

The
AUSTRALIAN
MUSEUM
MAGAZINE

Vol. X, No. 8

Price—TWO SHILLINGS



Parma Pademelon or White-throated Scrub-Wallaby.

THE AUSTRALIAN MUSEUM

HYDE PARK, SYDNEY

BOARD OF TRUSTEES

PRESIDENT:

H. B. MATHEWS, B.A.

CROWN TRUSTEE:

H. B. MATHEWS, B.A.

OFFICIAL TRUSTEES:

THE HON. THE CHIEF JUSTICE.
THE HON. THE PRESIDENT OF THE LEGISLATIVE COUNCIL.
THE HON. THE COLONIAL SECRETARY.
THE HON. THE ATTORNEY GENERAL.
THE HON. THE COLONIAL TREASURER.
THE HON. THE SECRETARY FOR PUBLIC WORKS.
THE HON. THE MINISTER OF PUBLIC INSTRUCTION.
THE AUDITOR-GENERAL.
THE PRESIDENT OF THE NEW SOUTH WALES MEDICAL BOARD.
THE SURVEYOR-GENERAL AND CHIEF SURVEYOR.
THE CROWN SOLICITOR.

ELECTIVE TRUSTEES:

PROF. A. N. St. G. BURKITT, M.B., B.Sc.
FRANK B. SPENCER.
O. G. VICKERY, B.E., M.I.E. (Aust.).
WALLACE C. WURTH, C.M.G., LL.B.
PROF. A. P. ELKIN, M.A., Ph.D.
F. McDOWELL.

R. J. NOBLE, M.Sc., B.Sc. (Agr.), Ph.D.
E. J. KENNY, M.Aust. I.M.M.
F. L. S. BELL, M.A., F.R.A.I.
FRANK W. HILL.
G. A. JOHNSON.
PROF. P. D. F. MURRAY, M.A., D.Sc.

DIRECTOR:

A. B. WALKOM, D.Sc.

Assistant to the Director:

J. R. KINGHORN, C.M.Z.S.

SCIENTIFIC STAFF:

Birds, Reptiles and Amphibians: J. R. KINGHORN, C.M.Z.S., Curator; J. A. KEAST, B.Sc., Assistant Curator.
Mammals and Skeletons: E. Le G. TROUGHTON, F.R.Z.S., C.M.Z.S., Curator.
Fishes: G. P. WHITLEY, F.R.Z.S., Curator.
Insects and Arachnids: A. MUSGRAVE, F.R.Z.S., F.R.E.S., Curator; K. C. McKEOWN, F.R.Z.S., Assistant Curator.
Molluscs: JOYCE ALLAN, F.R.Z.S., Curator.
Crustacea and Other Groups: F. A. McNEILL, Curator; ELIZABETH C. POPE, M.Sc., Assistant Curator.
Minerals and Rocks: R. O. CHALMERS, A.S.T.C., Curator; J. F. LOVERING, B.Sc., Assistant Curator.
Fossils: H. O. FLETCHER, Curator.
Anthropology: F. D. McCARTHY, Dip.Anthr., Curator.

LIBRARY AND PUBLICATIONS:

JASMINE M. McKECHNIE, B.A.

DEPARTMENT OF PREPARATION:

J. KINGSLEY.

HONORARY SCIENTIFIC STAFF:

Zoologists.

Asst. Prof. E. A. BRIGGS, D.Sc.
H. LEIGHTON KESTEVEN, D.Sc., M.D.
MELBOURNE WARD, F.R.Z.S., F.Z.S.
TOM IREDALE.

Entomologist.

T. H. GUTHRIE.

Ornithologist.

K. A. HINDWOOD, C.F.A.O.U., F.R.Z.S.

Archaeologist.

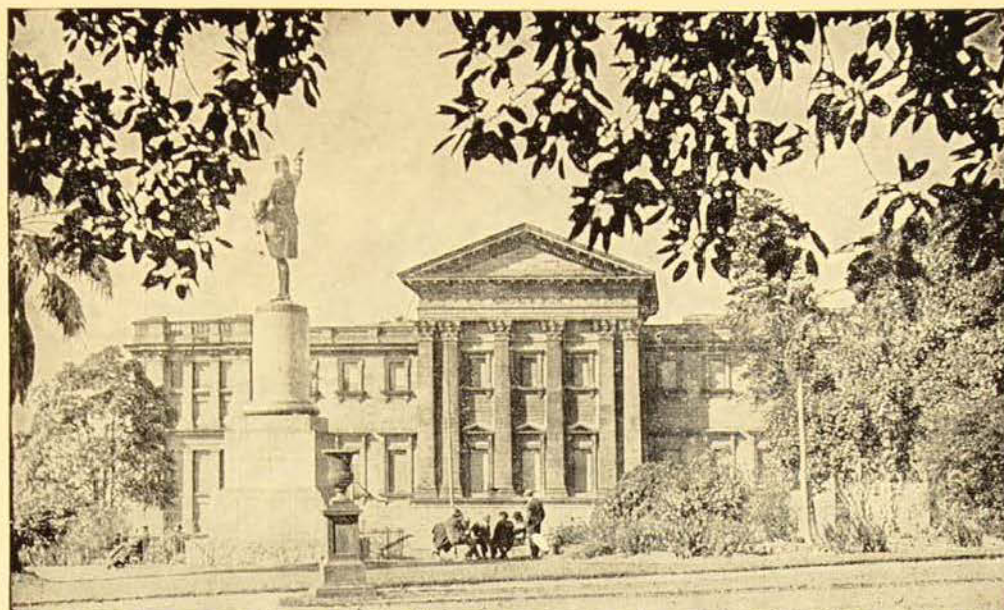
Prof. J. L. SHELLSHEAR, M.B., Ch.M.

