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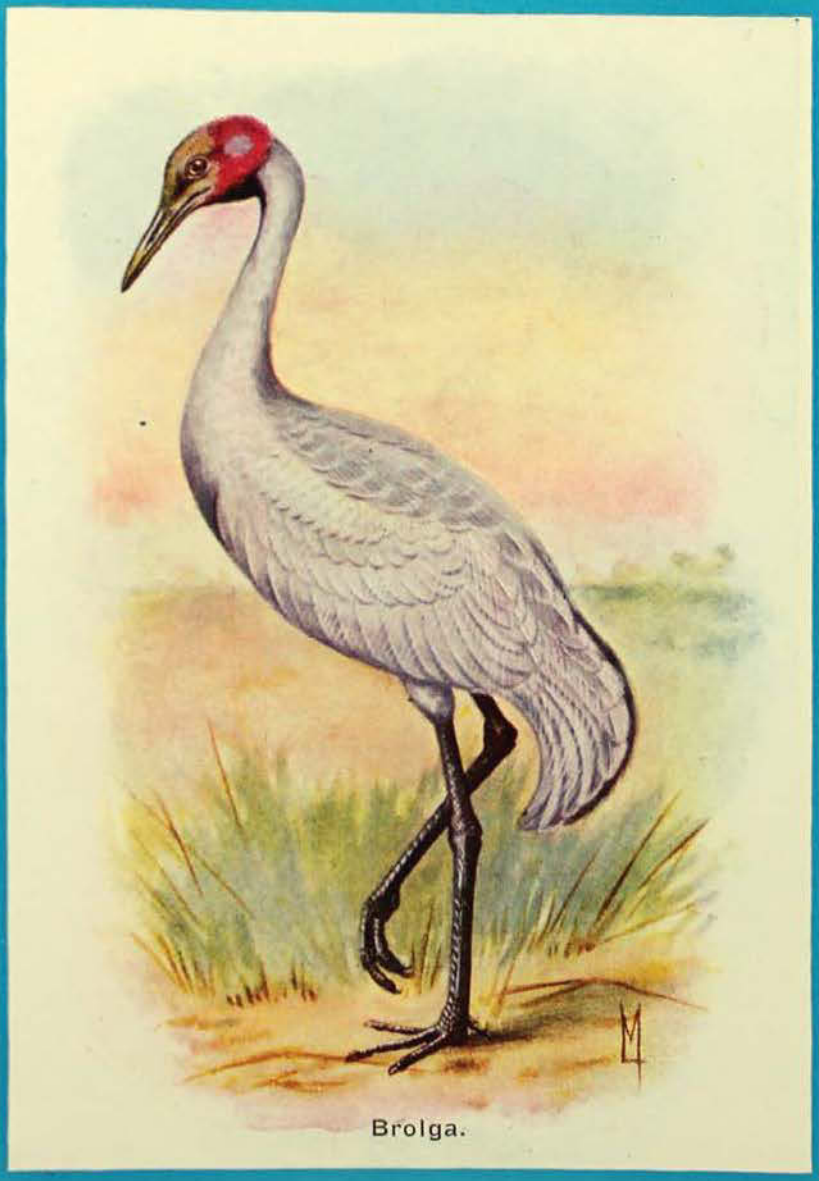

Brolga.

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# THE AUSTRALIAN MUSEUM

## HYDE PARK, SYDNEY

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# THE AUSTRALIAN MUSEUM MAGAZINE



*(Photography, unless otherwise stated, is by G. C. Clutton.)*

● OUR FRONT COVER. The Brolga or Native Companion (*Mathewsena rubicunda* Perry) is by Lilian Medland. It is one of a series of postcards issued by the Trustees of The Australian Museum.

The Brolga belongs to the Crane family, and is more distantly related to the Herons, which are commonly miscalled Cranes in Australia. The family contains a comparatively small number of species but is widely distributed, being found in every continent save South America.

The Brolga is found all over Australia in suitable localities, and has attracted a great deal of attention owing to its curious dancing habits. A group of birds will come together, set to partners, bow, thrust their long necks and beaks up into the air, at the same time flapping their wings, jump into the air with wings half opened, and perform a variety of curious antics.

It is a mixed feeder, subsisting on lizards, frogs, and insects, as well as on succulent roots, to obtain which it tears up the ground with its powerful bill. It does not fly much, but on occasions soars at a great height in sweeping circles, uttering its hoarse croaking cry, from which the aboriginal name is derived.

The nest is made of reeds, etc., in marshes, and two long eggs; buff or white with brown blotches, are laid.


VOLUME VII, NUMBER 6. SEPTEMBER–NOVEMBER, 1940.

"Bosun" Bird, or Red-tailed Tropic Bird (Phaethon rubricauda), Lord Howe Island.

This group was the Museum's first attempt at habitat group work on a large scale, and was originally constructed almost twenty years ago, funds having been provided by several friends of the Museum.

It has recently been remodelled. The exhibit is the work of Messrs. H. S. Grant, J. H. Wright, and W. Barnes. A new background has been painted by Miss Mary Soady.

This group is typical of the hundreds of "homes" of Bosun Birds, found breeding along the rugged cliffs, from sea-level to mountain-top, on Lord Howe Island. No actual nest is built, the eggs being laid on bare ground in a rock crevice or other suitable shelter.

The chick is covered with grey or white down, and the immature bird has blackish markings, which disappear in the satiny white adult. In life the plumage of the male is suffused with a delicate pink, but this soon fades under preservation.

The Bosun Bird derives its name from the long scarlet tail feathers, which, in the paired state, have a fancied resemblance to a boatswain's marline-spike. These feathers do not act as a rudder, as popularly supposed, but are merely decorative.

Bosun Birds wander far and wide over the warmer parts of the Indian and Pacific Oceans, flying with ease in all weathers; occasionally they are met with on the Australian coast.

# THE AUSTRALIAN MUSEUM MAGAZINE

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# A Message

A FEW years ago Mr. S. F. Markham, M.A., B.Litt., then Secretary of the Museums Association of Great Britain, accompanied by Professor H. C. Richards, D.Sc., of the University of Queensland, made a survey of the museums of Australia;* this was on behalf of the Carnegie Corporation of New York and the Museums Association.

Captain Markham, now of the British Expeditionary Force, is President of the Museums Association, and in the June issue of the *Museums Journal* he sends the following message to his members which we reprint, for it has a meaning which all must appreciate.

## A MESSAGE FROM THE PRESIDENT

### (CAPTAIN S. F. MARKHAM, M.P.)

Some years ago when we were trying, unsuccessfully, to get a very distinguished outsider to take on the Presidency of the Museums Association, I remember that he asked "What does the President have to do?", and that Sir Henry Miers replied, with his inimitable smile, "His principal job is to deliver a Presidential Address". I think this is the first time in the history of the Association in which a President has failed in that important duty. But as a serving soldier in the B.E.F. it is difficult "to see life clearly and to see it whole", and to give adequate attention to so important a duty, and I learn with pleasure that Sir Cyril Fox has consented to fill the breach by opening a discussion, as Chairman of the Council, at the Association's meeting.

A few months ago I was visiting museums in Norway, and I do not think anyone then could have predicted that the fascinating Sandvig Folk Museum at Lillehammer would become part of a battlefield, or indeed that museums from Trondheim to Prague and from Gascony to Finland would be taken over for war purposes, with irreparable damage to treasures of international worth. As I see things, all that we have been fighting for in terms of culture and art for years will be checked, confused and even perverted until peace rules again. For some of us there is the pride and the honour of helping to push back a ruthless barbarism that is the enemy of everything we hold dear, but we shall fight in vain if behind us there is not kept burning with a sturdy light a flame of learning and culture. The great task of museums and art galleries in this country during the war is to help preserve the basic sanity of our peoples and anything that can be done in this respect will be of greater ultimate value than most of us perhaps can now realize. In a way I feel like a deserter from the forces that are battling towards the light, but equally I know that unless we can halt, repel, and extinguish that soul-darkness which is evident wherever the Swastika flies, there will be neither light nor culture in this country for many years to come.

I wish you well in your deliberations and hope that when the time comes for our next Conference in July, 1941, we shall be able to meet as we met in 1939—united, resolute, and confident of great advances—but without the background of crises, wars, or rumours of wars.

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* A Report on the Museums and Art Galleries of Australia, by S. F. Markham, M.A., B.Litt., and Prof. H. C. Richards, D.Sc., to the Carnegie Corporation of New York. (Museums Association, London, 1933.)

# Aboriginal Stone Arrangements in Australia

By FREDERICK D. McCARTHY

ALTHOUGH the aborigines set up stone arrangements of various kinds, the term "megaliths" is rarely applied to them; the stones used are not shaped, rarely exceed three feet in length, and one or two men can always lift or roll them into place. Megaliths are either "made of, or marked by, large stones", according to the Oxford English Dictionary, so that, strictly speaking, many of the Australian structures come within this definition. Megaliths, however, are usually considered to be built of artificially shaped stones or of rocks so big that many men would be required to move them, they belong to a definite cultural period, and are associated with advanced traits not found in Australia; for these reasons the term "stone arrangements" is applied in Australia. They occur throughout the greater part of the continent and may be classified as follows: (1) Fish-traps. (2) Monoliths. (3) Heaps and cairns. (4) Circles and lines of stones. (5) Elaborate arrangements which combine (2) to (4).

FISH-TRAPS.

The simplest form is a low wall, two to three feet high, of stones built on a shallow shore; in some cases the wall extends out to sea as much as 300 feet. As the tide recedes the fish are speared or taken with scoop-nets. This type occurs on the coasts of northern Australia and Queensland, at Port Stephens, New South Wales, and Mount Dutton Bay in South Australia. The same device is utilized in flood channels in the interior. At Boulia in Queensland, and in Central Australia, gaps are left in the weirs, and on a stone platform beneath a net is placed into which the fish fall through the gap; conical traps made of cane are used in the same way on the Queensland coast. The most remarkable example is at Brewarrina on the Barwon River, New South Wales, where rows of enclosed pools extend from bank to bank for several hundred yards; the walls are constructed of boulders eroded out of the sandstone bar upon which the traps are built. At Lake Condah in Victoria are

**The fish-traps at Brewarrina extend for a quarter of a mile along a rocky bar across the Barwon River, New South Wales.**
Photo.—A. J. North.

**Line of stones at a Kantyu tribal totem centre for kangaroos, Emily Creek, Cape York.**
Photo.—Ursula McConnel, courtesy Australian National Research Council.

stone-lined channels, with weirs across them, designed to trap fish after floods. Baiami and his sons built these traps and laid down certain rules for their use.

MONOLITHS.

These are common in north-west Australia and have a generally similar significance to the natural rock masses associated with mythology. The Worora tribe say that a cylindrical stone was set up by a great man, *Kanawei*, to mark the spot near a tree where a black snake crawled over his thighs and awakened him. Another set of four elongate stones set up on a hill overlooking an arm of the sea are said by the same tribe to indicate the spot where a boobook owl stopped the sea from flooding the land. As the tide rose the owl seated itself on this hill, and, when it heard the owl's fearful cry and saw its big eyes, the sea drew back. Numerous instances may be quoted of monoliths, natural and artificial, forming totem-centres in north-west Australia. Thus an Ungarinyin totem-centre for honey is a cylindrical mass of stone, which had weathered *in situ*, projecting from the ground, and a similar but much larger mass of basalt in the Macdonnell Ranges is a centre for spirit-children. Two pieces of columnar stone are set up as though intended to represent the open seed of a palm, the fruit of which is eaten, and forms a totem of the Worora tribe. The Kantyu tribe in Cape York say that a line of elongate stones, up to three feet high, set on end along a ridge, represents a file of kangaroos, buck, doe, and young, and that the kangaroo ancestors who live in the creek below, and who placed the stones in position, visit them at night. Monoliths are set up on ceremonial grounds in various parts of the continent, where circles and other patterns of stones are laid out.

HEAPS AND CAIRNS.

Heaps of stones made by the aborigines are widespread and their meaning and function vary considerably. To the Worora, one heap marks the spot where a kangaroo was cooked by an ancestral *Wandjuna* hero, and its heart was placed on another rock, a cluster at the foot of a Bottle-Tree signifies the place where *Kulorubadu*, a *Wandjuna* hero, lay down and died, and a small heap has on its top a large oval boulder which represents the pounded and baked mass of grape-vine roots. A cluster of stones on Cooper's Creek, Central Australia, is a Yantruwunta totem-centre for tortoises. Three stones in a cleared space in the bush represent the male, female and young of the cod fish at a Kantyu tribal totem-centre in Cape York. Another type often seen in north-west Australia consists of one or more pebbles placed on a large rock *in situ*; thus at one totem-centre of the Worora tribe the base stone, a red one sticking out of the ground, is the head of the *Wandjuna* hero *Kulorubadu* (meaning "he-having-the-tranquil-dove"), a white stone set upon it is the dove, and several little stones are the chicks. In north-east South Australia a mound of stones was placed over a grave.

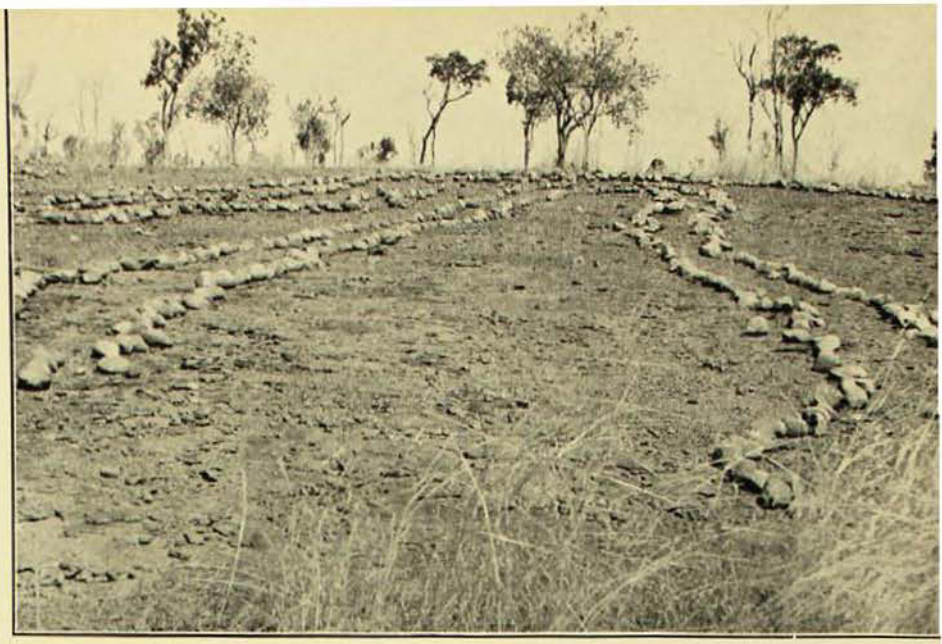
**Heap and cairn of stones forming part of the arrangement on Mount Foster, New South Wales.**
Photo.—C. C. Towle, courtesy of Anthropological Society of New South Wales.

Large heaps were gradually built up in the Olary district of South Australia by aborigines who passed by and deposited a stone on one of them. They were situated between valleys, and the practice was believed to prevent evil spirits from following a man into the next valley. One is twenty-four feet in diameter, and nearly four feet in height, and is estimated to comprise 37,000 pebbles. Similarly, Worora tribesmen, when passing a group of seven cairns near the Sale River, place a spear or stick upon one of them so that they will not be bothered by sneezing all day. Sir George Grey and Carnegie observed large heaps in Western Australia built up in this way, and they occur also in the Broken Hill district of New South Wales.

