will settle the question, but certainly all the available evidence points that way.

At Parramatta Weir conditions are favourable for migration at virtually any period of the year. The large catchment area maintains the river at a level sufficiently high to assure a perpetual discharge through the overflow pipes. Under such circumstances one would expect to discover the elvers migrating in dry periods. But it is significant that every upward movement which I have observed to date has been heralded by a substantial fall of rain. Light falls have signally failed to stimulate the elvers to activity.

Dampness is essential, when rocks are to be scaled. Experiments have taught me that elvers are impotent on dry surfaces, and it is quite possible that racial experience has implanted the lesson in the eel that it is advisable to postpone

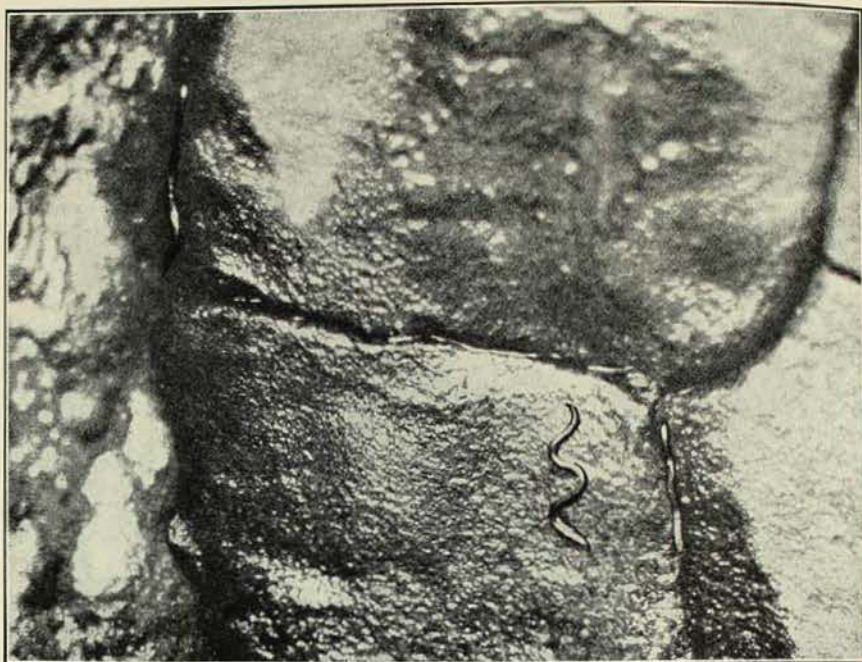
any attempt at migration until a recent "fresh" has saturated the locality, and created propitious conditions for the journey.

Accounting each "wave" (or successive movement) witnessed in January, February and March of 1929 as a distinct migration, I now have observed some half-dozen movements from salt to fresh water. On each occasion the trek took place following a heavy downpour. The elvers waited until the violence of the flood had subsided and conditions were propitious for their travelling without being hindered by swift currents.

Possibly the statement that migrations occur only after rain needs a slight qualification. As previously explained, several discharge pipes, through which water always is flowing, pierce the weir. Prior to the rain which preceded each migration, isolated elvers were noted exploring these possible inlets to the fresh water. They laboriously climbed the perpendicular wall to an outflow, only to be washed back as they encountered the current in the pipe. On each occasion each pipe was tested by these advance agents.

Then ensued a rather remarkable thing. Once the actual track for reaching the fresh water had been located, all attempts to use other pipes ceased. A definite trail had been established; the full force of the migrants was concentrated upon it, and other apparent avenues were ignored.

A pretty little problem presents itself. By what process do these immature creatures decide to follow the possible way, and scorn the lure of the impossible? To the eye there is no difference; only actual exploration can resolve the point. That exploration, apparently, is undertaken by scouts; it reveals certain things and unanimous action follows. It is rather perplexing, as one cannot credit such lowly organisms with the faculty of reasoning. Yet the blessed word instinct seems grossly inadequate. It is important



Young Eels (*Anguilla australis*) ascending the rocks of the Hopkins Falls, near Warnambool, Victoria. Note the S-shaped body of the specimen in the foreground, and others wriggling up the crevices. [After J. A. Kershaw.]

to note that, while the vanguard is testing possible trails, sweeping with a net in the main channel will disclose a shoal of the migrants, apparently awaiting results.

Last year the elvers crossed the weir in millions. There was no possible method of computing actual numbers, but some conception of their density may be gleaned from the fact that, in the brief space of about ten minutes, I filled a four-quart billy with specimens for despatch to Dr. Johannes Schmidt, leader of the *Dana* expedition. This year the numbers have been appreciably less, so far as the migration has gone. Nevertheless, many thousands have crossed the weir, and it is important to remember that the main flow of last year's migration did not occur until after the March rains.