Numismatist.

G. C. HEYDE, A.S.T.C., F.R.N.S.

Philatelist.

FRANK W. HILL.

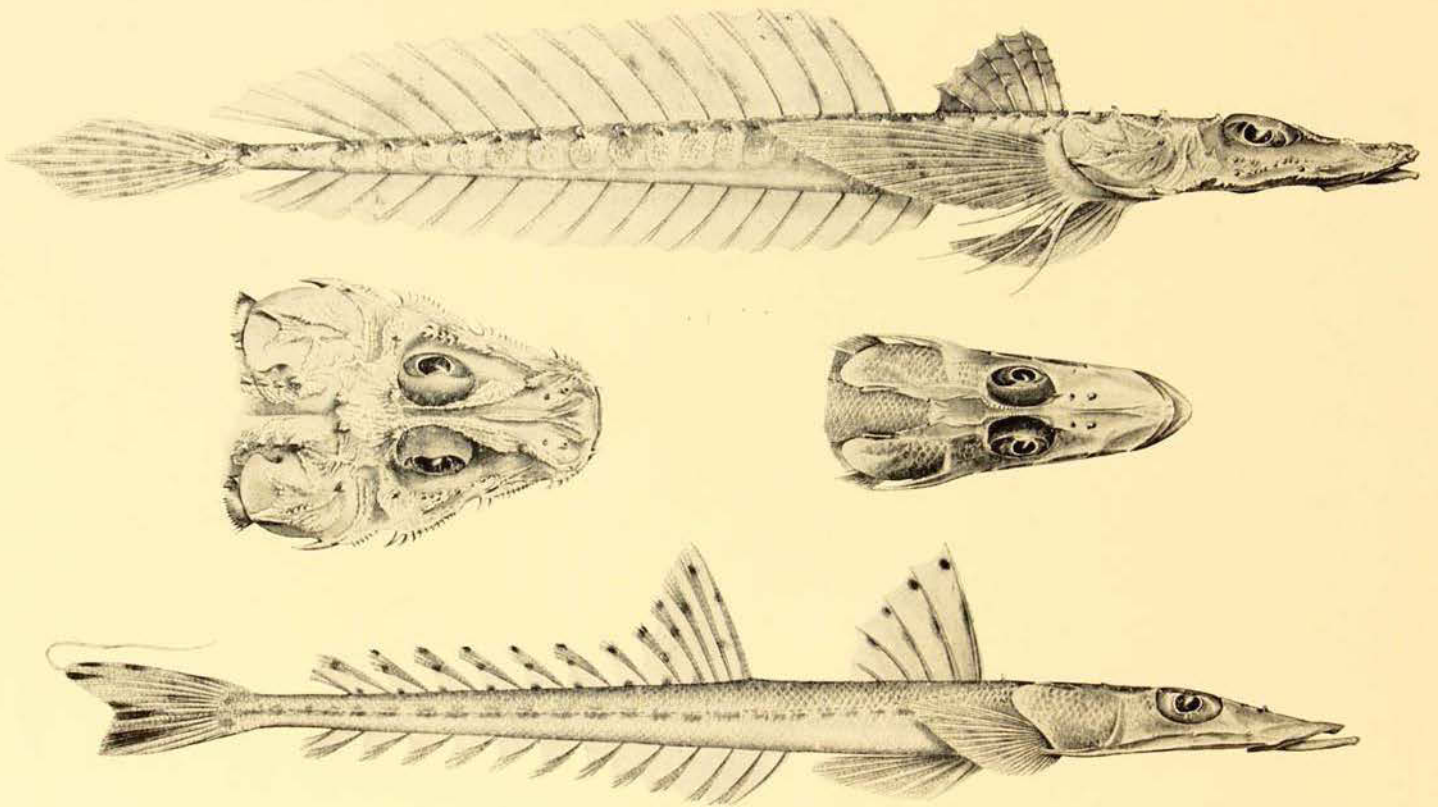


THE AUSTRALIAN MUSEUM MAGAZINE

CURIOUS FLATHEADS	<i>Frontispiece</i>
CHRISTMAS BEETLES— <i>Keith C. McKeown</i>	241
FLATHEADS— <i>G. P. Whitley</i>	244
ABORIGINAL RAIN-MAKERS AND THEIR WAYS, PART I— <i>Frederick D. McCarthy</i>	249
AN INSECT CALENDAR, PART II— <i>A. Musgrave</i>	252
THE KANGAROO FAMILY—THE PADAMELONS OR SCRUB-WALLABIES, PART II— <i>Ellis Troughton, F.R.Z.S., C.M.Z.S.</i>	261
A MARINE CURIOSITY— <i>K. H. Barnard, D.Sc., F.L.S.</i>	265
THE SNOWY MOUNTAINS OF NEW SOUTH WALES, PART I— <i>H. O. Fletcher</i> ..	266
TE BAITARI—AN EDIBLE JELLYFISH FROM TARAWA— <i>Elizabeth C. Pope, M.Sc.</i>	270
REVIEWS	260, 272

(Photography, unless otherwise stated, is by Howard Hughes.)