There is at Dalhousie in Central Australia a line of stone heaps said by Sir Baldwin Spencer to denote tribal boundaries. The explorer Giles saw evenly spaced heaps, two feet six inches high, each with a large stone in the middle, in the Rawlinson Ranges. Such series occur in far western New South Wales and south-west Queensland, often with single boulders between the clusters, and associated with well-worn native tracks; there are heaps along a "pad" which runs from the Wilson River to the native quarry at Coppra Mingi, and passing natives place a stone upon them. A carefully constructed type has been recorded in the Flinders Ranges. It is made of slabs of slate. In one a base is laid with two pieces three feet six inches long and six inches wide, upon which two slightly shorter slabs are placed at right angles near each end; this method is continued to a height of over three feet, there being twenty-eight layers in the turret-shaped cairn. Little wedges of stone are inserted to offset unevenness in the slabs. Six of these cairns occur in the Weroonee Range, three on top of a hill in a line and from fifty to eighty yards apart; some eighty yards away, on the western slope, the other three form a group. A large flat stone is placed near some of these cairns. They were said by local aborigines to be used in rain-making rites. On Mount Foster in New South Wales is an arrangement composed of three heaps in an east-west line, another one to the north of the middle heap, and beside the latter is a double circle of stones; a single heap is built on Little Mount some miles away, and a line of twenty boulders in a paddock between between Mounts Foster and Harris. Its significance is not known.

### CIRCLES.

A widespread custom was to make a ring of stones round a platform on which a corpse had been placed to dry. An



**An arrangement of stones representing yams at a totem-centre of the Ungarinyin tribe, north-western Australia.** Photo.—Prof. A. P. Elkin, courtesy Australian National Research Council.

inquest was held by the old men to ascertain who was responsible for the death. His identity was revealed by the body juices which dropped on the earth, either splashing one of the stones—each represented a possible culprit—or pointing in its direction. On the Clarence River stones were placed round a grave, and in western Victoria around the large oven mounds (in some of which were burials). On the south coast of New South Wales stone circles, known as *Nambi*, were visited by medicine-men when they wished to communicate with the ancestral spirits. In the Nandewar Ranges these circles figured in the initiation of a medicine-man. Eyre observed on a hill near the Murray River an oval figure of stones, thirty-three feet long and from three to six feet wide, made of stones which projected up to five inches from the ground. It was called *Mujumbuk* by the natives, who said it was a place for disenchanting a person afflicted with boils. The Aranda of Central Australia placed stones around a man who expected to be attacked with weapons or by sorcery.

On some of the *Bora* initiation grounds of south-east Australia stones were placed round the circular spaces, which were up to a hundred feet in diameter. One made by the old men of the Ucumble tribe near the Peel River covered several acres and had smaller circles within its boundary. It is probable that many of the natural circles of large blocks of stone which occur on hilltops in the granite belt in Victoria and New South Wales served as *bora* grounds. Circles of stones on the hills near Lake Macquarie were said to have been placed there by the eaglehawk, probably by the spiritual ancestor of this clan or moiety. They have been reported on Mount George and in the Gloucester district. One at Gleniffer had a central cluster of stones, and others in the Paterson River district had a stone and ashes in the middle. In the Mudgee district Brown described thirteen erections of loose stones, three feet in diameter and two feet high, each large enough for a man to climb into, with a bigger one on a nearby hilltop.

In western Victoria and in South Australia circles were formed as a result of placing stones round huts. One circle represents the totem-centre for the whitefish in the Worora tribe's territory, where another totem-centre is a U-shaped figure of stones representing the roots of the wild-grape, a hollow stone at one end being where the stem of the plant emerges.

### ELABORATE ARRANGEMENTS.

The structures already described constitute the elements of stone arrangements in Australia, but they are often combined into more elaborate patterns, usually on clay-pans and ridges covered with loose stones. Wood Jones described an arrangement in northern South Australia which consists of "millions" of stones. It covers an area of 800 by 600 yards. In the middle there are heaps up to four feet high, with loops and connecting lines around them, and straight rows of carefully selected stones radiate

out into the sandhills. A white man "gone native" said that it is a sub-incision ground of the local tribe, who claimed that it was made by the spiritual ancestors.

An arrangement at Weelina Waterhole on the Finke River in Central Australia consists of four sets. Two are well defined curved lines, sixty feet long. The third set occupies an area of 200 by 300 yards, and consists of a U-shaped figure, sixty feet long, with heaps at each end of the two arms. Nearby are two parallel rows of stones, fifty feet long and six feet apart, and a collection of flattened slabs, up to three feet high, set in the ground. Some 500 yards away are ovals and circles, and a cairn ten feet in diameter and over three feet high. The fourth set is another series of ovals up to thirty-six feet long. The stones used are up to eighteen inches in diameter, and mostly up to twelve inches in height. This extensive arrangement was associated with a carpet snake ancestor who made the waterhole, and rites for the increase of the snakes, and probably of the ancestor's activities, were carried out on the site.

A series of connected ovals form a yam totem-centre of the Ungarinyin tribe in north-west Australia. A number of similar groupings have been recorded in far western New South Wales, and one of them is 176 feet long. A very fine arrangement on Endrick Mountain, New South Wales, consists of a divided oval figure fifty-five feet long and nineteen feet wide, with a heap at each end, the stones being laid out on an extensive exposure of sandstone. Nearby is an oval seventeen feet long, with a large stone at its eastern end and a cluster at its western end, and forty yards up the slope is a group of clusters some of which form a square. The stones used are up to nineteen inches thick.

A notable feature of some of the elaborate arrangements is that they are associated with a cave, to which the stones lead, examples being at Durham Downs and Moana, South Australia, and at Tattiara in western Victoria.

**These stones mark the site where the boobook owl caused the sea to recede in the territory of the Worora tribe, north-western Australia.**
Photo.—J. R. B. Love, courtesy S.A. Museum.

Finally, there is the curious custom of natives placing stones in tree forks. Thus, in South Australia, at McPherson's Pillar rock hole, Giles saw dozens of pebbles in the trees, and at Alexander Springs he saw them wedged into the fork of every tree round a ceremonial ground. According to Dahl, in Arnhem Land the purpose of this custom was to mark the height of the sun at the time of passing spot as a message to others following. Stones were so disposed in Central Australia and far western New South Wales.

### DISCUSSION.

The above descriptions will serve to demonstrate that, although the stone arrangements may be classified into different types, and such a division is convenient for descriptive purposes, it is purely arbitrary, because it is not consistent with their function. Each type is used for more than one purpose in the ritual associated with magic, religion and mythology, and, further, even to denote notable events in daily life. This brings us to the important distinction to be drawn between structures believed to have been made by the mythological beings who lived in the ancient dream-time world, and those made by the living aborigines. The former group comprises natural sites, totem-centres, initiation

grounds, fish-traps, and places associated with culture heroes and magic. The sites which commemorate an event in the journeyings of the mythological beings are more commonly artificial structures in northern Australia and Cape York than in other parts of the continent; at them the episodes they commemorate are re-enacted in the historical rites.

The totem-centres are important because ceremonies are carried out at them for the purpose of increasing the associated totemic species. During the rites stones may be struck with clubs or other rocks, pebbles thrown into a water-hole, earth or water distributed about the surroundings, the place tidied up, and so on; the sacred appeal to make the species abundant is recited during the rites.

In considering stone arrangements in Australia one is impressed by the fact that they form an essential part of the daily and secret life of the aborigines as we know them, and are not, therefore, relics of an extinct people or culture. Further, clumps of bushes, trees, rocks *in situ*, waterholes, and other features of the landscape are just as important as the megaliths. It might be mentioned that a great variety of megaliths of both simple and highly developed types occur in Malaya, Micronesia and Polynesia; in New Guinea and Melanesia are circles and other patterns of upright stones often taller than a man, and enormous carvings in stone of the human figure. The fact that circles and heaps of stones occur in Tasmania indicates that the custom was brought to Australia at a very early period. It has been employed more extensively in those parts of the continent where cult totemism with increase rites is present. Whether there is an historical relationship between the oceanic occurrences of arranging stones is a problem that may be solved only by archaeological work yet to be carried out.

Stone arrangements in any part of Australia should be reported to the State museums and every effort made by local people to preserve them.

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# Snakes that Fish

By G. P. WHITLEY

IN the *Sun* newspaper, Sydney, April 4, 1938, there appeared a curious paragraph entitled "Snake Goes Fishing". It read as follows:

Bathurst, Monday.

The extraordinary sight of a black snake [*Pseudechis porphyriacus*] emerging from a shallow pool with a small carp fish [*Carassius*] in its mouth was witnessed by George Gunther and his wife, of Bathurst, at "The Forge", a well-known fishing resort near here.

Gunther fired at the snake, but missed. The reptile dropped the fish and returned to the pool, apparently reluctant to lose its meal.

With his next shot Gunther killed the snake, which measured five feet.

Whilst sea-snakes are well known as fish-eaters, and certain northern Australian freshwater snakes (*Myron*, *Acrochordus* and *Cerberus*) are very partial to fish, the above account is the only one known to me of a land snake actually caught fishing in Australia.

Mr. J. R. Kinghorn, in his *Snakes of Australia*, 1929, p. 162, says of the Black Snake that "Those living near rivers almost invariably have frogs, fish, and small eels in their stomachs". There are many American records of snakes as "fishermen", most of the observations dating from the 1880's, and quoted in Bashford Dean's *Bibliography of Fishes*. Many of us have probably seen snakes in our country rivers or marshes, but it seems we must award the prize for serpentine angling to the common Black Snake.

# New Insect Exhibits

## Man's Insect Enemies in Peace and War

By A. MUSGRAVE

WHILE the exhibition collection of insects in the Invertebrate Gallery has recently been undergoing complete reorganization and revision, time has been found to prepare an exhibit which has a special significance in the troublous days through which we are at present passing. Two cases have been installed in the main entrance to the Museum, one dealing with "Man's Insect Enemies in Peace and War", the other with "Insect Pests of Stored Grain and Food Products". In the preparation of this exhibit assistance has been extended by the Entomological Branch of the Department of Agriculture, Sydney, the School of Public Health and Tropical Medicine, and the Zoology Department of the University of Sydney. The information contained in the labels has been drawn from recent literature on the subject, and a list of these works is embodied in a special label.

The first case, "Man's Insect Enemies in Peace and War", treats primarily of those insects likely to affect the Australian soldier at home and abroad; that is, those forms likely to transmit disease through the agency of their bites, or, by their persistent attentions, to cause loss of sleep and hence loss of efficiency.

To epitomize even briefly all the forms likely to be encountered by the Australian soldier in the execution of his duties would be impossible, as the Australian continent itself extends from the tropics of the north, with its mosquito-borne diseases, to the cool conditions of Tasmania, with its corresponding changes in insect life. The countries of Egypt, Palestine, Europe, and the Pacific may all in turn produce their "plagues". The present article is only an outline of the information given in the labels.

### THE BODY LOUSE.

Perhaps the insect pest best known to the campaigner in Europe and elsewhere is the Body Louse, an insect which down the ages has been associated with gaols, famine, and wars. This is the "chat" and "cootie" of the British and American soldier. The Body Louse, *Pediculus humanus corporis* De G., and its near ally the Head Louse, *Pediculus humanus capitis* De G., are known to be the transmitters of three war diseases: *typhus*, *relapsing fever*, and *trench fever*.

The two forms may be separated as follows:

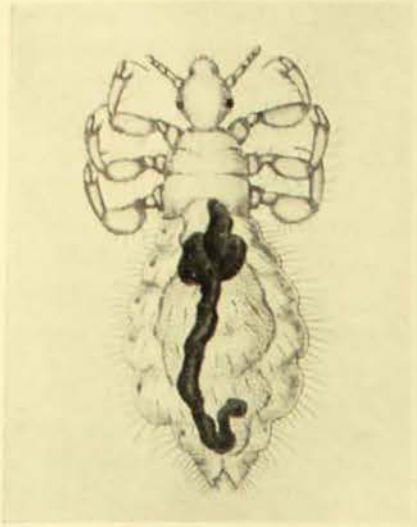
| *Head Louse.* | *Body Louse.* |
|---|---|
| Small and dark. | Large and pale. |
| Antennae thick. | Antennae slender. |
| Abdominal segments sharply defined. | Sides of abdomen merely undulated. |
| Head Louse more-primitive, eggs laid in hair. | Body Louse less primitive, eggs laid on hair and clothing. |

The stages from egg to adult are similar in the two forms and do not exceed two months, and sometimes only sixteen or seventeen days. The eggs or "nits" are laid at the rate of from eight to twelve a day, and 300 may be laid by a single female. Lice feed on blood and so keep close to the body, though they can exist for more than a week without feeding. The adults live from three to five weeks.*

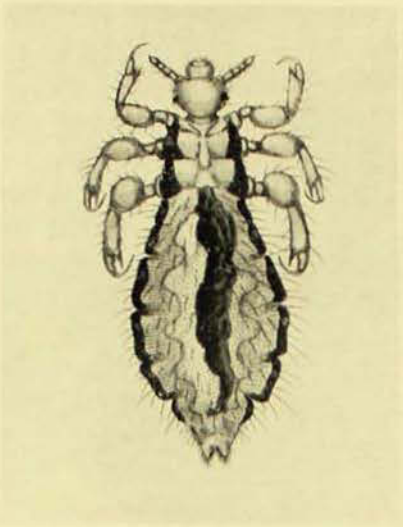
### THE "CRAB" LOUSE.

Another louse which causes annoyance to man by sucking his blood, is the "Crab" Louse, *Phthirius pubis* L. It does not carry any disease, but the effect of its bite may cause feverish symptoms. It is easily recognized by its squat appearance;

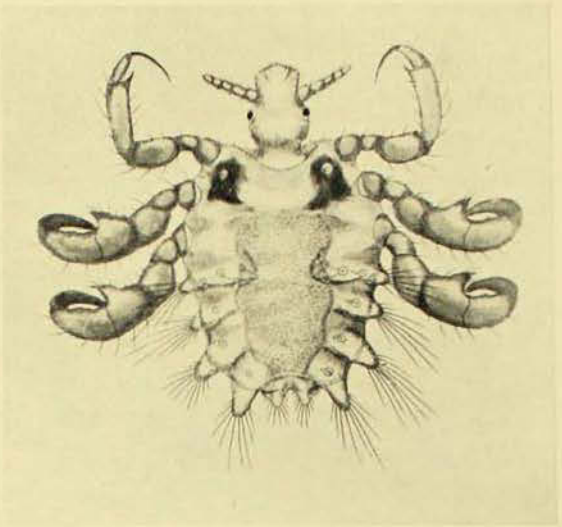
* J. Waterston, The Louse as a Menace to Man, etc. *Brit. Mus. (Nat. Hist.), Econ. Ser.* No. 2, 1921.



**The Body Louse, Pediculus humanus corporis de Geer.**
After H. Denny.



**The Head Louse, Pediculus humanus capitis de Geer.**
After H. Denny.



**The Crab Louse, Phthirius pubis Linné.**
After H. Denny.

the legs point outwards and the forelegs have long and thin claws, but the two hind pairs are very strongly developed, and are armed with thick powerful claws to enable a firm hold to be made on the hairs. The "Crab" Louse occurs wherever the hair is suitable, chiefly in the crutch and armpits, and sometimes among the eyelashes. It keeps close to the skin, feeds continuously, and does not move more than a couple of inches from where it emerged from the egg. When it does move, it moves sideways like a crab, hence its popular name. It does not live long after leaving its host. The female may lay twenty-six eggs, which hatch in from seven to eight days, and the life-cycle is complete in from three to four weeks. Young crab lice cling to a *single* hair, but the adults grasp *two*, one on each side.

The itching caused by their bites and the pale blue-grey eggs or nits betray their presence. They are conveyed from one person to another by actual contact. Both eggs and adults are found in lavatories and latrines as a result of becoming dislodged from affected persons.

### CONTROL OF LICE

Control of lice consists in (1) treatment of infested persons, (2) destruction of the parasite and their nits on clothing, bedding, greatcoat, and pack.