The actual migration of the elvers presents many interesting features. On the extreme northern side of the weir is a pipe six inches in diameter; it discharges about seven inches above a level concrete surface. As there is a continuous flow of water from this pipe, it is obvious that its source is the freshwater river. Unfortunately, the municipal authorities are unable to furnish any information on the subject. However, it is immaterial; that it is employed regularly by the

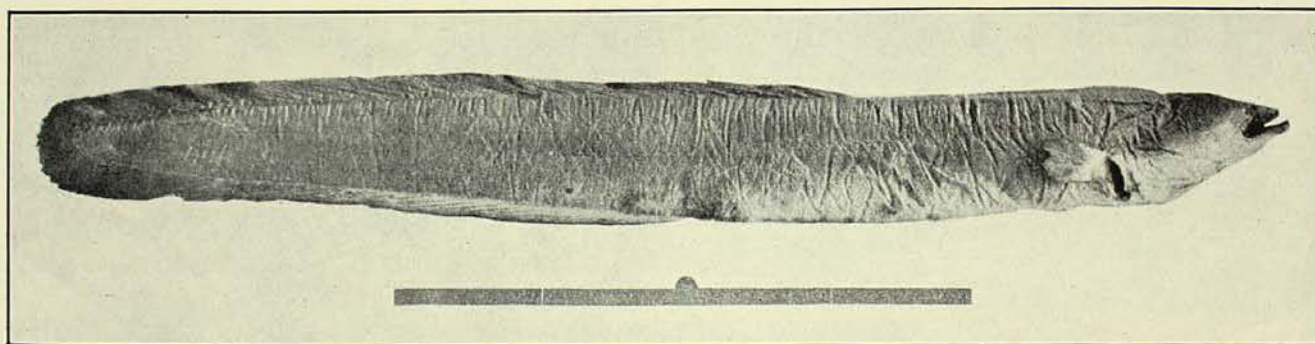
elvers seems to be sufficient proof that it connects with the upper river.

The effluent from this pipe runs across the flat concrete surface to a central channel. It is along its course that the elvers make their pilgrimage. Where the water is still they swim; but where currents are in evidence they wriggle round the damp edges to avoid them. So, alternately swimming and wriggling, as circumstances dictate, they eventually reach a shallow pool beneath the outlet of the pipe. Here they rest for lengthy periods, to prepare themselves for the final stage.

Suddenly an elver will leap at the wall, impacting against it with its head a full inch above water level, its body contorted to the shape of two capital S's placed end to end. This attitude probably is

cally straightens the rear half. Thus far the movements are deliberate, though continuous. But, immediately the tail half has been drawn straight by the convoluting of the front portion of the animal, it is whipped, like a flash, into an S again. Thus the elver progresses, each complete movement reversing the positions of head and tail. At one moment the head is facing to the right and the tail to the left; at the next, the tail is turned to the right and the head curled to the left.

The actual course between the pool and the pipe is right-angled. First they ascend seven inches in a vertical line, occupying from twenty to twenty-seven seconds in the process. Then they turn sharply to the left along the damp margin of the falling water, and progress hori-



The Long-finned Eel (*Anguilla reinhardtii*). A specimen measuring four feet four inches, and measuring twenty-five pounds.

[After D. G. Stead.

assumed to give the maximum of resistance, and prevent the young eel from sliding down the perpendicular face of the wall. This hypothesis is strengthened by the fact that they usually adopt a straight posture on a horizontal surface or when at rest at the bottom of pools, though sometimes they are curled into a semi-circle, possibly to relax the muscles. The two-S shape only is affected on a vertical face, and a simple mathematical calculation will reveal that it increases frictional resistance enormously.

Having gained a position on the face of the dam, in the posture indicated, the elver extends the front half of its body until it is drawn straight, but leaves the rear section curled into an S as at the outset. The front section is then contorted into the typical S, which action automati-

zonally across the face of the wall to the mouth of the pipe, maintaining approximately the same speed of one inch per three seconds while actually in motion. Throughout extreme care is exercised to keep clear of the water. The journey is made along the verges, kept damp by capillary attraction. Having reached the mouth of the pipe, they enter its dark cavern, still keeping above the water-line, and vanish into the unknown.

During the hours of daylight the elvers remain in seclusion, either in the main stream or beneath stones in the pools on the concrete. They commence the daily migration just after sunset and continue it until dawn, the movement reaching its peak between 10 p.m. and 2 a.m. Invariably the advent of daylight traps numbers in the tiny pool beneath the pipe,

where they seek out hiding places. One night I placed a wet corn-sack in the centre of this pool. On lifting it next afternoon, I disturbed thousands of elvers, which shot away in all directions to seek cover.