● OUR FRONT COVER. This original illustration of the rare *Parma Pademelon* or White-throated Scrub-Wallaby is from the second volume of John Gould's *Mammals of Australia*. According to that great naturalist, about 1856 the beautifully coloured wallaby was so plentiful in the Illawarra scrubs south of Sydney that it was hunted by the aborigines who named it "parma". Its extinction owing to spread of settlement, and the fox, stresses the vital need for protection and sanctuaries for the marsupial fauna.



Curious Flatheads trawled in Queensland.

Above (with top of head shown to the left): The Ghost Flathead, *Oplichthys ogilbyi*, from 73 fathoms off Cape Moreton, showing the bony bucklers along side of body and the feeler-like rays below the pectoral fin. *Below* (top of head to the right): The elongate *Elates thompsoni*, from about 20 fathoms off Pine Peak; this kind has a single slender preopercular spine on each side of the head and thread-like tail-filament.

[See article on page 244.]

A. R. McCulloch, *del.*

THE AUSTRALIAN MUSEUM MAGAZINE

Published by the Australian Museum - - - - - College Street, Sydney

Editor: A. B. Walkom, D.Sc.

Annual Subscription, Post Free, 8/6

VOL. X, No. 8.

December 15, 1951.

Christmas Beetles

By KEITH C. McKEOWN

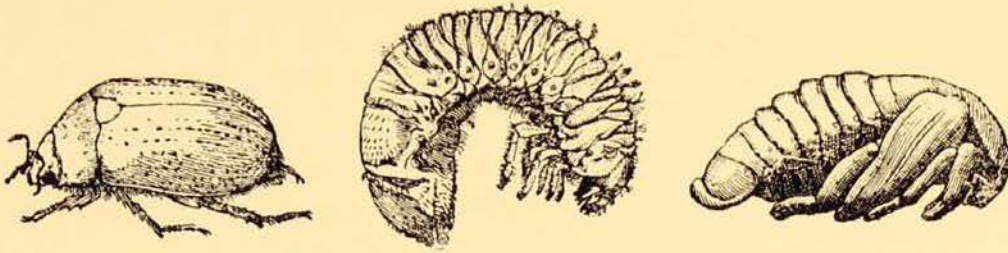
THE coming of the Australian summer awakens memories of long, hot days in the bush, of brilliant sunshine and the blended aromatic scents of varied trees and shrubs, and of whirling swarms of large, iridescent beetles about the tops of the eucalypt saplings. These insects are the so-called "Christmas Beetles". The name is apt for, although they are numerous in the bush throughout most of the summer months, the beetles seem to reach a triumphant climax in their activities round the festive season. No one species alone receives the popular designation, but a number of different kinds collectively share the name of "Christmas Beetle"; all, however, belong to the genus *Anoplognathus* of the family Scarabaeidae. The popular name is so firmly established that one suspects that its beginning may lie with the early settlers in Australia, but the only references I have been able to find concerning it are of comparatively recent origin.

In spite of their large size and conspicuous coloration, and the popular interest they arouse, surprisingly little is known concerning the details of their life-history, and much of our "knowledge" of them seems to be based largely on supposition. Confirmation by direct observation is needed on many aspects of their lives.

The eggs, comparatively large in size, are deposited in the soil, the female beetle crawling down among the tangled grass-stems to perform the operation by means of her stout ovipositor, or egg-placer.

The little larvae, or "grubs", on hatching from the eggs, lose no time in working their way downwards in the soil until the sweet, sappy grass-roots are reached, for the larvae are root-feeders. It is possible that the larvae of some species, and under certain conditions, may feed upon decaying vegetable matter in the soil. The larvae of Christmas Beetles are white, fleshy, and tightly curled, head and tail close together, and are consequently called "curl-grubs". These curl-grubs are frequently turned up by the spade in gardens, and are valued by fishermen as an attractive bait to lure their victims to destruction. Not all such curl-grubs are the offspring of Christmas Beetles, for the form is typical of the larvae of most members of the great family Scarabaeidae, of which the habits of many are very similar, though the adult beetles themselves may be dull and inconspicuous.

When fully fed, the larva constructs a rounded cell some inches below the surface of the ground, and in this secure



The life-history of *Anoplognathus porosus*.

After Dept. Agric.

refuge it changes into the pupa or chrysalis from which the adult insect will emerge the following summer.

As the sun warms the soil, the perfect insect, stirred into activity by the increasing temperature, emerges from its pupal skin and digs its way upwards through the soil to the sunshine above. It sometimes happens that the insect's resurrection may be postponed; it may remain, although its transformation is complete, for some time, possibly weeks, still sealed within its earthen cell. This deferment of the beetle's adult activities may be caused by climatic conditions falling short of the perfection required by the beetle. The full period occupied in the insect's transformations and life-history may be long. It is, at least, safe to assume a period of about twelve months from the laying of the egg to the emergence of the perfect beetle. It is quite possible, however, although confirmation of this is lacking, that, should weather conditions prove unfavourable, the life-cycle may extend over two years.