Treatment of the person consists of (*a*) stripping, (*b*) removal of the body hairs, (*c*) rubbing the body with an emulsion of equal parts of olive oil and kerosene oil, (*d*) followed by a hot bath and clean clothing. Treatment of the clothing should take place at the same time, and the method employed is to subject the garments to heat. All lice and nits are killed in half an hour in a temperature of 140°F. (60°C.), but disease germs are not killed, and so steam disinfection is considered better. All underclothes may be placed in a 2 per cent. lysol solution until ready, and linen and cotton garments may be boiled. Ironing with hot irons, paying special care to the seams, will destroy any lice in coats and trousers.

### THE HOUSE FLY.

The House Fly, *Musca domestica*, carrier of intestinal, excremental, and worm diseases, is also included, and its habits, life history, and methods for its control are dealt with. By preventing the breeding of flies by covering or destroying all possible breeding grounds, and by the destruction of eggs, maggots, pupae, and adults, the pest may be kept under control. Adult flies may be controlled by means of traps, poison baits, spraying, etc., for which formulae are given.

### MOSQUITOES.

Mosquitoes (Family Culicidae) are carriers of such diseases as malaria, dengue, yellow fever, elephantiasis, and filariasis, and are thus some of man's greatest enemies. Among the species harmful to man are those of the genus *Anopheles*, the carriers of malaria, and *Aedes aegypti* L. (= *Stegomyia fasciata* Fab.), the vector of yellow fever and dengue fever. About 100 species are recorded from Australia, and about twenty-eight species are known from the Sydney district. Three mosquito-borne diseases occur in eastern Australia: *malaria*, from north of Cairns, Q., and sporadic cases from Sydney and Victoria; *filariasis*, endemic in coastal Queensland and extending into northern rivers district of New South Wales, is carried by the common house mosquito, *Culex fatigans* Wied.; *dengue fever*, carried by *Aedes aegypti* L., the only vector, stops at Newcastle, the southern range of the mosquito.

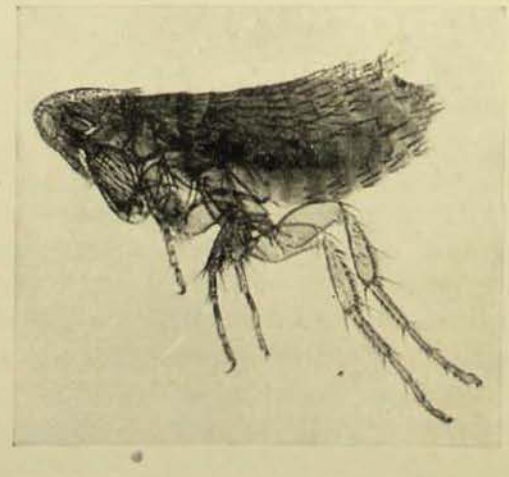
### FLEAS.

Fleas are all small, wingless, laterally compressed insects with mouthparts adapted for piercing and sucking. They progress mainly by leaping. Economically they are an important group, and eleven species are said to be capable of transmitting bubonic plague. All the forms which come into contact with man in Australia have been introduced with the animals with which they are usually associated. These are the cosmopolitan Human Flea, *Pulex irritans*, the Dog and Cat Flea, *Ctenocephalus canis* and *felis*, the Mouse Flea, *Leptopsylla musculi*, the European Rat Flea, *Ceratophyllus fasciatus*, the Indian Rat Flea, *Xenopsylla cheopis* (the species usually identified with bubonic plague) and the Stick-tight Flea or Jigger, *Echidnophaga gallinaceus*. The Chigoe, *Dermatophilus penetrans*, which attacks man in tropical countries, has not been recorded from Australia.

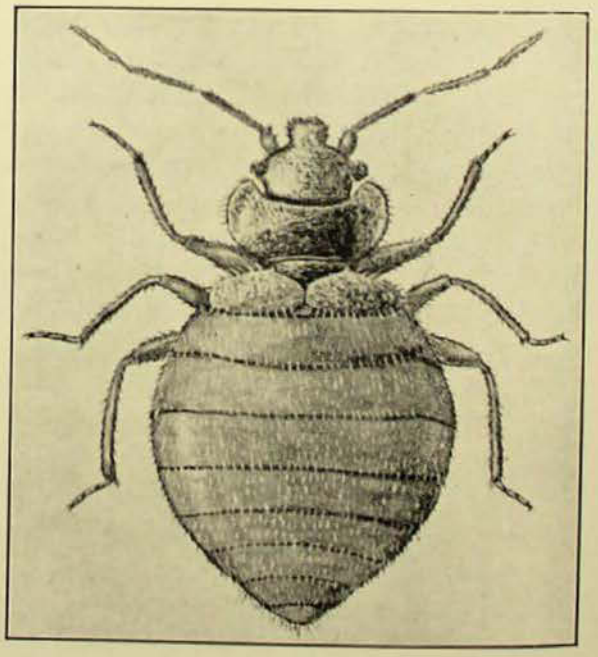
To control fleas it is necessary to remove all dust, and to see that cleanliness is maintained. Floors should be scrubbed with a kerosene emulsion; cats and dogs may be dusted with derris powder or pyrethrum dust, and their bedding changed frequently.

### THE BED-BUG.

Like fleas, the Bed-bug, *Cimex lectularis* L., is a pest to man through its bite, which often causes swellings accompanied by severe irritation. An unpleasant feature of the Bed-bug is the offensive odour so characteristic of these insects. Bugs, unlike fleas, are night-feeders of human blood, and during the day they live in crevices and cracks in beds, furniture, walls, and roofs. The



**The Mouse Flea, Ctenopsylla musculi.**
Photo.—R. Grant.



**The Bed-bug, Cimex lectularius.**
After Patton and Cragg.

best method yet devised for their control is fumigation by means of hydrocyanic acid gas, a deadly substance the use of which should be left to experienced persons.

THE ITCH MITE.

Though not a true insect, but an arachnid, the tiny acarid, *Sarcoptes scabei*, is the cause of the skin complaint in man known as "scabies". This is an extremely unpleasant malady, though not a true disease. The mite burrows in the skin and the female lays her eggs (forty to fifty) in the burrow. When the larvae hatch out they burrow still deeper, causing vesicles or pimples. The life-cycle is complete in nine to fifteen days. The burrows are found between the fingers and in the crutch, etc. Infestation is due to close personal contact, and the disease is regarded as allied to the venereal diseases. Control measures consist of attention to personal cleanliness, and disinfection of clothes and bedding. Infected persons will require medical treatment.

Such, then, is a brief review of the insects dealt with under the heading of "Man's Insect Enemies in Peace and War". In the present contribution it is not possible to deal also with the "Insect Pests of Stored Grain and Food Products".

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# Review

THE FISHES OF AUSTRALIA: Part I: SHARKS, RAYS, ETC. By G. P. Whitley. (Royal Zoological Society of New South Wales, 1940.) 280 pp., 303 figs. 7/6.

AN Australian book on sharks cannot fail to interest a wide public, especially when written, as this book is, graphically and with a wealth of illustrative and diversely informative material. Mr. Whitley presents a full and fascinating account of shark attacks, including the notorious shark arm case. He has visited most parts of Australia to obtain and study material, and has apparently ransacked most European museums in his survey of type specimens worked upon by the earlier zoologists. With the exercise of indefatigable scholarship he has also covered the vast mass of popular and scientific literature on sharks in many languages, quoting even from such recondite sources as James Joyce and Oppian's Halieuticks. The result is a most illuminating compendium of data about sharks and their kin—from mythological lore to the fabrication of Jenny Hanivers by the old-time sailors.

The serious purpose of the book, however, is the section devoted to a descriptive account of the Australian species. There are numerous photographs, and these and formal illustrations of all the species, together with a short summary of distinguishing characters, will aid the fisherman or student in identification. There are, however, no family or generic diagnoses, so that the inexpert reader must, in order to identify any particular specimen, search through the whole gamut of descriptive matter. One misses the very handy keys which made identification so rapid in such handbooks as those of E. R. Waite and A. R. McCulloch. Mr. Whitley, however, would present himself with a difficult task in preparing keys, since, in the instance of sharks alone, he now indicates no fewer than 61 genera to accommodate the 81 species. Many will regret that he has not followed the modern trend to revert to the concept of regarding genera as convenient receptacles for groups of allied species. As a result there appear in this work many monotypic genera and many unfamiliar names of genera and species. Some changes in names of species must regretfully but perhaps inevitably be accepted under the operations of the law of priority; others, based on slight differences from closely related foreign forms disclosed by recent comparisons, urge one to feel that the sub-species concept, now so widely used in vertebrate taxonomy, might have been more widely applied, especially since the author himself admits that variations, due for example to differential growth, occur. The work carries a very comprehensive index, in which, however, the principal references might with benefit have been emphasized.

HAROLD THOMPSON.

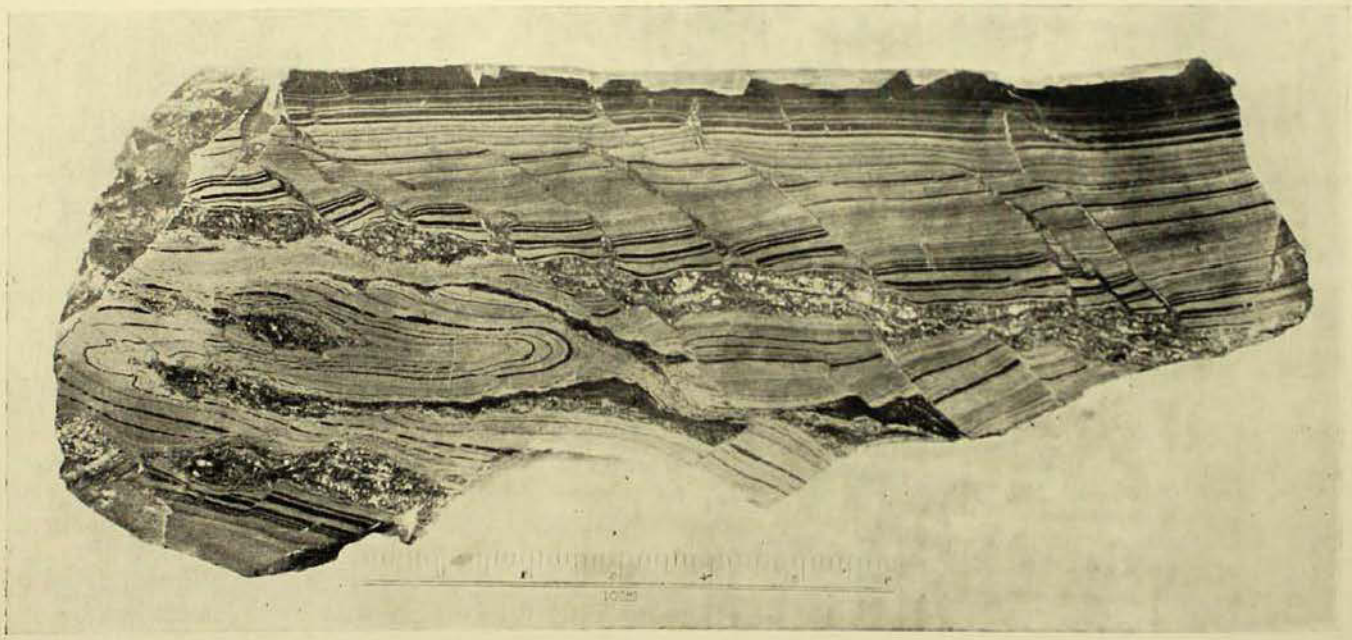
# Minerals from Mount Isa, North West Queensland

By T. HODGE-SMITH

THE ability of the Mineral Department of the Museum to display some of the marvels of the mineral kingdom to the general public depends in no small measure on the liberality of both the mining companies and the mining people of Australia. The minerals referred to in this article have been presented by courtesy of Mount Isa Mines Limited.

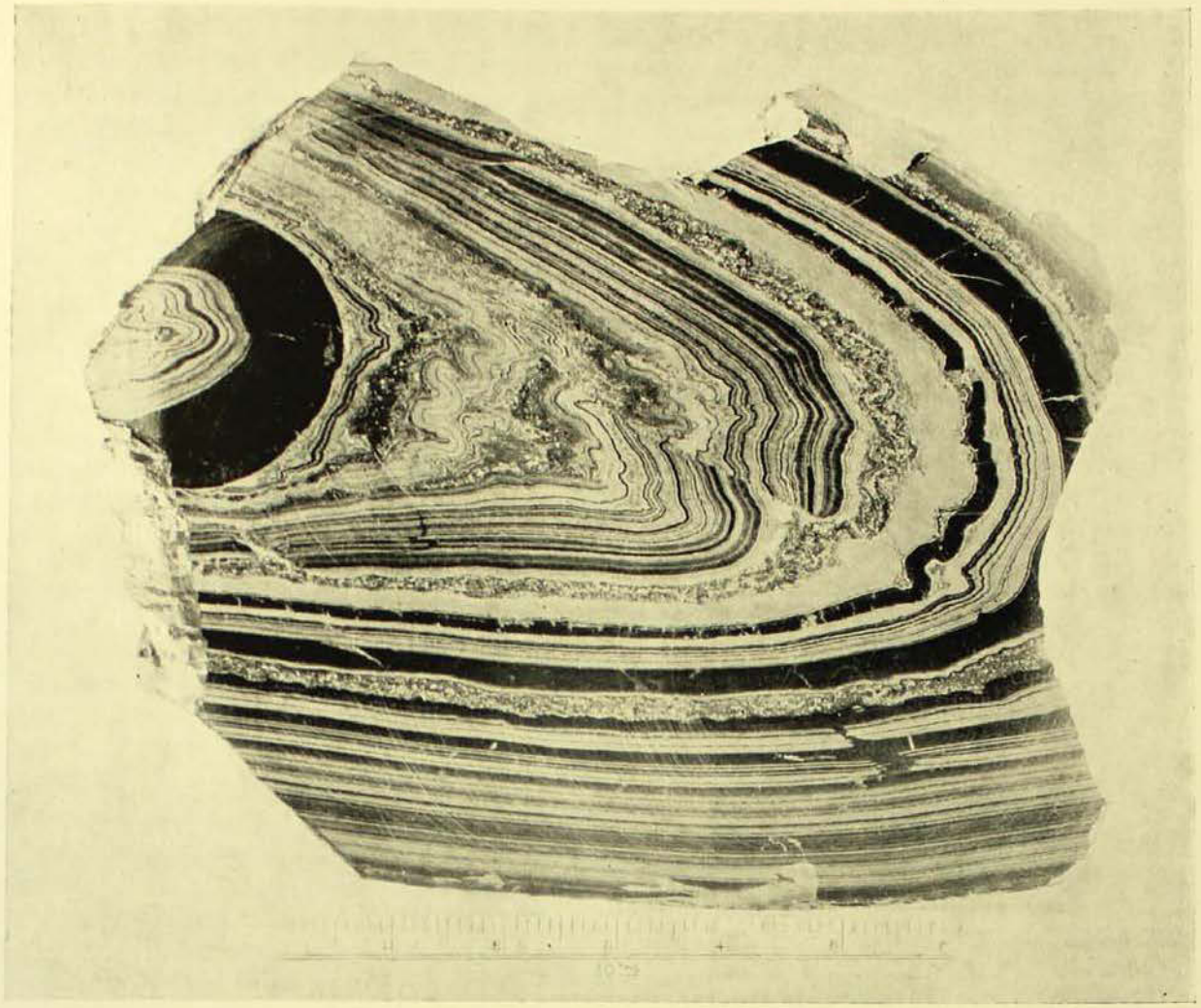
On display in our mineral gallery are beautifully crystallized specimens of pyromorphite displaying delightful shades of orange and green, while the pure white cerussite is hardly less pleasing. Both these minerals are comparatively rare at Mount Isa because they are found only at odd places near the surface in the oxidized zone, which here extends to an average depth of 175 feet. It is in this zone that the original ore consisting of silver, lead and zinc sulphides has been attacked by surface waters, resulting in the removal of much of the silver and zinc, and the alteration of the lead sulphide (galena) through the sulphate (anglesite) to the carbonate (cerussite), and to a much lesser extent to the chloro-phosphate (pyromorphite).