When migrating at dusk or dawn, they are excessively timid, and hurl themselves from the wall when approached. After dark, on the contrary, they prove indifferent to everything but actual handling; even the close proximity of a candle or torch is ignored.

They are feeble swimmers in a current, though able to dart swiftly in still water. They propel themselves by a ciliary motion of the whole body from the gills to the tail. Those who have observed a ciliary cell, under a microscope, will have an excellent idea of the manner in which elvers swim.

To test the intelligence of the migrants I deliberately diverted the flow of the seepage on the concrete, beside (and through) which they travel. At midday I cleaned out a lateral crevice, which permitted the water to reach the main

channel not only about fifty yards closer than before but round a rectangular corner. No eels were making the passage when I examined the line of migration at 6.15 p.m., but on my returning at 7.20 the movement was in full sway at the new point of emergence. There was no sign of pioneers re-testing the other effluents.

A sidelight on these migrations is worth noting. The freshwater portion of Parramatta River swarms with the common shrimp (*Paratya australiensis* Kemp). Great numbers of these crustaceans are washed over the weir with every "fresh." Close scrutiny during the past twelve months has failed to reveal any sign of migration back to their native habitat. But they invariably accompany the elvers, marching sedately among the wriggling forms, and maintaining their exact pace. As the elvers are very subject to exhaustion, and rarely move more than from three to ten inches without prolonged rests, the shrimps must endure rather a monotonous trek. They present a strangely ludicrous appearance as, with heads solemnly erect, they march "in step" with their serpentine comrades.

John Brazier

Conchologist.

FIFTY years ago John Brazier entered the service of this Museum, but the great financial depression of 1893 cut short his employment. He has just now passed to his long rest, having outlived all his colleagues and every one connected with the Museum in his time. Apparently he was endowed with a love of shells almost from his birth, as we find him collecting seriously three-quarters of a century ago when only a boy of thirteen. At that age he accompanied his father, who was a sea-captain, on a cruise through the islands, and shells collected by him on that trip are still extant. His interest was so pronounced that ten years later he was selected by Julius Brencley to accompany him as shell collector on a cruise on the H.M.S. "Curaçoa" through

the islands of the South Sea, visiting the Samoan Group, Fiji, Solomons, New Hebrides, and New Caledonia. Brazier has told how he and Rossiter had been industriously collecting around Sydney from 1860 to 1865, when Rossiter removed to New Caledonia; the same year Brazier himself visited that island, a trip quite unexpected when Rossiter left him. Brazier's association with Rossiter is worthy of record, as Rossiter (Senr.) was the captain of the ship which rescued Eyre after his memorable walk from South to Western Australia. Through his father's acquaintance with Rossiter (Senr.), young Brazier and young Rossiter collected shells together as noted above, and afterwards Brazier married Miss Rossiter, who was also a keen shell collector, and

whose Christian name is preserved in *Cypræa sophiæ*, *Conus sophiæ*, and other shells. After the return of the "Curaçoa," Brazier communicated some of his results to the Zoological Society of London, and in 1869 he was elected a corresponding member, and must have been about the oldest member of that Society. The Linnean Society of New South Wales was founded in 1875, and Brazier was the last of the original members. The first paper published in the *Proceedings* of that Society was written by Brazier, and many papers followed dealing with the mollusca collected on the scientific expedition of the "Chevert," which Sir William Macleay formed to investigate the natural history of the Queensland coast and islands of Torres Strait. In 1867 Angas, formerly Secretary of this Museum, published a "List of Species of the Marine Mollusca found in Port Jackson Harbour," and this caused Brazier to send his novelties to Angas, so that ten years later Angas had added nearly three hundred species to his list, almost exclusively due to Brazier's efforts. Upon his appointment to the Museum, he reviewed many small groups, using Angas' determinations, and corresponded with most of the leading conchologists in the world. He began a catalogue of the shells in the Museum, and three small parts had been issued when the financial depression caused the abandonment of the project.

Brazier's name will always remain an honoured one in the history of Australian conchology on account of his extraordinary

collecting ability. All dredgings made were conserved, and illimitable patience enabled him to sort out thousands of microscopic specimens, adding greatly to our knowledge in that respect. In the



field he had a very keen eye and very little was missed by him, while many records still stand to his credit after all these years of research. He was born in Sydney on September 23, 1842, and died here on August 20, 1930.

TOM IREDALE.

Dr. J. H. Macarthur has deposited on loan a number of interesting Nelson relics, of which one, a well-preserved uniform coat, has been placed on exhibition.