On emerging from the soil, the beetles ascend to the foliage of the trees to feed and mate, or fly on resonantly buzzing wings in a wild saturnalia about the tree-tops.

In feeding, the beetles cluster thickly upon the foliage, often piled one upon the other upon some particularly succulent growth. Clinging to the edge of a leaf, the insect rapidly bites away the leaf-tissue with its powerful jaws, soon cutting deep and jagged indentations in the green leaf, and often stripping it completely, the mid-rib only remaining. It does not take long for a large swarm of these beetles completely to defoliate a bushy eucalypt. I have watched these insects so engaged, their activities divided between the delights of love and of the table, on the Tuross River,

New South Wales, where, on the trees overhanging the river, the precarious clusters would lose their footing, or hungry jaws inadvertently sever the leaf-stalk, to precipitate all into the water below, where they soon fell a prey to the voracious Brown and Rainbow Trout, which took full advantage of such a lavish banquet. Often the fish would be so replete that nothing would entice them from the depths of the stream to accept so much as one more insect. They lay on the stream-bed content to let the world go by.

Some years ago, large areas of eucalypts in the Australian Capital Territory were defoliated by what were possibly Christmas Beetles in conjunction with the smaller, allied brown beetles of the genus *Liparetrus*. Of the defoliation by *Liparetrus* there was no doubt. The harmless possum was blamed for the destruction, but the injury to the leaves was entirely typical of the feeding methods of Scarabaeid beetles, and impossible of accomplishment by the teeth and jaws of the mammal. It was, however, possible that the possum with its mixed diet, might have accomplished some little in the reduction of the insect swarms by eating some of the leaf-eating beetles.

Apart from the activities of the possum or Phalanger, the Christmas Beetles have many enemies; most of the larger birds feed readily upon them and do not fail to take advantage of the lavish feast provided when the insects are swarming. Scoliid wasps parasitize the curl-grubs, although the extent of this control is uncertain, and has been in the past possibly exaggerated.

One species of *Anoplognathus* has proved itself a serious pest to the strawberry grower; this is *Anoplognathus porosus* Dalm., an insect measuring about an inch in length, of a general yellowish-brown

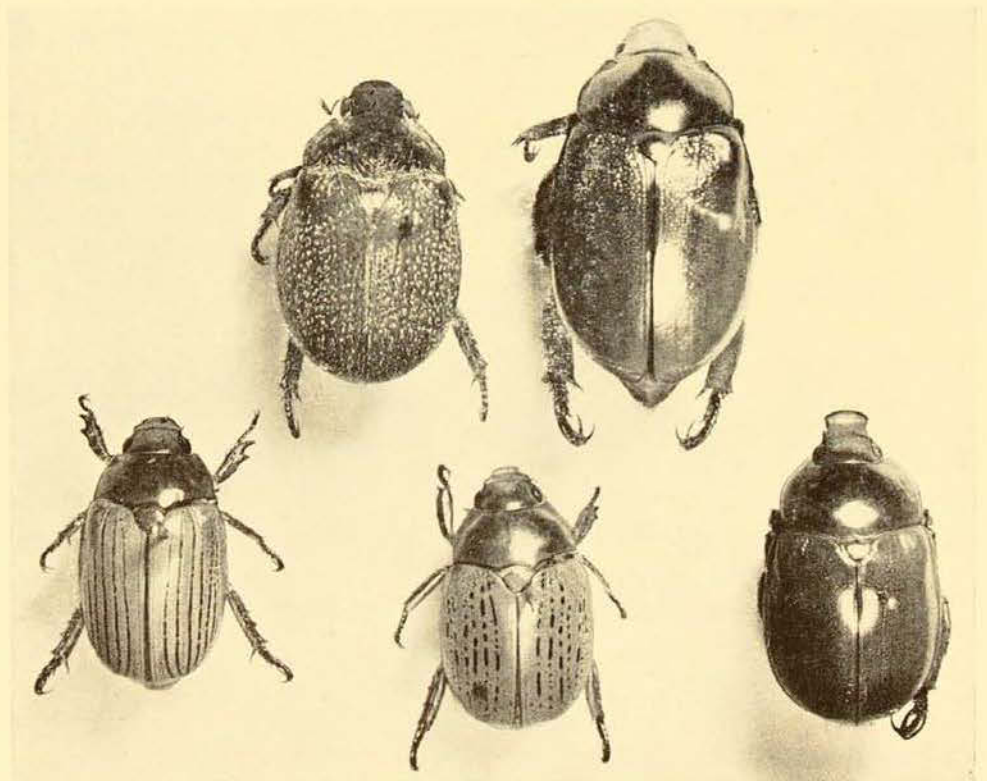
with opalescent tints, and the wing-covers (elytra) marked with irregular longitudinal broken lines of dark-brown or blackish pits. The under-surface and legs are a shining coppery-red. The larva has acquired a taste for strawberry roots, and may cause much damage in its subterranean operations. It is possible that there may be two generations in the season, as larvae of different sizes may be found at one time.