Recently Mount Isa Mines Limited kindly supplied the Museum with two interesting specimens from the unoxidized or sulphide zone, showing clearly the complicated folding and faulting of some of the ore material. The specimens have been polished to show the structure more distinctly, and incidentally to provide the Museum with two structural specimens that for beauty and interest cannot be matched elsewhere in the world.



**Polished specimen of Mount Isa ore showing folding and faulting of the shale. The speckled portion is the lode material which has replaced the shale.**

Let us trace the history of these specimens. Once upon a time about 900,000,000 years ago the material, not including the mineral matter which it



**Polished specimen of Mount Isa ore showing folding of the shale. The speckled portion is the lode material which has replaced the shale.**

now contains, was carried by rivers as fine mud to the sea, where it slowly collected on the bottom to form a stratified deposit. Naturally Mount Isa was not a mountain then, but merely a spot beneath the trackless ocean.

Later, the deposition of the shale conditions changed, and probably a general elevation or raising of the ocean floor brought the coast line nearer to what is now Mount Isa, and a great thickness of sand was deposited on top of the mud. Slowly this mud and sand were converted into solid rock to form shale and sandstone respectively. The latter has been subsequently converted into quartzite.

Beyond this our story becomes somewhat vague, but there is good reason to believe that both the shale and the sandstone were buried to a depth that could be measured in miles. Then as a result of a tremendous stress set up within the earth's crust an upheaval upon a large scale occurred and the whole series of sediments was tilted, so that the beds of shale and quartzite were no longer horizontal but steeply inclined like plates standing on their edges. Had it been possible at this stage to collect the rock material represented by the polished specimens there would have been no folding or faulting but only straight unbroken bands, though probably not so well marked as they are today.

Later a separate, less intense local thrust or stress from within the earth's crust caused development of the folding and faulting observed in the polished specimens. Where the shale was unable to withstand the pressure it became crumpled and folded as illustrated, much

as the leaves of a book would react if strong pressure were applied to them from one end. When the strain was too great the shale fractured and movement or displacement took place along the fracture planes which produced the structure known as faulting.

It is only where the shale is distorted by folding and faulting that mineralization occurs at Mount Isa. Although these shale beds have a width of more than two miles at the present surface, the mineralized zone, within which the ore bodies occur, has a maximum width of only 660 yards or slightly more than one-sixteenth of the total width of the shale.

Now all is ready for the invasion of the ore-bearing solutions which would be able to attack the disturbed shale more easily than the unaffected rock. Generally ore-bearing solutions are closely associated with great intrusions of molten rock material which solidifies to form an igneous rock such as granite. No sign of intrusive rock has been found in the shale, but pegmatite occurs in adjacent rocks several miles distant, and it is possible that the solutions were derived from the same igneous source as the pegmatite.

It seems likely that the intrusion of the pegmatite dykes into the adjacent rocks, or the intrusion of the larger reservoir of igneous rock deeper beneath the earth's present surface to which the pegmatites must be related, may have been responsible for the later local stress which caused the folding and faulting in the shale.

Wherever the mineralizing solutions originated the specimens clearly show how they attacked the shale along the folded bedding planes and along the fault planes to replace the rock, in the first place, by quartz and pyrite (iron sulphide). Then followed the main mineralizing solutions that replaced the shale by the lead, zinc and silver minerals, the recovery of which is the object of the operations of the Mount Isa Mines Limited.

The specimens were collected from mine workings at a depth of 800 feet beneath the surface. Similarly folded and fractured ore-bearing rock extends upward to the surface, and downward from the 800 foot level for many additional hundreds of feet; but the patterns of the alternating ore and rock minerals are not always as beautifully developed and preserved as in the polished specimens.

It has already been stated that the rocks were buried to a great depth below the earth's surface when they were intruded by the ore-bearing solutions and it is not definitely known how they reached their present position above sea level. During the hundreds of millions of years since all this took place many thousands of feet of overlying rock have been eroded in this portion of Queensland, and at least several disturbances in the earth's crust are known to have occurred in this region and these have all tended to elevate the deeper-lying rocks. Probably both erosion and uplift have combined to bring the Mount Isa silver-lead-zinc deposits to their existing position of exposure at more than 1,300 feet above sea level.

The polished specimens would be welcome to the Museum merely as objects of beauty. With their history pieced together by geologists into a more or less connected story, their value is greatly enhanced. I am indebted to Mr. Graham Hall, Senior Geologist of the Mount Isa Mines Limited, for the geological information contained in this article.

# Australian Shells

## Ear and Siphon Shells, Brackish Water Slugs and Snails

By JOYCE ALLAN*

THESE groups of shells are placed in the subclass Pulmonata, a division of the Gasteropods which embraces all the land and freshwater univalve shells. The Pulmonata are usually snail-like animals with a crawling foot and spiral shell. Their breathing organ is adapted to their mode of life, and is the simplest form of lung, resembling the branchial chamber of the sea-snails, but lined with a network of respiratory vessels, instead of gills.

The majority of Pulmonata are land-living, the best examples being the ordinary garden and bush snails, but some live in freshwater creeks and ponds, or in rivers, and a few inhabit damp places near the sea where at high tide they are covered by its waters. It is these last ones which form the subject of this article.

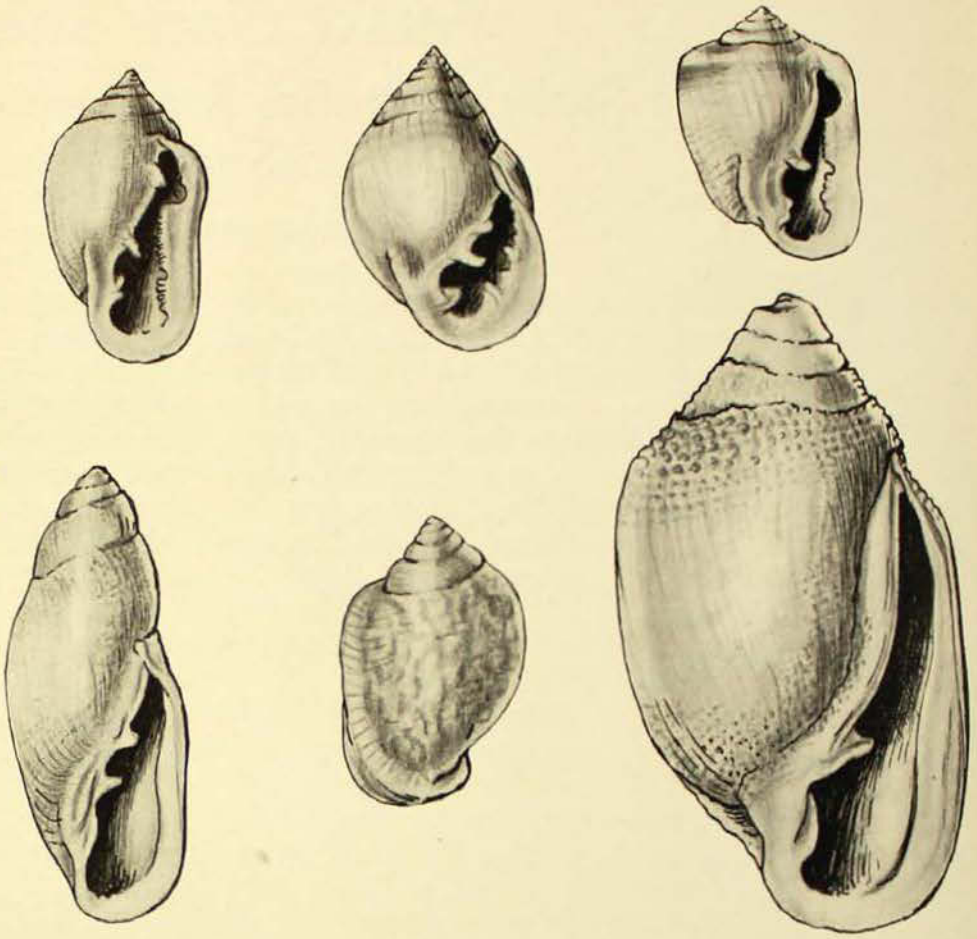
Ear and Siphon shells and the brackish water slugs and snails are a most interesting group, but more so to the trained scientist who is interested in their ecological and zoological relationships than to the amateur shell-gatherer, who frequently prefers showier shells. Though they are able to live out of the water for often considerable lengths of time, some of the species in the group form a definite link between it and purely marine shellfish. Examples of these are the genera *Siphonaria* and *Gadinia*, limpet-like shells related to the true limpets of the sea-shore, and the brackish water slugs of the family Onchidiidae, which are related to the very beautiful, and much more brilliantly coloured sea-slugs, the Nudibranchiata.

With the exception of the Siphon shells and the Gadiniidae, the shells dealt with here are found in brackish water, frequently among mangrove swamps throughout the tropical and subtropical regions. They may be seen at high tide crawling over the muddy bottom in several feet of water, or amongst stones and gnarled roots of mangroves, far back from the waterline, showing indifference whether their environment is aquatic or terrestrial, provided the air is moist.

The soft black mud of the mangrove regions and the brackish water, with its reduced salinity compared with that of the foaming surf crashing along the rocky coastline, are suitable for the existence of only a small and specialized shellfish fauna, as they are for other faunas. Whole classes are absent, since mangrove waters are shunned by vast numbers of families requiring more salinity or sunshine, a different substratum, or different food. The species of shells which do live there are very different in colour, texture, and shape from those found, for instance, amongst warm waters and sandy beaches of coral reefs. Though they may be solid, they are in most cases dull coloured, and frequently covered by a dark brownish epidermis. Teeth, which incidentally act as a good guide in identifying members of the group, may in some species limit the mouth opening considerably.

It is the ability of these shellfish to exist for a length of time out of the water, and to become practically air-breathers, even if temporarily, that makes them such an interesting study. For the same reason, the Siphon shells, which are part-time air-breathers of the rocky shore, are always an interesting problem. A short account of the commoner forms of this group will now be given, commencing with the Ear shells. It must be remembered that there are

* Illustrations by the author.



**Larger Ear Shells. The three top ones, from left to right, are Rhodostoma aurisfelis, Pythia scarabeus, and Rhodostoma angulifera; and in the bottom row are Ellobium aurisjudae, Rhodostoma rugata, and Ellobium aurismidae.**

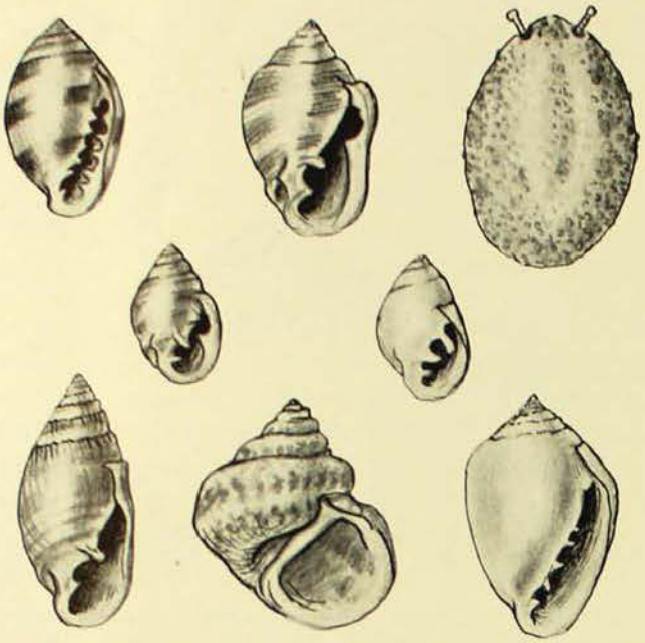
numbers of closely allied species, but it is impossible to include them in an article of this length.

EAR SHELLS.

These must not be confused with the rocky shore Abalone, which is sometimes known as the Ear shell, owing to its ear-like shape. In the Pulmonate Ear shell, it is the ear-like shape of the mouth opening which gives it the popular name. Ear shells belong to the family Ellobiidae, which contains the largest members of the group, many of those found round the Philippines and the East Indies being particularly large and handsome. They usually inhabit salt water marshes and mangrove swamps, and quite a number of species are found in Australia.

As Ear shells are quite distinct in shape, there is no need to give lengthy descriptions of their characteristics; it should be a simple matter to identify them from illustrations.

One of the best known species of the family is *Pythia scarabeus*, a flattened, solid, oval shell, about one and a half inches high, which is common throughout the Indo-Pacific, where it lives in damp places near the shore. The outer lip of the mouth is widely expanded, and series of strong teeth on the lips of the mouth almost block the aperture: it is brownish-yellow, with a green or blue tinge, and is frequently mottled. The typical Ear shell is *Ellobium aurisjudae*, an Indo-Pacific species about two inches or more long, with a finely granulated surface showing through a brown epidermis, and a white mouth with two strong teeth on the inner lip. It creeps through slimy mud round roots of mangroves, and is believed to have lost its eyes through disuse. The largest species of the family living in Australia is *Ellobium aurismidae*, from Western Australia and Queensland, also New Guinea. It is a heavy white shell covered with a golden polished epidermis, and has bead-like



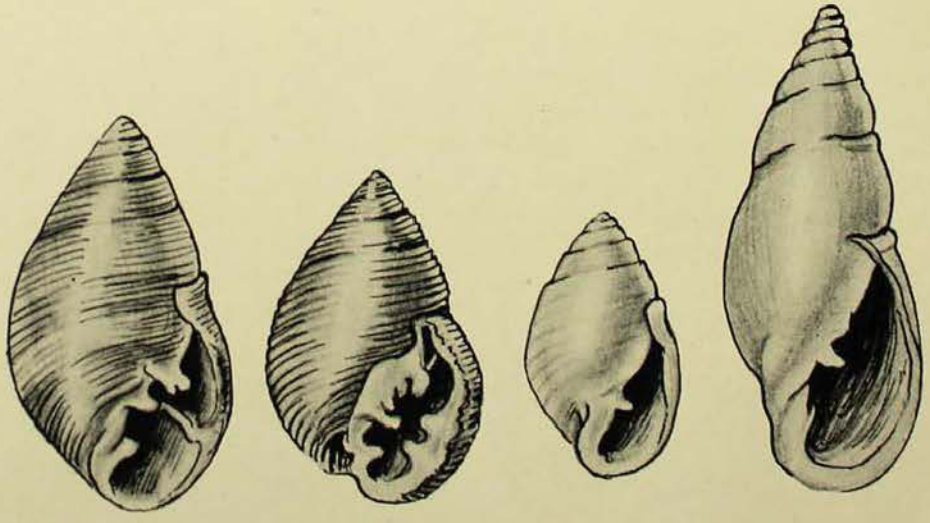
**In the top row are two Ear Shells, Melampus fasciatus and Rhodostoma nucleus, and the Mangrove Slug, Oncis chameleon; in the middle row are, from left to right, Melosidula zonata and Cremnobates parva; in the bottom row are Ophicardelus ornatus, Salinator fragilis and Melampus luteus.**

cancellations on the upper part of the whorls.

Contrasting with these two species is *Rhodostoma angulifera*, a northern Australian shell with a square shoulder, well-marked teeth, and a white line running round the pale brown ground colour on the shoulders; it is a little over an inch high. Another slightly larger species, *Rhodostoma rugata*, also from northern Australia, is chocolate brown, with creamy yellow mouth and teeth, and has its surface, especially the back, thickly and unevenly plicated, giving it a very rough appearance, as the illustration shows. A close relative, *Rhodostoma aurisfelis*, from the same locality, is more slender with less pronounced plications.