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Among recent visitors to the Museum were Professor J. T. Wilson, of the Chair of Anatomy, Cambridge University, a

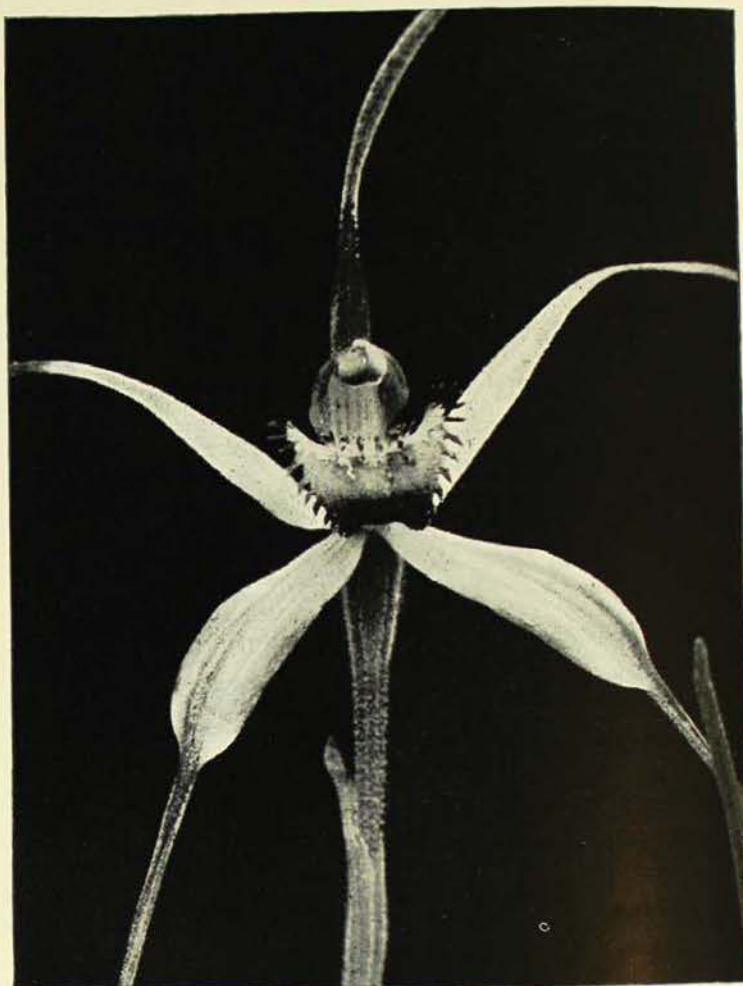
former Trustee; Dr. Otto Roehr, Mexico City, who is interested in Ethnology and made arrangements for an exchange; Sir Colin MacKenzie, Director of the Institute of Anatomy, Canberra, and Lady MacKenzie; Mr. Hannibal Hamlin, American Museum of Natural History, New York, a member of the Whitney South Sea Expedition.

Reviews

GUIDE TO THE ORCHIDS OF NEW SOUTH WALES. By the Rev. H. M. R. Rupp, B.A. (Angus and Robertson, Limited, Sydney.) 1930. Price: 7s. 6d.

The orchids form one of the most interesting of plant families on account of the fragrance of their flowers, their variety of form and structure, and the various devices they exhibit for the purpose of securing cross-fertilization.

The author of this little work has long been a keen student of our orchid flora, and his Guide will be welcomed alike by botanists and by those who merely love flowers. It is, indeed, written chiefly for that large class which is unfamiliar with scientific terminology, and the author has avoided the use of technicalities as much as possible. His descriptions, supplemented by a large number of excellent illustrations, will enable even the tyro to identify the various kinds of orchids. There is a useful glossary and an appendix giving the meanings of the generic and specific names used in the book.



Caladenia Patersonii.

[From Rupp's "Guide to the Orchids of New South Wales."]

STARS OF THE SOUTHERN HEMISPHERE.

By James Nangle, O.B.E., F.R.A.S. (Angus and Robertson, Limited, Sydney.) 1929. Price: 6s.

Mr. Nangle, who besides being Superintendent of Technical Education, is also Government Astronomer, has written a useful book descriptive of the stars of the southern sky. He points out that, although astronomy is an abstract science and its serious study demands considerable mathematical knowledge, yet one can learn a great deal about the stars without entering a very deep study or even possessing a telescope other than an ordinary binocular field glass or a pair of opera glasses.

He explains succinctly the apparent motions of the heavenly bodies, what is meant by star magnitude, the basis on which stars are classified, and gives lists of the constellations ancient and modern. The bulk of the book is taken up with descriptions of the southern star groups for each two months of the year, starting with December-January. For each two months there is a map showing the positions of the various star groups in the southern hemisphere at certain hours of the night. There are also some striking photographs of nebulae and star clusters. By means of these maps an observer will readily recognize the various constellations which the author describes in a simple and graphic manner.