The largest and most striking of all our Christmas Beetles is *Anoplognathus viridi-aeneus* Don., which measures about one and a half inches in length and is of a glorious metallic green, while the under-surface is a deep metallic green lightly clothed with grey hairs; it is indeed a beautiful insect! The full-grown larva is about two inches in length, dull creamy-white with the head reddish-brown. The pupa, measuring about one and a half inches long, is a dark ochre-yellow, becoming a dull bronze-green shortly before the perfect insect emerges. This species is sometimes referred to as the "King Beetle", but that name is shared by the long-jawed, green Stag Beetle (*Lamprima latreillei* Macleayi). The adult beetles sometimes attack the foliage of the introduced Pepper or "Pepperina" tree (*Schinus molle*) and the cultivated apricot.

Anoplognathus boisduvali Bois, somewhat closely resembles *A. porosus* in colour and general appearance, but the dark, depressed lines on the elytra are, to the unaided eye, continuous and not broken as in that species. It is commonly found in Queensland, where it is a pest of sugar cane.

Among so many beautiful insects it is difficult to select a few only for special mention, but attention must be given to *A. velutinus* Bois., a widely distributed species, which, although a nut-brown in colour without metallic tints, is remarkable in having the elytra clothed sparsely with tufts of stout white hairs. There are three striking varieties of *A. smaragdinus* Ohaus from North Queensland; a rich, soft green, blue, and a bright reddish hue. *A. viriditarsis* Leach, another very plentiful species, is brown with a rich metallic green gloss; the legs are yellowish, and the tarsi (feet) greenish-black. It has been recorded as attacking the foliage of a number of different kinds of cultivated fruit-trees.

As a group there are few more striking Australian insects than the Christmas Beetles, both on account of their size and brilliant, jewel-like coloration, which seldom fail to excite popular admiration.



Christmas Beetles.

Top: *Anoplognathus velutinus*;
A. viridi-aeneus.
 Lower: *A. boisduvali*; *A. porosus*;
 and *A. viriditarsis*.



WE are so accustomed in Australia to seeing flathead offered for sale in the fish shops that we may not realize how unique we are in enjoying such quantities of this easily recognized type of fish. There are, for example, no flathead in New Zealand fisheries; tropical flathead form a very minor proportion of the food of Indonesians and South Sea Islanders, and they are not plentiful enough in other countries for a special fishery. To visitors from overseas, the long, brown fishes with the broad, flattened heads appear strange, but they are soon convinced of their good edible qualities when they taste the flakes of white flesh, so easily detached from the bones. Flathead represent a considerable proportion of Australian fisheries, millions of pounds being caught annually, mainly by trawling, but also by lines and inshore netting. All are marine, existing in various depths from shallow to very deep water.

There are many kinds of flathead but all of them have a very depressed head, much broader than it is deep, with extensive gill-slits, and the body is nearly always scaly. The dragonets or stink fishes (of the family Callionymidae) are sometimes confused with flathead, but they have very small, almost pore-like, gill-openings and their bodies are covered by a naked skin. Flatheads belong to the Order of the Mail-cheeked fishes (Scleroparei) which includes the Rock Cods, Butterfly Cods, Gurnards, Stonefishes and other oddities, but they are separated as two families, the common Platycephalidae or ordinary flatheads with scales, and the Oplichthyidae or rare deep-sea Ghost Flatheads, with

their skins unscaled except for a row of bony bucklers along the middle of each side. The former family is divided into several subfamilies and there are numerous genera and many species, nearly forty different kinds being recorded from Australia alone.

No fossil flatheads are known, and these fishes have probably evolved in fairly recent epochs from at least three different stocks of rock-cod-like or even gurnard-like ancestors. Essentially they are bottom-dwelling fishes, often burying in sand, with which their colours harmonize. The eyes are large and though they have no eyelids, there is generally a fringe-like lappet on the upper rim of the cornea or else a tassel-like tentacle (cirrus) over the eye to afford some shade or render the eye less conspicuous. On each side of the head, at the corner of the preoperculum, are two sharp spikes with which a struggling flathead can inflict a severe cut, but the spines are not venomous. The lower jaw projects in front of the upper lip so that the capacious mouth, with its rows of fine sharp teeth, is directed slightly upwards. Flathead frequently leave the bottom to seek food in mid-water. Any length over 3 feet is unusually large for a flathead, most of them being between 1 and 2 feet long, but *Planiprora fusca*, the Dusky Flathead, is said to grow to 4 feet in length and about 32 pounds in weight. Some flatheads have conspicuously marked tail fins and these, when unfolded, probably act as signals or recognition marks against the murky background as the fish lie (like flounders, sting-rays, and stonelifters) flat on the bottom. These marks may be merely dusky or

nondescript, but some species have a sort of broad arrow, others giraffe-like spots, or dark spots above and below an unspotted area, or a series of tapering or curved black stripes on the tail-fin, which is usually blunt or convex at its margin, rarely pointed or concave, or with a filament. The main characters for separating the species are the nature of the ridges on the head, the relative sizes of the preopercular spines, the teeth, the numbers of fin-rays and scales, the proportions and the colouring, all of which should be carefully noted.