Amongst smaller species of the family, those under an inch high, are *Rhodostoma nucleus*, a light brown shell with revolving white bands and fine striae, from New Caledonia; a small dark brown species, *Melosidula zonata*, from the upper regions of Sydney Harbour, such as the Parramatta and Lane Cove Rivers and Middle Harbour; a tiny, pale buff, white toothed shell, *Cremnobates parva*, from Tasmania; a South Pacific Islands' golden brown and white striped species, *Melampus fasciatus*; a yellow and white, smooth, slightly polished shell, *Melampus luteus*, which natives of the South Pacific thread into necklaces; and a common Sydney mangrove shell, *Ophicardelus ornatus*, which can only be described as dark mud coloured. In company with the latter species is frequently found a closely related, southern Australian one, *Ophicardelus quoyi*, and also a more northern one, *O. sulcatus*.

Apart from these a number of smaller species, about one-quarter inch or less in height, are figured. These are a Sydney shell, *Plecotrema lirata*; a New South Wales, South Australian and Tasmanian shell, *Leuconopsis inermis*; another southern Australian species, *Marinula meridionalis*; and a brown and white Queensland form, *Laimodonta conica*.

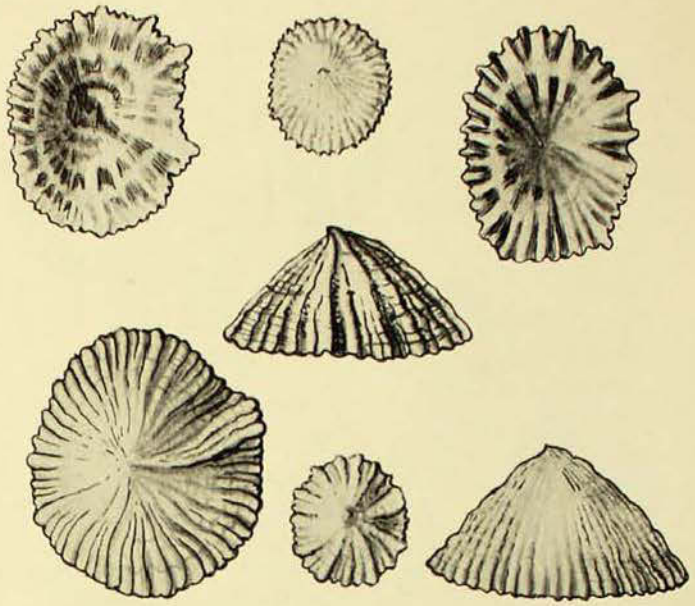


**From left to right the species figured here are Laimodonta conica, Plecotrema lirata, Leuconopsis inermis and Marinula meridionalis. These are somewhat enlarged.**

### SIPHON SHELLS.

Owing to their limpet-like shape, and the fact that they live between tides attached to rocks along coastlines, Siphon shells are often a problem to young collectors, who find difficulty in distinguishing them from true limpets. They are, however, not limpets, but connecting links between those and the Pulmonata, a relationship depending upon anatomical structure. The true gills or branchiae of the normal sea-snail are absent in Siphon shells, and the mantle instead functions as a pulmonary sac or lung, with rudimentary branchiae forming triangular folds of the lining membrane. Siphon shells are as a rule more flattened than limpets, and have a horse-shoe shaped muscle scar inside, divided on the right by a deep, light-coloured, siphonal groove. It is this groove which helps to identify them, especially as in most cases it produces a slight projection on the right side margin of the shell. Siphon shells, which belong to the family Siphonariidae, live in warm and temperate seas, and quite a number of species are found in Australia. Though they are marine creatures, they can remain for lengthy periods out of the water, depending only on the occasional dashing of spray, a condition for which their respiratory structure amply fits them.

Only a few species have been chosen for this article, and these are *Siphonaria scabra,* with a range from New South Wales to south west Australia; *Siphonaria bifurcata,* from New South Wales; a more elevated, uniformly ribbed, southern Australian species, *Siphonaria denticulata*; a very elevated Tasmanian species, *Siphonaria funiculata*; and a small, delicate shell from the southern regions of Australia, *Siphonaria baconi.* A small, delicate, buff-cream shell, *Gadinia conica,* of the family Gadiniidae, is rather like a Siphon shell in shape and sculpture, but is flatter and only about half an inch in diameter; it is fairly common on beaches round Sydney, and occurs also in southern Australian States. A very small oval shell with a twisted apex towards one end is called *Pugillaria stowae.*



**Siphon Shells. The three top ones are Siphonaria bifurcata, the small Gadinia conica, and the inside view of Siphonaria denticulata. Between the upper and lower row is side view of Siphonaria denticulata, and in the bottom row Siphonaria scabra, Siphonaria baconi, and a side view of Siphonaria funiculata, a very elevated species.**

### BRACKISH WATER SLUGS.

Brackish water slugs in this case refer to those belonging to the family Onchidiidae. It is possible for typically marine slugs, especially pelagic forms, under unusual circumstances to be washed up into brackish waters, but it would only be a matter of time before they found existence a struggle in their changed environment. The Onchidiidae, sometimes known as Mangrove slugs, but more usually Onchidiums, thrive, on the other hand, amongst the black mud and gnarled roots of mangroves, where they live in comparative safety, secure in the knowledge that in those sheltered waters their enemies are few. As far as man is concerned a trip into mangrove country may mean a battle with clouds of mosquitoes, sand-flies and sinking mud, so that only the keen collector hunts Onchidiums.

In appearance these slugs are unattractive. A little over an inch long, roughly oval in shape and brownish olive to grey coloured, they crawl about on a

broad foot, with two tentacles standing out from the head, and are often difficult to see when in their natural surroundings. They are a connecting link between the Pulmonata and the typical sea-slugs, the Nudibranchiata, and some species can exist for at least a month either under the water or out of it provided the air is moist, respiration being performed by the dorsal surface of the mantle and its appendages. The distribution of the family is tropical and subtropical, but several species are found in the colder waters of south New Zealand. About twenty-six different species are believed to occur throughout the South Pacific, including several in Australia, particularly along its east coast.

Among mangroves lining the foreshores of the upper reaches of Sydney Harbour, such as the Lane Cove and Parramatta Rivers and Middle Harbour, and at Port Hacking, occur such species as *Oncis chameleon*, figured here, *Onchidium damelii* and *Onchidella patelloides*. The first two are said to have the power of changing their colour when disturbed or when their position is changed to a different background. The former of these is olive toned with two light yellow bands running along the dorsal surface from the head towards the posterior end, and the latter is olive-green with darker markings, and many of its dorsal pustules bear conspicuous "eyes". The third species is yellowish-brown with radiating black lines.

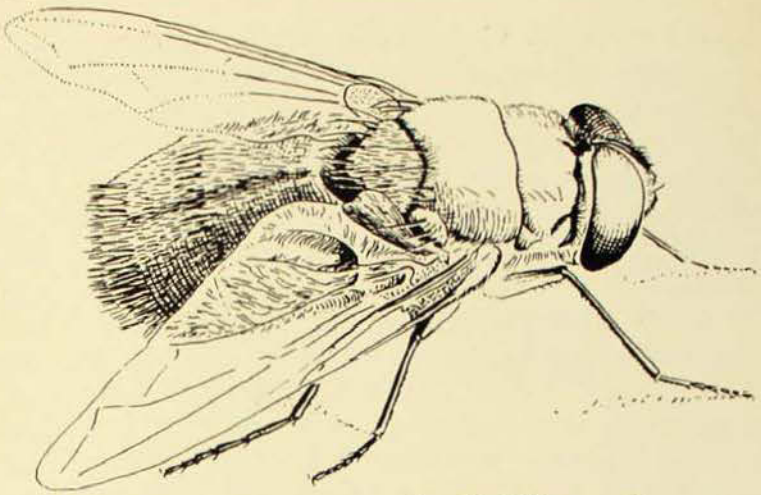
### BRACKISH WATER SNAILS.

The best known representative of this group of Pulmonata, as far as Australian waters are concerned, is *Salinator fragilis*, of the family Amphibolidae, a species distributed along the east coast from southern Queensland to South Australia. The shell is typically snail-like in shape, about three-quarters of an inch high, and underneath a pale brown epidermis is quite prettily marked. Though a pulmonary lung replaces gills in these snails, they have not become inhabitants entirely of fresh water, but like the Siphon shells are intermediate between the essentially freshwater and marine living forms. Their usual home is on muddy flats, where they burrow out of sight at high water, but at low water emerge and move about, leaving a track behind them. Their eggs are laid in a sandy ring-like girdle, resembling that of the Sand Snails. Mrs. M. E. Freame, of Melbourne, who has collected these brackish water snails at many localities along the Victorian coast, particularly at Altona, has written a very interesting account of their habits in the March, 1940, issue of the "Victorian Naturalist". Mrs. Freame has observed them for some time and is now able to produce for the first time excellent photographs of the snail and its egg-girdle as well as of the young snails developing in the egg. Though this is the first time a record of this development has been printed in Australia, the related New Zealand species, *Amphibola crenata*, has been very thoroughly investigated in that country. The Australian species is common in estuarine waters and amongst mangroves near Sydney.

The present article, so far as marine and semi-marine shells are concerned, brings to a conclusion the Gasteropoda proper, or univalves, as they are generally called, with, of course, the few exceptions previously mentioned. In the Gasteropoda are a few more very interesting groups, quite unlike the normal sea-snail in appearance, and these will in all probability be the subject of the next article on Australian shells, after which the Bivalves will be commenced.

# Some Strange and Beautiful Flies

By NANCY B. ADAMS*



A handsome bronze green fly, Rutilia regalis. × 3.

IT is not unnatural that we should regard the subject of flies as a singularly unattractive one, for we invariably associate the word "fly" with something that is at best a nuisance; at worst a loathsome carrier of disease. The species with which we are most familiar—sandflies, blow flies, mosquitoes and the ubiquitous house fly—are all creatures whose unpleasant habits make a far from agreeable subject for study, and, moreover, constitute a definite menace to our well-being. In fact the order Diptera to which the flies belong is by far the most important group of insects when considered in relation to man. In it are included species which cause tremendous losses among sheep every year, and which deposit their eggs or larvae on blankets and wool; pests of plants, cereals, fruit, vegetables; parasites of horses and cattle; notorious carriers of disease, and contaminators of food. Yet this order is a very large one, and contains many beautiful and harmless species as well as some which are definitely useful. So much attention has been paid to the economically important members of the group, that the many species interesting because of exceptional beauty of form or unusual life histories have been neglected. The object of the following article is to give a brief account of a few of the more decorative Australian flies, and those remarkable for their curious habits, apart from their economic significance.

* Illustrations by the author.

The fascinating subject of life histories is outside the scope of the present article, but the life cycle of a fly may be briefly summarized. The eggs are usually soft, creamy white, and more or less oval in shape. From the egg hatches a fleshy larva or maggot. These larvae are extremely diverse in form, though all agree in that none have any true legs. A few are provided with stumpy processes known as pro-legs, but the majority are completely legless, soft, with small heads and strong curved jaws. These larvae may be found in stagnant water, decaying animal and vegetable matter, living plant tissue, as parasites in the bodies of spiders, or are active and predaceous on aphids. When fully grown the larva changes into a pupa. The pupal stage is a resting period during which the insect changes into the adult form, so that these pupae take no food and remain comparatively inactive. They vary a good deal in shape, and in some groups the pupa is enclosed in a tough papery shell—the last larval skin. The perfect insect eventually emerges by splitting open the pupal skin, so completing the life cycle.

The adult members of the group may be distinguished by the fact that only one pair of wings is present, the second pair being reduced to two small processes known as balancers or halteres. A pair of enormous compound eyes are a conspicuous feature, and as a rule the mouth parts are adapted for piercing or sucking. Although all members of the order have

these basic characteristics they exhibit an extraordinary diversity of shape, size and colour.

The order is divided into a number of families, the classification being based largely on the type of wing venation. The wings of flies are for the most part clear and transparent so that the arrangement of the veins is plainly visible, each family having its own distinct venation pattern.

Among the most striking members of the group are the Asilidae or Robber flies. They prey upon bees, flies and even tough-shelled beetles, seizing their unfortunate victims in the air, transfixing them by means of a long horny beak and sucking up their body juices. The larvae, which are found in rotting wood and in the soil, are either scavengers or else they prey upon the larvae of other insects. The handsomest member of this family is *Blepharotes coriarius*. One of the largest of all Australian flies, it is about one and a half inches long and measures two inches across the outspread wings. It is black, the wings smoky brown, and the bright orange body decorated along the sides with tufts of black and white hair. It is not uncommon in New South Wales and because of its striking appearance is frequently sent in to the Museum for identification.

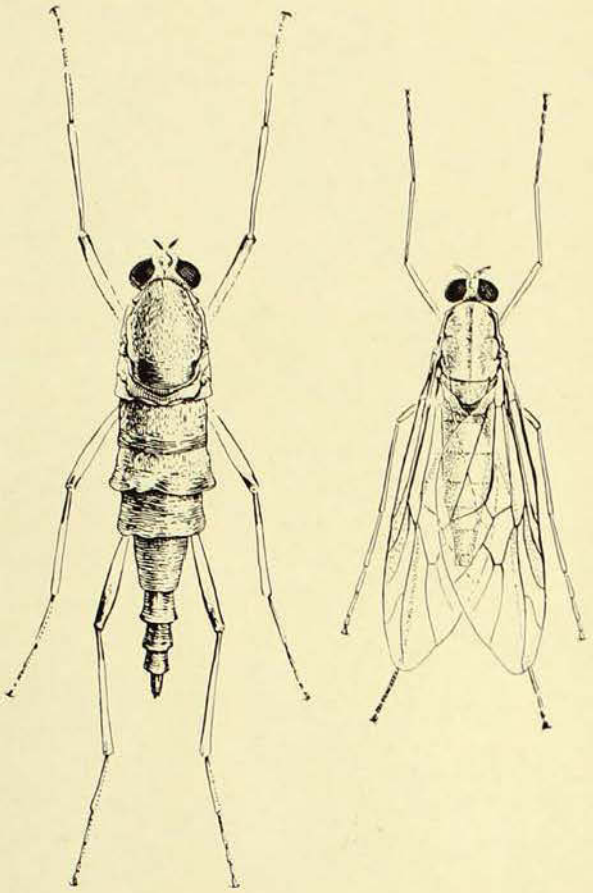
The family Mycetophilidae is remarkable for the curious larvae known as "glow worms", but they are not closely related to the European insects of that name. These small thread-like larvae are found on rocks in damp shady places, where they spin webs in the crevices to capture prey. A large colony of these flies is situated in a gully at Bundanoon, New South Wales, where it is a great attraction to tourists. At night these creatures gleam like hosts of tiny stars in the darkness.

The Hover flies, which belong to the family Syrphidae, are so-called because they may often be seen poised over flowers, wings vibrating so rapidly that they are visible only as a confused blur at the sides of the body. These flies make sudden swift darts forward and then hover motionless in the air. They are very common in gardens in sunny

**One of the largest Australian flies, Blepharotes coriarius. Natural size.**

weather, and hide among the leaves after the sun goes down. The eggs are laid on aphis-infested plants, and the larvae, which are usually pale green, legless, elongate and capable of great extension of the body, feed upon aphids, stabbing them with their jaws and sucking up their body fluids. The pupae are hard oval-shaped objects which usually fall to the ground, but may sometimes be found gummed to twigs.

Perhaps the most remarkable of Australian flies is one of the members of the family Stratiomyiidae which has no popular name and is scientifically known as *Boreoides subulatus*. The male is not particularly striking, but the female is a peculiar wingless creature, larger than the male, with a heavy dingy brown body and long spidery legs. It is not uncommon in the vicinity of Sydney, and has been recorded as occurring in large numbers round a house in Victoria, the wingless females crawling over the



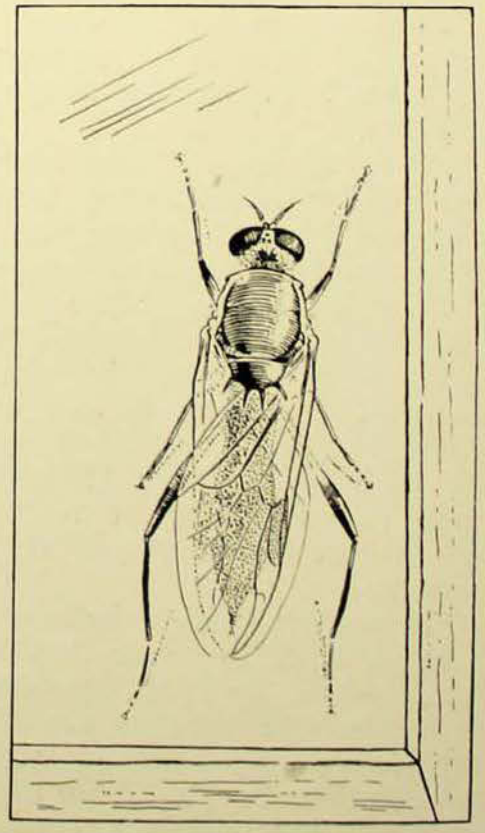
**Right, male; left, female of Boreoides subulatus. × 2½.**

verandah in alarming swarms. The best known Stratiomyiid fly is a shiny black insect just over half an inch long, very slender, with clear wings clouded with black, which often comes into houses about Sydney and crawls over the window panes, seeking a way out. It has been scientifically christened *Neoexaereta spiniger.*

The family Empididae is a little known group, its members being remarkable for their curious courting habits. They prey upon other insects, and Mr. K. C. McKeown in his book "Insect Wonders of Australia" gives an amusing account of the courtship of these strange flies which "bring offerings in the shape of the bodies of other insects to the female, and, after dancing before her, offer their gift as a prelude to pairing. I have observed an undetermined species of Empid going through these preliminaries before both his offering and his attentions were accepted with favour by his chosen mate." The larvae are slender cylindrical creatures, and little is known of their habits, though they are thought to be carnivorous and are found in rotten wood and leaf mould, and a few are aquatic.

During the summer large heavily built, magnificently coloured flies with broad bodies covered with bristly hair are often seen resting on fence posts or the trunks of trees; when disturbed they fly away with a loud buzz. Most of these belong to the tribe Rutilini, and the commonest of the group is known as *Rutilia regalis*, a handsome bronzy green insect nearly an inch long. These are among the most decorative Australian flies, many being gorgeous with iridescent, metallic blue and green colours, extremely shiny, and carrying stout bristles and tufts of hair. Some have a distinctive pattern of black and white markings. The larvae, which live in the soil, are parasitic on various beetle grubs.

The old story of the spider and the fly is familiar to most of us, so that from nursery days we retain the impression that spiders are mortal enemies of flies, but in the case of the family Cyrtidae the



**A fly commonly found on the window panes of houses about Sydney, Neoexaereta spiniger. × 3.**

tables are turned. Details of the life histories of Australian species are not available, but there is good reason to suppose that they follow closely the habits of other members of the family in America. The shiny black eggs are laid on the bark of trees or on the tips of bare twigs, to which they adhere by means of a sticky coating. These flies lay an extraordinarily large number of eggs; a single female of an American species is recorded to have produced 3,977. The entire surface of a twig may be covered with a mass of tiny eggs resembling a dark fungus. The eggs may remain dormant for long periods during dry weather, but when humidity is high they hatch and the young larvae emerge. These larvae are extremely active, being provided with two long stout bristles at the hind end of the body by means of which they can leap a comparatively long distance—several times the length of the insect itself.

The tiny larvae make their way into the spider's body through the thin tissue at the joints of the legs, and feed on the internal organs of the unfortunate victim. In the case of an American species the host lives until the larva emerges through an opening which it makes in the abdomen of the spider when the latter dies. The larva pupates after leaving the body of the host and the adult fly emerges as a curious small-headed, swollen-bodied, hump-backed creature, the mouth parts being degenerate and non-functional.

**Cyrtid or "Bladder Fly", the larva of which is a parasite of spiders. × 6.**

It has been possible to mention only a few of the many strange and beautiful flies found in Australia, and, moreover, the accompanying illustrations in monochrome give very little idea of the delicate perfection of structure, the rich downy pile, and the splendid colouring of these creatures.

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# Gifts for Soldiers

## A Practical, Easy and Safe Method

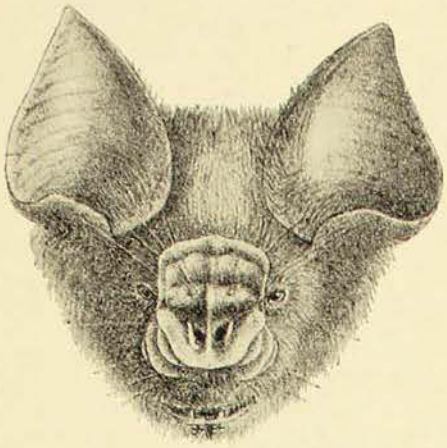
THE system of Canteen Orders, devised by the Australian Defence Canteens Service, operated in conjunction with the Postal Department, and backed by the Government, certainly clears away many problems for those who previously forwarded parcels to men of the Forces.

Canteen Orders on Australian Defence Canteens Service are available to relatives, friends and the general public, for the benefit of men of the Forces *in Palestine and in Australia.* They are issued by all Money Order Post Offices and are similar to Postal Notes, with all the protection of a crossed cheque. They will *not be available* for the troops *in the United Kingdom* until Australian Canteens are established there.

Canteen Orders are obtainable throughout Australia in denominations of 5s. (blue ground), 10s. (red ground), and 20s. (purple ground).

The name and number of the soldier, together with the name and address of the donor, appear on the order.

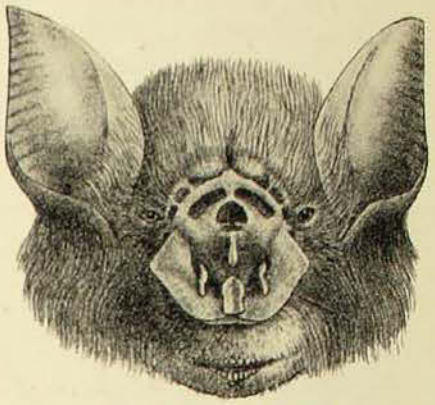
Goods sold in overseas canteens by the Australian Defence Canteens Service are not subject to any duties, sales tax, excise or other imposts; therefore, soldiers are able to obtain far better value than is possible when gifts are purchased in Australia and posted to members of the A.I.F., while all canteens are carrying a wide range of products eminently suitable for members of the Forces.



Diadem or horseshoe leaf-nosed bat of north-east Queensland.

# Furred Aeronauts of Night

## Little Bats as Friends of Man



Orange-yellow north Australian leaf-nosed bat.

By ELLIS TROUGHTON, C.M.Z.S., F.R.Z.S.

ALTHOUGH a gliding kind of flight with the aid of skin-flaps between the limbs has evolved in several groups of furred animals,* the only mammals that can sustain continuous flight by the beating of their arms and membraneous hands are the so-called "flying-foxes" and the "little bats" or "flying-mice". The wings of the prehistoric flying reptiles or pterodactyls differed from those of bats in having the membrane supported only by the greatly lengthened fifth finger. In birds the wrist and finger bones are reduced and adapted for the support and control of overlapping feathers, which replace membranes derived from the skin in reptiles and bats.

In all bats the wing-membrane stretches between the four greatly elongated fingers, while the short but well-developed first digit or thumb has a sharply hooked nail for assistance in climbing and attachment in tree-hollow and cave-shelter haunts. Because of the perfect adaptation of the fore-limb for flight, bats are grouped in the Chiroptera or "hand-winged" order of mammals. Also, in addition to the remarkably modified circulatory system which allows them to hang and sleep upside-down, bats have a most highly organized anatomical and nervous system, so that they are usually classified in zoological precedence next to the order of Primates which embraces the lemur-monkeys, apes, and man.

### ORIGIN AND SUPERSTITION.

Little is known of the prehistoric origin of bats, doubtless because the frail structure of their skeletons left but few traces of the ancestral stock. The few fossilized remains of bats from the Upper Eocene geological formations are found to resemble existing kinds so closely in aerial equipment that it would probably be necessary to go back a few million more years before tracing the missing links between bats and their non-flying mammalian relatives. Certain it is that the quaint winged creatures evolved from a primitive mouse-like stock of insectivorous mammals, fluttering out of the dusky ages to achieve mastery of the air long before prehistoric man walked upright.

The first fires of the cave man's rocky refuge flickered about the little "upside-down bats" clustered on rocky ledges, wrapped in the sheltering wings which serve alike as coverlets and curtains, and sent them flitting after the moths and beetles lured by the gleams of those first firesides. In this early mammalian comradeship inarticulate cave-men probably understood more of the bats' habits than we do today, because man has progressively drawn away from his natural contact with the companions of his dawning humanity. Becoming more

* See Troughton, "Marsupial Gliders or Flying Possums". THE AUSTRALIAN MUSEUM MAGAZINE, Vol. V, No. 8, 1934, p. 257.

**Australian Long-eared Bat. Five distinct species inhabit the mainland and Tasmania. The great lobes act as ear-trumpets for the highly pitched sounds of insect prey, or may be furled along creases to lessen wind resistance and to shut out sounds when sleeping. These bats, and the long-eared European species, have the largest ears proportionately of any living mammals.**

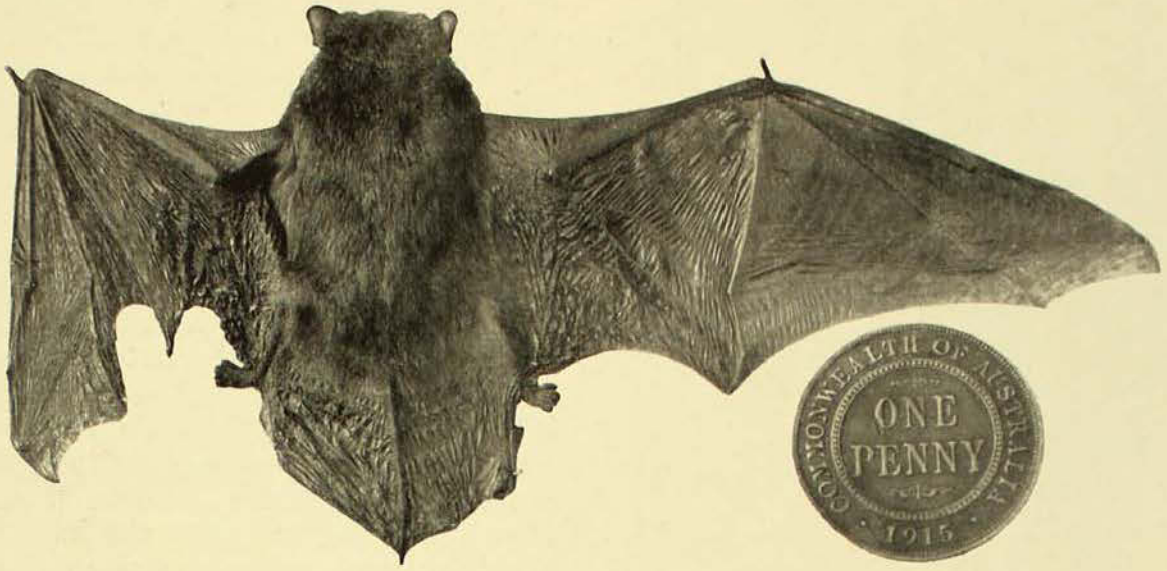
imaginative as reason developed, man grew to fear the cave-haunting dwellers of the darkness from which he originally emerged, and so, from time immemorial, bats have been maligned as harbingers of evil. The wings of bats became emblems of the infernal, so that ancient artists graced benign spirits and angels with bird-like wings and provided malignant demons and our old friend the devil with the sombre wings of bats.

In *Macbeth* Shakespeare reflects the popular sentiment of his day by classing bats with toads and adders as fit ingredients of the witches' "hell-broth", while in the terrifying novel *Dracula* Bram Stoker achieved a revolting blend of vampire and were-wolf from old Slavonic legends which could hardly fail to increase any reader's unreasoning fear of bats in general. Even today many otherwise matter-of-fact people regard the advent of a bat as foreboding misery or death, and the Chinese are amongst the few peoples that justifiably consider the little bats as happy omens, probably from knowledge of their usefulness to man.

In Australia, quite apart from any superstitious dread, the little bats are feared by most womenfolk for the mistaken idea that they are likely to become entangled with their hair. Others wrongly fear that bats will infest dwellings with myriads of lice-like insects, whereas the bat's few parasites are only minute wingless flies which are entirely dependent upon their aeronautical hosts. Actually the harmless and sensitive little bats are quite as useful as, and nearer to man than, the birds which we are pleased to call "our feathered friends". They enter lighted rooms solely to catch the insects which are so troublesome around country lamps in summer time, and the remarkably acute senses and agility involved in the pursuit of their swift-flying prey avoids any risk of collision with people, or lamps and other fixtures. Anyway, most small bats are unable to bite or scratch severely and invariably should be left in peace to their useful visitations.

### THE DISTRIBUTION AND CHARACTERS OF BATS.

The flying ability of most bats compares favourably with that of birds so that they are very widely distributed over the globe to the limits of tree-growth, at least one species extending to the Arctic Circle. About 2,000 individual species are now recognized, and the secretive nature of their habits is indicated by the great majority having been discovered to science within the last century, because in 1758 the great Swedish naturalist Linné listed only seven kinds, which only increased to fourteen in the following fifty years. The entire group exhibits an extraordinary diversity of form and size, ranging from tiny insectivorous bats, not much larger than humming-birds, to the great fox-bats of Malaya and the South Sea islands with a wing spread of over three feet.