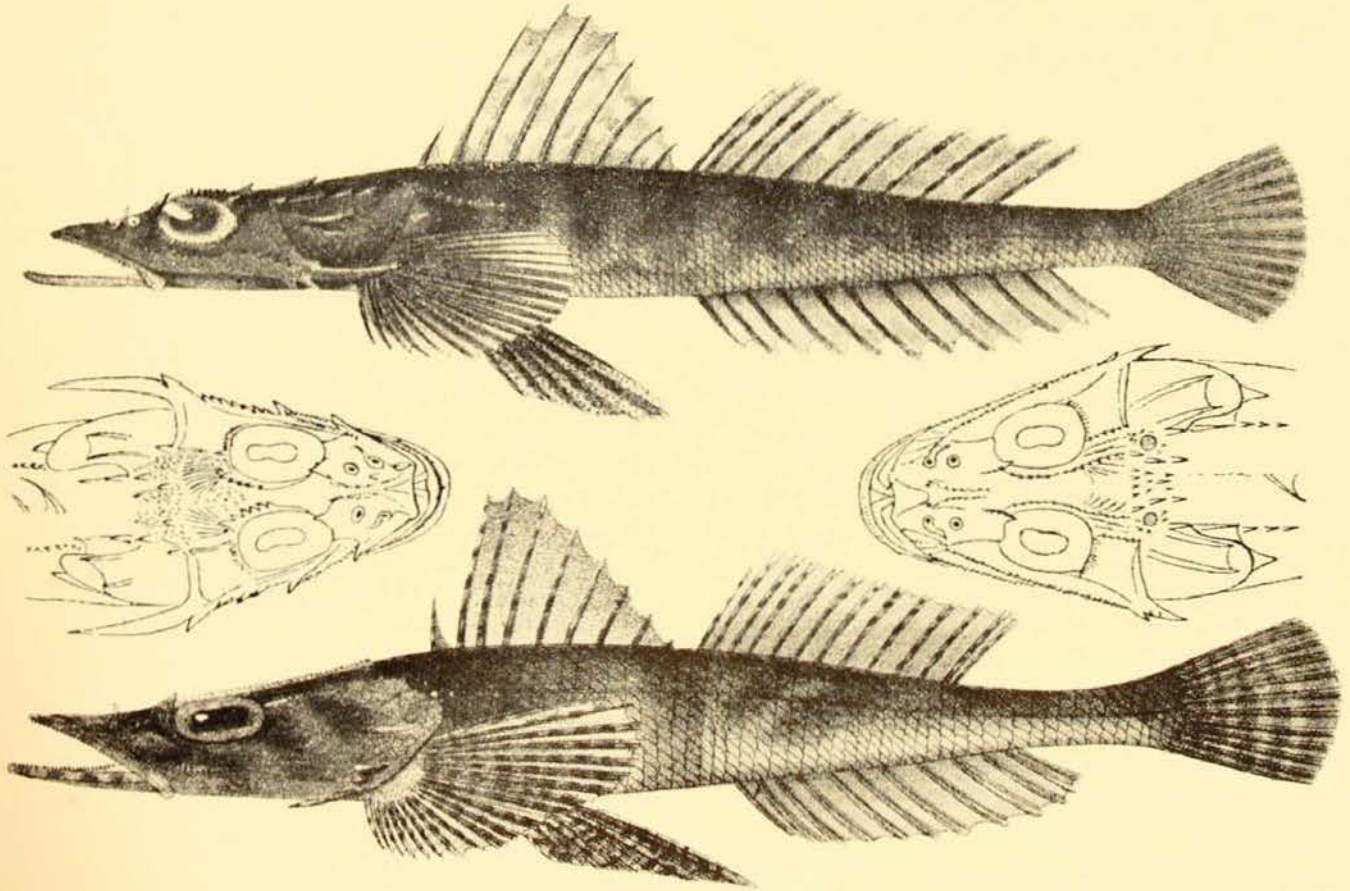
Linnaeus in 1758 described the first species as a kind of dragonet, which he called *Callionymus indicus* but a later worker, Bloch, in 1795, provided the separate genus *Platycephalus* we now use for this Asiatic species and its allies.

Platycephalus means a flat head and so does "Planocephalus," a name invented for a Tasmanian species by William Anderson, in January, 1777; he was one of the naturalists with Cook's Third Voyage, and

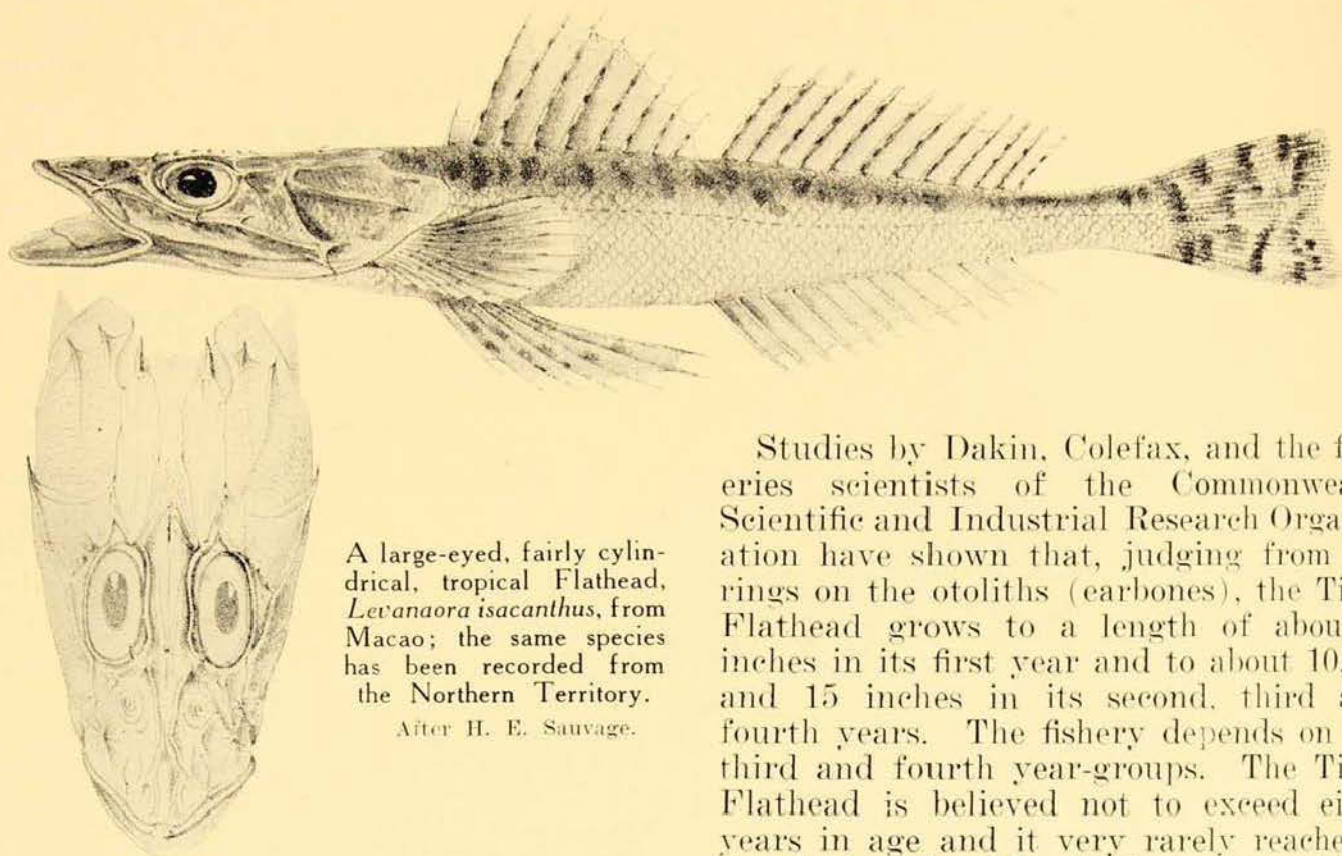
his unpublished Latin descriptions I have studied in the British Museum (Natural History) Library. His was the first recorded account of an Australian flathead and Anderson thought his "*Planocephalus*" was like a pike, but with the nature of the slimy, bottom-living flounder.

Sydney Parkinson, another of Cook's naturalists, had earlier drawn a Tahitian flathead, *Cottus otaheitensis*, and Forskal, in 1775, discovered *Cottus insidiator* in the Red Sea and I have seen his actual specimen preserved in Copenhagen, Denmark.

The aborigines must have had special names for flathead but I have found only a few records, and no folklore, so far, thus: Governor Hunter, in 1793, noted "Padde-wah, a fish called a flathead" in New South Wales; J. Neill in the 1840's mentioned Cumbel or Cumle from King George's Sound, Western Australia; and the native name Wirra-magoora is still used by some Sydney fishermen for the Rock Flathead *Thysanophrys cirronasus*.



Rough-headed Insidiators from Indonesia which extend into tropical Australian seas. *Above* (with top of head on left): *Repotrudis macracanthus*, with very long preopercular spines; and *below* (with top of head on the right): *Rogadius pristiger*, which has a forwardly directed spine below the head.



A large-eyed, fairly cylindrical, tropical Flathead, *Levanaora isacanthus*, from Macao; the same species has been recorded from the Northern Territory.

After H. E. Sauvage.

The principal commercial species is the trawled Tiger Flathead, or "Teethies" (*Neoplatycephalus macrodon*=*richardsoni*) of New South Wales and Victoria, characterized by long canine teeth, whilst the head and body are generally spotted with rusty-red. Millions of pounds of these used to be caught annually. In recent years this yield has dropped, apparently due to overfishing, so the biology has been studied to try and find a remedy for this decline. The breeding season is in summer and a mature female may produce up to two and a half million eggs at each spawning, but the infant mortality must be very high before the young fish are large enough to be exploited commercially.

The egg, and very small young¹ float with the plankton at first, then for the first two or three years of life, the young live inshore, generally on a rough bottom, at a depth of 30 fathoms or less.