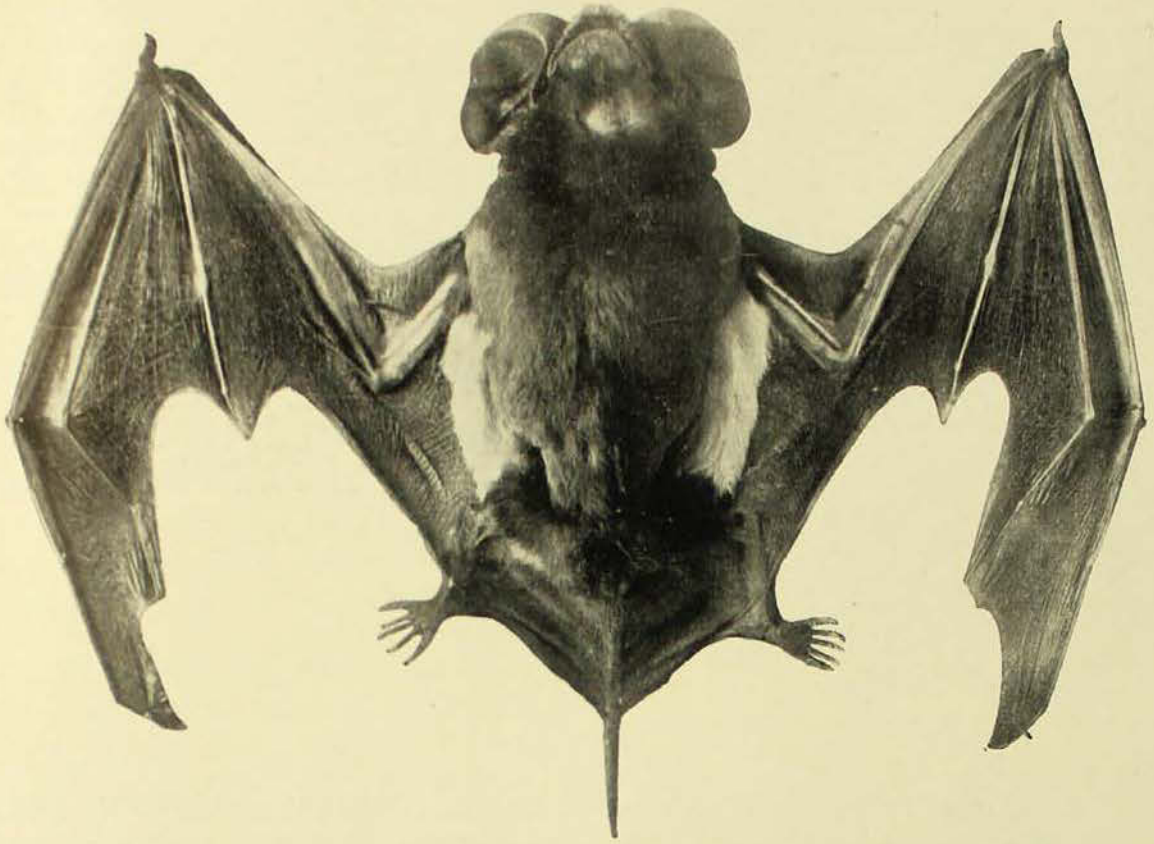



**The Little Bat is one of the smallest of our insectivorous bats, as the specific name pumilus indicates, and it ranges over the mainland, Tasmania, and Lord Howe Island, where the author first noted it. Though compared in size with the penny, the little flying mammal is "worth its weight in gold" as a consumer of mosquitoes and other insects.**

To simplify the study and classification of this great variety of hand-winged mammals, the order Chiroptera is divided into two very distinct groups. The sub-order Megachiroptera includes the larger and mainly frugivorous and blossom-feeding bats to which the zoologically misleading name of "flying-fox" is commonly applied in reference to the foxy appearance of the head, with its slender snout, bright eyes, tapered ears, and usually reddish colouring. The smaller and mainly insectivorous bats dealt with in this article are known as "little bats" and are therefore included in the sub-order Microchiroptera. Although usually recognizable by their wizened little faces and beady eyes, insectivorous bats are invariably distinguished by the character of their molar teeth. The cusps of the molars form sharp W-shaped crowns for the grinding of brittle insect parts, instead of the smoothly hollowed molar-crowns of the frugivorous flying-foxes, adapted for the pulping of fruits and blossoms. In the little bats, also, only the thumb is clawed, never the second digit as in many fruit-bats. The tail is always present, and, unlike the tails of fruit-bats, is invariably enclosed by the inter-thigh membrane. The shaft of the tail may pierce the upper surface of the membrane, or extend beyond it so that the membrane may be reefed along it as a further aid to mobility of flight, or out of harm's way when crawling over roughened surfaces after insects. Other uses attributed to the tail-membrane are that when curled forward it forms a pocket into which the young are born, as a scoop for taking up drinking water in flight, and even as a drag-net for the fish-eating bats of the West Indies.

### HABITS IN RELATION TO HEALTH AND COMMERCE.

Owing to their secretive, mainly nocturnal ways little is known of the life history of bats compared with other mammals, and it is not surprising that popular opinion usually divides our local bats into the flying-fox pest of orchards, and some kind of little "flying-mouse" which flutters around in the twilight and into lighted rooms. Though our bats form but a small part of the vast world population, most readers will be surprised to learn that there are at least fifty distinct species known to inhabit the Australian mainland and Tasmania. Of these only four of the ten frugivorous species may become pests in orchards, while the forty odd insectivorous bats are most useful little allies of man. Contrary to popular



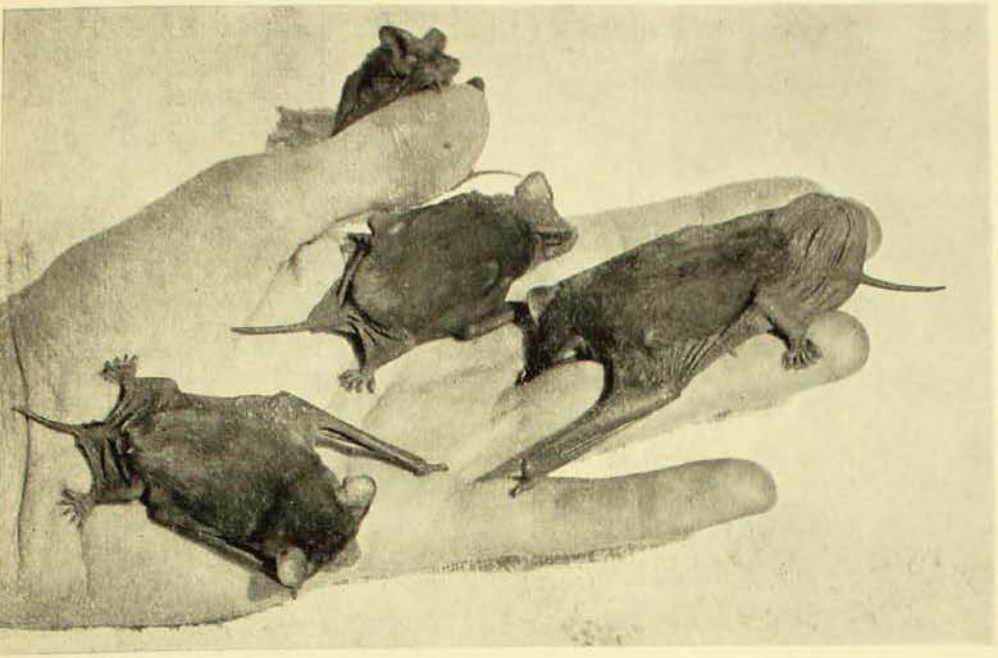
**Large Free-tailed or Mastiff-Bat. The tail-membrane can be extended for flight control, or reefed-in when crawling on rough material. The group-name of mastiff-bat refers to the deeply wrinkled lips which manipulate wriggling prey. The neck-pouch is apparently a scent-gland apparatus for the attraction of other bats, and the white flounces are probably a relic of protective coloration. The enlarged "sole" pad at the base of the hooked thumb, and the stout leg, indicates that the bat crawls about for much of its insect food.**

belief, the economic balance in regard to these amazing mammals is therefore distinctly in human favour.

Fortunately most of the thousand or more little species of bats actually assist in controlling the malarial mosquito and other insect pests. It is even clear from the writings of Pliny that the mosquito-feeding habits of bats were appreciated in Roman times, while scientific opinion has suggested that the control measures against yellow fever, which hampered the first attempt to construct the Panama Canal, are greatly assisted by the natural activities of mosquito-feeding little bats. Impressed by these mosquito-destroying activities in malarial country about San Antonio, Texas, a Dr. Campbell has described in a voluminous book, "Bats, Mosquitoes, and Dollars", how he successfully established colonies in specially designed "bat-roosts" about 20 feet high from which the annual yield of guano is supposed to have averaged about two tons.

Establishment of such roosts in all malarial countries was strenuously advocated by the author, who hoped to exploit a "secret method" of attracting colonies by wetting the interior of roosts with a solution of guano, as the bats are known to trace their tree-hollow and cavern homes by scent. However, it was shown in a United States Public Health Report that any proposition that the bat-roosts would colonize sufficient bats adjacent to malarial swamps to eradicate mosquitoes, and incidentally supply enough guano to defray expenses, had not been substantiated, though the natural value of bats in insect control was incalculable.

Valuable natural deposits of guano have been formed in vast caverns by the droppings of bats which have haunted them for countless ages. The guano is



**Little Free-tailed or Mastiff Bats. The widely spread tail-membrane of one bat may be compared with the reefed-in membranes of the other two. The wings of all are furled and almost sheathed against the forearm, which is seen in the walking position, resting on the thumb-pad. Note the widely spread toes, and the clinging effect of the tiny needle-hooked toe and thumb nails.**

valued as a fertilizer owing to its richness in nitrogen and phosphoric acid derived from the digested insect food of the bats, and has a commercial value ranging from £6 to £8 a ton. In the great Carlsbad Cavern of New Mexico guano, estimated at about 100,000 tons, was removed in twenty years; although the rate of accumulation naturally varies, 60 to 70 tons have been taken annually from a cavern in Texas. In Australia the kind of cave structure and colonization apparently does not present the same prospect of guano exploitation, though Professor Wood Jones has referred to the occasional exploitation of deposits in the Wooltana Caves of South Australia.

The flight of most little bats probably surpasses that of the nocturnal birds in the speed and control which enables them to catch the very swift-flying insect prey, aided by a combination of the senses which is one of Nature's marvels. They cannot rely on scent alone, as erratic insect flight would leave no traceable course, and it is suggested that their acute hearing is of great assistance since their own cries are pitched almost above human reception, so that the buzzing of a mosquito may sound like the drone of a minute aero-engine to the bats.

### WIRELESS WAVES AND FLIGHT CONTROL.

As early as 1793, cruel experiments in depriving bats of sight, and later and kindlier ones in which the eyelids were sealed with wax, demonstrated that sightless bats had an uncanny power of avoiding or attaching themselves to objects at will, and could fly freely amongst wires strung fairly closely in a darkened room. It has also been noted that bats do not normally crash into lighted windows when entering or escaping from lighted rooms, as birds often do. It would seem that condensations or slight vibrations of air are set up by the beating wings; these are reflected from objects and picked up by acutely receptive nerve-endings in the pointed ear-projection, known as the tragus, and fleshy nose-leaves common to many bats, as well as in the coarser "whisker-hairs" usual in mammals.

The reception of such air-vibrations could be likened to the action of a radio set with the numerous hairs acting as aerials implanted in the batteries of nerve-charged tissue. There is no doubt, however, that sight plays the most important part in the actual capture of prey, as it would be impossible for blinded bats to pursue flying insects. The

old saying "blind as a bat" is certainly not apt, and any experiments in captivity are not likely to elucidate the sensory activities of the highly organized creatures in which several senses appear mutually attuned to activities beyond man's comprehension.

Though able to fly in broad daylight, the little bats dislike strong light and rarely appear until dusk, slipping stealthily out from caverns or hollow limbs, when hosts of night-flying insects are a-wing; or even from under the raised bark of trees whence the writer has lively recollections of collecting numerous insects and spiders in the shirt front while stripping the bark of large Casuarinas in search of the more solitary kinds of bats. More unusual was the crowding of twenty-six adults and young of a small Malayan species into a one-foot joint of bamboo with a two-inch hollow and a quarter-inch entrance at the widest part, through which only the suitably flattened skull of the species enabled them to pass. Another Malayan bat with bright reddish fur and brilliantly marked wings is said by the natives to sleep curled up in the flower of a Cala Lily, of which the Dutch naturalist Jentink wrote that it sounded like a wonderful fairy tale "a golden and red and black coloured bat sleeping in a Lily-flower". Unusual local hiding places include the nests of two species of Scrub-Wren, in which several small bats were found "roosting".

Single young are most usual, but twins are frequently born, and remarkable flying power is shown by the fact that small bats are known to catch flies in mid-air while burdened with young weighing more than the parent. There are innumerable records of insectivorous bats being successfully kept in captivity for various observations, when they become quite friendly with their captors, whom they apparently distinguish mainly by sense of smell. The larvae of the common meal-beetle forms the most practical diet, and surprisingly large quantities are eaten at a time. A small bat has been noted to average about seven dozen meal-worms a day, representing about one-quarter ounce of food, which would seem rather exceptional.

The greatest care should be exercised in attempting to handle or keep the highly sensitive little mammals, especially in providing them with adequate food, as one gathers from Museum correspondents that the increasing weakness of starvation is sometimes mistaken for tameness, with consequent suffering to the small animals. To deliberately kill, or worse, to maim such marvellously modified little mammals, because of unreasoning fear of omens or damage, is a positive crime against Nature. Those accidentally killed in the felling of trees, or in clearing them from inconvenient roosting places, may be preserved in spirits for the Museum. Otherwise these useful little mammalian cousins of man should be left in peace to carry on their eternal "black-out" battle against the insect hordes of night.

[NOTE.—Australia is fortunate in not harbouring representatives of the repulsive disease-carrying vampire bats of the American tropics. Owing to lack of space these unpleasant animals and our own False Vampire Bat will be included in the succeeding part of THE AUSTRALIAN MUSEUM MAGAZINE.—EDITOR.]

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THE first two issues of this publication are to hand, and to which we extend a welcome. The Curator, Mr. A. R. Penfold, in his foreword to the first issue, refers to the demands upon Applied Science Museums which wars and depressions occasion, and to the part the Museum takes in connection with them.

Short paragraphs refer to various economic matters, principally essential oils, and also exhibits.

# Australian Insects. X

## Orthoptera, 5. — The Long-horned Grasshoppers

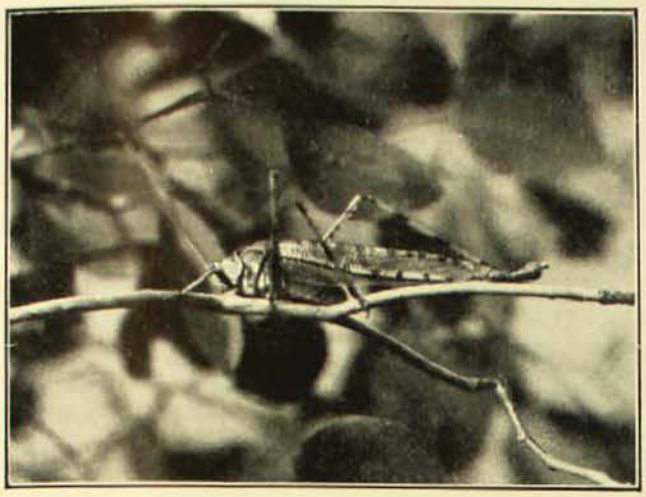
By KEITH C. McKEOWN

IN contrast to the members of the preceding family, the Acridiidae, the Long-horned Grasshoppers (Tettigoniidae) are generally more slender in form, and possess long thread-like antennae, frequently considerably exceeding the length of the body. The sound-producing apparatus of the males consists of a file and ridge upon the forewings or tegmina, and frequently there is an area of tightly stretched membrane to act as an amplifier to the notes produced. The music of these insects is usually in the nature of chirping or clicking. The 'ears' are situated in the tibia of the fore-legs just below the knee. The ovipositor, or egg-placer of the female, is long and sabre-shaped, but may be reduced or even absent; in no case does it form the drilling plates found in the true locusts. The long-horned grasshoppers and their allies, the "Tree-crickets" are not strict vegetarians; plant-tissue, certainly, is eaten, but some species have carnivorous tastes, others are practically omnivorous. Some 200 species have been described from Australia.

Very little is known of the life-histories and habits of most of these grasshoppers, while the lives of others, of which something is known, show such diversity that it is impossible to present even a generalized picture which might be taken as reasonably typical of them all. It will, therefore, be necessary in discussing certain of the species to give as much detail as possible of the habits of each.

**Eggs of Long-horned Tree Grasshopper.**

The sub-family Phaneroptinae contains a number of primitive but interesting insects. *Caedicia olivacea* frequents the gum trees, and is a master of camouflage; the tegmina are shaped like eucalypt leaves, venation and all other detail complete, and are of a dusty greyish-green colour. The ovipositor of the female is short, broad, and strongly curved, something like a Ghurka kukri. The eggs are flattened and scale-like, and are laid in a long row, one overlapping the other, usually along a twig or the edge of a leaf. These eggs are frequently attacked by a minute parasitic wasp, parasitized eggs being noticeable by the tiny round hole through which the wasp has emerged. This grasshopper sometimes causes damage in citrus orchards by nibbling patches from the skin of young oranges: with the growth



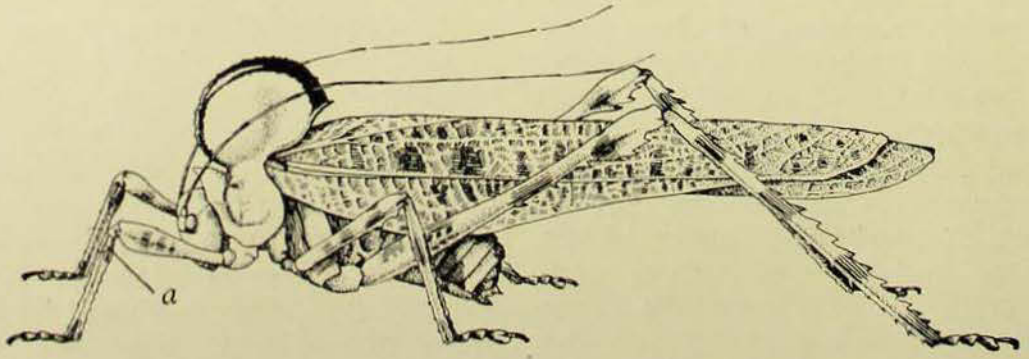
**A Tree Grasshopper (Ephippitha 32-guttata), an excellent example of protective coloration.**
Photo.—K. C. McKeown.

of the fruit such scars assume quite considerable dimensions and seriously disfigure the fruit for market.

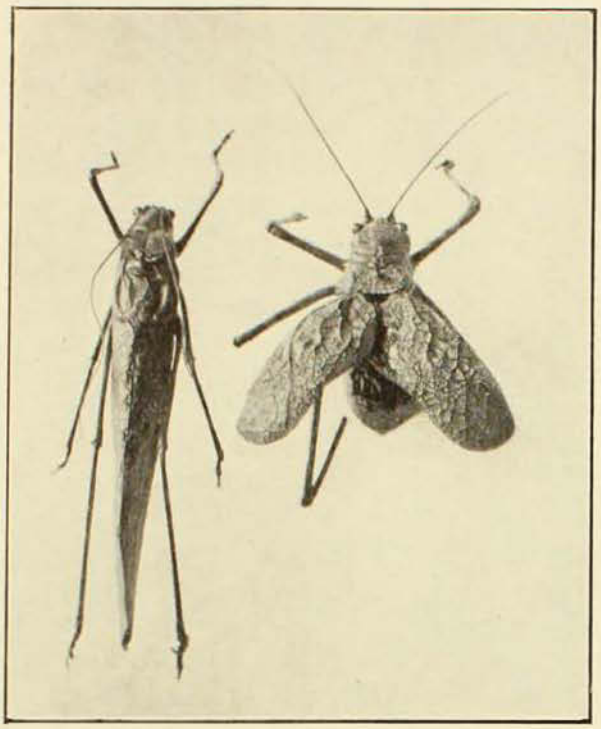
The large Speckled Grasshopper (*Ephippitha 32-guttata*) has a wide range in Australia, but is especially plentiful in the inland districts. This inland form is sometimes considered to be a variety. It is a large insect about two and a half inches in length, with the wing-covers of a rich green, plentifully blotched and spotted with black and brown. The name implies that there are thirty-two spots, but the actual number varies considerably, some having more, others less. The insect lives in the higher branches of the eucalypts, and at night emits a rather musical clicking note, something like that produced by winding a mechanical toy. The striking colouration, so conspicuous when the insect is seen apart from its natural surroundings, is a really fine example of protective coloration when the grasshopper is at rest among the foliage, blending closely with the broken light and shade as the sunlight filters through the leaves.

Similar in size and general coloration, but even more striking, is the Crested Grasshopper (*Alectoria superba*) of the dry inland areas. Here the thorax is expanded into a large circular crest edged with black and red, standing high above head and body. This crest is apparent in very small and immature examples, and is probably developed at a very early age.

The Mountain Grasshopper (*Acripeza reticulata*) is in many ways one of the really remarkable members of the group. The sexes differ so greatly in appearance that they might easily be taken for different species. The male has the typical slender form of the long-horned grasshoppers; the dark-brown tegmina are slender and elongate, and cover a pair of well-developed, fan-shaped flying wings. The female, on the other hand, is a dumpy, thick-set, and most un-grasshopper-like creature. Her tegmina, like those of the male, are dark, dead-leaf brown in colour, and coarsely reticulate. They are short and deeply curved, much like half-peanut shells; these wing-covers fit closely over the body, but cover no wings—flying wings are absent. The soft abdomen is strikingly banded with alternate rings of bright blue, red, white, and black. When disturbed, this strange creature makes no attempt to escape, but, raising herself high upon her legs, she elevates the tegmina and displays all




**The Crested Grasshopper (Alectoria superba).**
Nancy B. Adams, del.



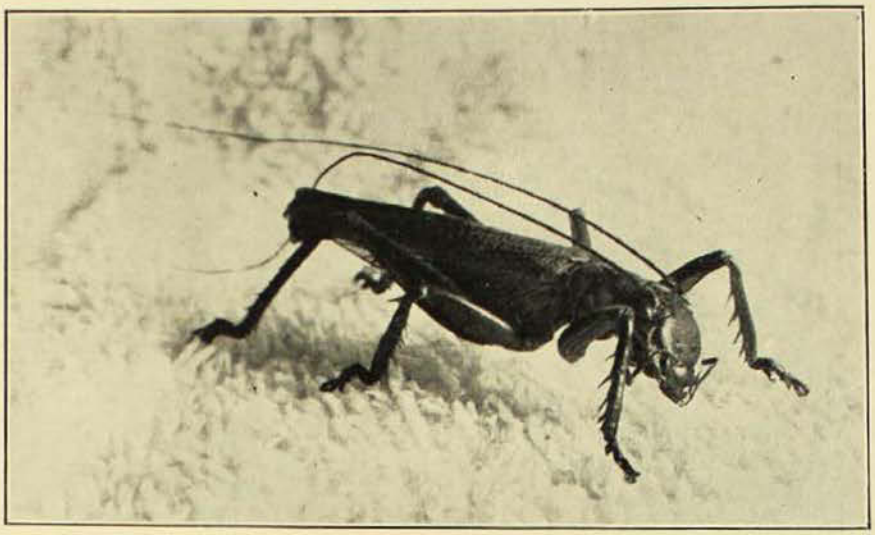
**The Mountain Grasshopper (Acripeza reticulata). The completely winged male (left) measures about two inches in length; the female (right) is stout, without wings, and measures a little over an inch, the short wings concealing an abdomen spotted with red, blue, and white.**

the bright colouration of her abdomen. If annoyed further, the angry insect protrudes a bright orange coloured membranous 'collar' from behind and around the head. It appears that this display is of a warning nature, but no direct evidence is as yet available as to whether the grasshopper is actually distasteful to birds and other enemies—or whether it is just 'pure bluff'.

These grasshoppers are usually to be found among grass-tussocks on mountains or elevated plains, but Mrs. Edith Coleman, who has worked out much of its life-history, records the insect as being common at Sorrento, Victoria, where it feeds on the introduced Ragwort (*Senecio*). The pale biscuit-coloured eggs are seed-like, and under natural conditions are probably attached to the food-plant. The young larvae possess much of the bright colour of the adult female, and the 'collar' is conspicuous. With growth moulting takes place, and the cast skins, at least in the later stages, serve as a meal for the insect that discarded them.

The sub-family Tymnophorinae contains two species of somewhat ghost-like insects of a pale green colour, the males with broad tegmina bearing a large musical organ; the females are wingless. One of the species (*Tympanophora pellucida*) has been recorded from West Australia, while the second (*T. uvarovi*) inhabits eastern Australia. They are of exceptional interest, since they have very close affinities with fossil forms found in the Lower Oligocene amber of Europe. The present-day representatives of the group are found in forest country where they rest upon twigs, jumping and disappearing with remarkable rapidity when disturbed. It is probable that other, as yet unknown, species may be found in Australia.

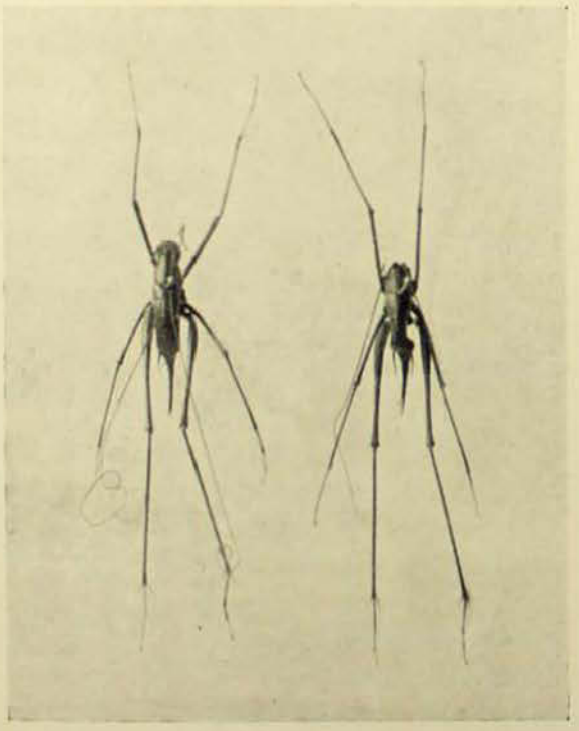
The Gryllacrinae are very different in appearance from the other members of the family; they are heavily-built insects with broad, bulging heads, and their wings have the appearance of being wrapped about the body rather than resting roof-wise. The antennae are excessively long and are often several times the length of the body. These insects are popularly known as 'Tree-crickets'. *Paragryllacris combusta*, a large, light-brown to rather blackish insect, which lives in holes in tree-trunks, between the leaf-sheaths of certain plants, or in holes in the ground, is common around Sydney as well as in the more inland areas. It is not unusual for these insects, attracted by the light, to come from bush and garden into houses at night. Indoors they create something of a disturbance in domestic affairs, and many enquiries are received as to whether they are harmful. If carelessly handled they are capable of inflicting a sharp bite which may even draw blood, but in other respects they are perfectly harmless, although I have known instances where the insect, resting upon a curtain, has cut a piece from the material with its sharp jaws to form a flap under which to hide. Both sexes are winged, and the abdomen of the female bears a long sabre-shaped ovipositor—sometimes thought to be a



**The Tree Cricket (Paragryllacris combusta), which often comes into the house, is an unwelcome guest on account of its unpleasant bite.** Photo.—A. Musgrave.

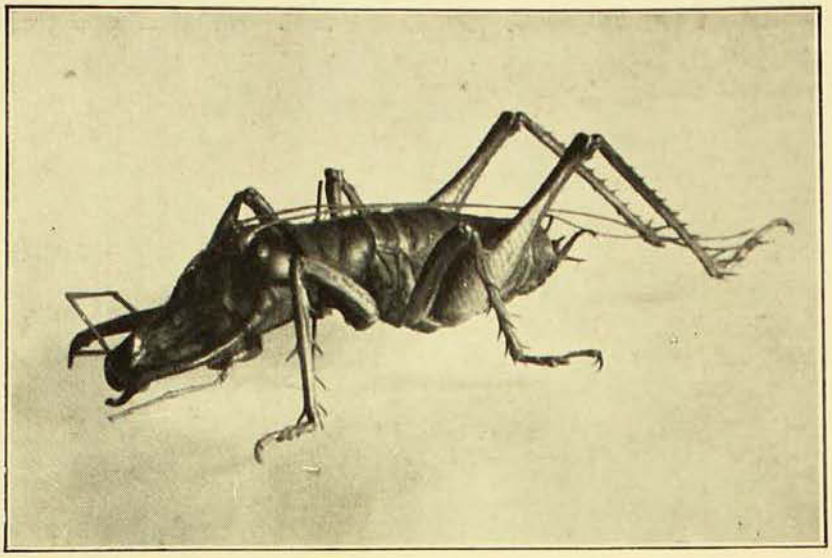
'sting'. Little is known of the habits of these grasshoppers, but they are, at least partly, carnivorous.

The sub-family Rhaphidophorinae contains the 'Cave-crickets' and the Cave Wetas of New Zealand. The true Wetas belong to another sub-family, the Stenopalmatinae. The 'Cave-locusts' or 'Cave-crickets' are truly amazing creatures. They are completely wingless, their bodies are short and soft, and the antennae and legs are extraordinarily long and slender. They have apparently no sound-producing apparatus, nor do they possess ears. Some of them are blind, the sensitive antennae apprising them of their surroundings. The 'Cave-crickets' live in complete, or almost complete, darkness in the depths of caves, and in the Gunn's Plains and Mole Creek Caves, in Tasmania, I have seen these insects literally in millions; so great were their numbers that they covered the limestone walls in some of the deepest of these caverns with a living tapestry of brown bodies, scattering in all directions immediately they were disturbed. What they feed upon in such an environment, unless cannibalism is practised, is a mystery, for the only possible food that is revealed by a careful search appears to be the minute dipterous larvae, known as "Glow-worms", creatures so small that they would provide but a scanty meal, especially to such a horde of voracious creatures. An allied species is sometimes found in the city, where they hide in inspection pits for electric cables, or in cellars, and sometimes the insects invade shops and dwellings, a circumstance for which weather conditions may be responsible. Numerous reports of happenings of this nature in Sydney were received during the excessively dry period of March, 1940.



**Cave Crickets from Mole Creek Caves, Tasmania.**

The "King Crickets" of Australia are surely the most remarkable members of the family. *Anostostoma australasiae* is a huge wingless insect, measuring



**With head and jaws occupying more than a third of the length of the body, the Giant Wingless Tree Cricket (Anostostoma australasiae) presents a formidable appearance.**
Photo.—A. Musgrave.

about three inches in length with antennae adding another four inches. It is of a rich brown colour with an immense head and strangely curved jaws which project forwards. Head and mandibles frequently constitute one-third of the total length of the insect. These "King Crickets" present such a formidable appearance that they are seldom handled by the inexperienced without considerable trepidation, but apart from a strong bite they are harmless. These strange creatures live in holes in trees or in the ground, and nothing appears to be known regarding their habits and lives. They inhabit the coastal districts of northern New South Wales and Queensland. It is to be hoped that someone with facilities for their study will endeavour to fill in some, at least, of the blanks in our knowledge before the destruction of forests reduces the insects to extreme rarity or extinction. The same suggestion also applies to all our species, and any observations secured cannot fail to be of interest and value.

Another "King Cricket", *Anostostoma crinaceus*, of similar colour and form, but with quite short jaws, and measuring about one and a half inches in length is not uncommon in bush and gardens around Sydney.

# The First Two-headed Shark in Australia

By G. P. WHITLEY

A YEAR ago, in THE AUSTRALIAN MUSEUM MAGAZINE (vol. vi., part 5, January-March, 1937, p. 154), I gave an account of "Double-Headed Fishes in Australia and New Zealand", including every case then known. I have since learned that, just 100 years ago, a double-headed shark was found in Tasmania, for, in a supplement to the *Australian*, a Sydney newspaper, for March 27, 1838, we read:

*Sharkemese Twins.*—A gentleman at Richmond has in his possession a young shark with two distinct heads and bodies. The bodies join at the dorsal fin, so as to form one tail. The length is about three inches, and the size of each body is in proportion. This singular formed fish was taken alive, with several single-headed sharks, from the inside of the mother when killed.—*Hobart Town Courier.*

The Tasmanian newspaper from which the above was extracted was the *Hobart Town Courier* for Friday, March 9, 1838.

Coming to more recent times, we read in the *Sun* newspaper, Sydney, for March 26, 1928, of a "Grey Nurse" shark from Sans Souci, Botany Bay, with two heads, two mouths, and four eyes. It was said to have been eleven inches long.