¹Larvae only about $\frac{1}{4}$ in. long, of another species of flathead were discovered by the *Terra Nova* expedition in Melbourne Harbour in October, 1910, and one was illustrated by Regan in the *Terra Nova Natural History Report*, Zool. i, 4, 1916, p. 146, pl. x, fig. 4.

Studies by Dakin, Colefax, and the fisheries scientists of the Commonwealth Scientific and Industrial Research Organization have shown that, judging from the rings on the otoliths (earbones), the Tiger Flathead grows to a length of about 6 inches in its first year and to about 10, 13 and 15 inches in its second, third and fourth years. The fishery depends on the third and fourth year-groups. The Tiger Flathead is believed not to exceed eight years in age and it very rarely reaches 2 feet in length. The food consists of fish, mainly "flathead food", *Apogonops*, and crustacea, particularly *Nyctiphanes*. Many thousands of flathead have been measured by investigators and some have been tagged and liberated in hopes of their being recaptured and remeasured to gain some idea of their migrations (which are evidently not extensive) and growth-rate.

Further south, in Victoria and South Australia, is the closely related King Flathead (*Neoplatycephalus speculator*). Although not yet specifically recorded from that State, this fish occurs in abundance in Tasmania whence the Museum has a specimen from Wineglass Bay. It grows to at least 2 feet long.

A few of the more distinctive other Australian flatheads may be mentioned.

The Smooth Flathead, known to Victorians as the Port Albert or Rock Flathead, "Blacks", Grassy or Marbled-bellied Flathead (*Leviprora laevigata*) has a rather rounded head without distinct bony ridges on the top and the eyes are large and closer together than in other flatheads. Its rounder form suggests that it may be a primitive type nearer the ancestral "rock cod" form from which some flatheads

seem to have evolved. It is a very dark, almost blackish fish, the dark dorsal colour being broken up along the sides by dark blotches on the white ground-colour.

At Esperance, W.A., a close relative, *L. inops*, is called the Weed or Crocodile Flathead, and I have seen there a "tortoiseshell" colour variety. There are several varieties from our southern coast-lines, up to 20 inches long.

The Long-spined Flathead, *Longitrudis longispinis*, is the "Spikey" of New South Wales, so called because one of the preopercular spines is much longer than the other. It can inflict a severe cut, or can damage a net, with these spines. It has been caught in Queensland, Western Australia and New South Wales by line, or trawled down to about 50 fathoms, and grows to about 13 inches.

The Dusky or Mud Flathead, *Planiprora fusca*, is the largest of all, growing to 4 feet, though usually taken at less than half that size. These bury themselves in mud when disturbed and young ones are found in rivers such as the Parramatta.

There are several related species, the Marbled, *P. marmorata*, the Ashy, *P. cinerea*, and the Western Australian Sand Flathead, *P. melsomi=castelnaui*, the latter being shown at the head of this article.

Coming to the typical genus *Platycephalus* we find in tropical Australia the classic *indicus* of Linnaeus coming down to Shark's Bay in the west and Moreton Bay in the east.

In various waters of Australia there are also about half a dozen so-called species of *Platycephalus* of whose status we are not sure. For example, I have made two unsuccessful trips to Queensland to try and catch *P. mortoni*, a species described in 1883 from the lower Burdekin River and not represented in any Museum collection so far searched. The Department of Harbours and Marine, Brisbane, is kindly co-operating in supplying many kinds of Queensland flatheads for my studies.

Sand Flatheads, strictly so-called, belong to the genus *Trudis*, the best known one being *bassensis* from southern Australia.

This Common or Bass Flathead (*Trudis bassensis*) is known as Cliff or Spring Flathead in Victoria, and is caught in Port Phillip and elsewhere in a baited net, which is like the Tasmanian graball but with pieces of fish tied to the net to attract the flathead which are entangled by their spines in the 2-inch mesh. Messrs. Dunbavin Butcher and D. D. Lynch, of the Fisheries and Game Department, Melbourne, who have kindly supplied me with notes and specimens of all the Victorian commercial flatheads, inform me that the Cliff or Spring Flathead are said to come into Port Phillip in mid-October and disappear in December; they are caught in the southern waters of the bay and up as far as Portarlington. These fish are more expensive than other flathead, but perhaps this is due to their scarcity rather than to superior flavour, as I have been unable to distinguish them specifically from the common Bay or Sand Flathead of Port Phillip, the so-called "Trawled Flathead" of Lakes Entrance, Victoria. Fishermen in Victoria call 10 to 11-inch fish "Frogs", Channel Rats, and "Greys", and these are very common in the Melbourne market.

In New South Wales, *T. bassensis* is replaced by the Red Flathead *T. caeruleopunctatus*, which is the Long-nosed or Yank Flathead of Victoria. It has white or milky blue spots and a more sharply pointed snout and smaller preopercular spines than *bassensis*. Near Sydney it spawns at approximately Eastertide, fish being mature at about 9 inches long.

The Rock Flathead of New South Wales and south to south-western Australia, *Thysanophrys cirronasus*, is short and thick-bodied, purple on the back and yellow to cream below with variegated pattern and black lines on the fins, which harmonize with the rocks and weeds it inhabits; some fish have flaps of skin on the head and shoulders to heighten the resemblance. This is another of the more rock-cod-like flatheads.

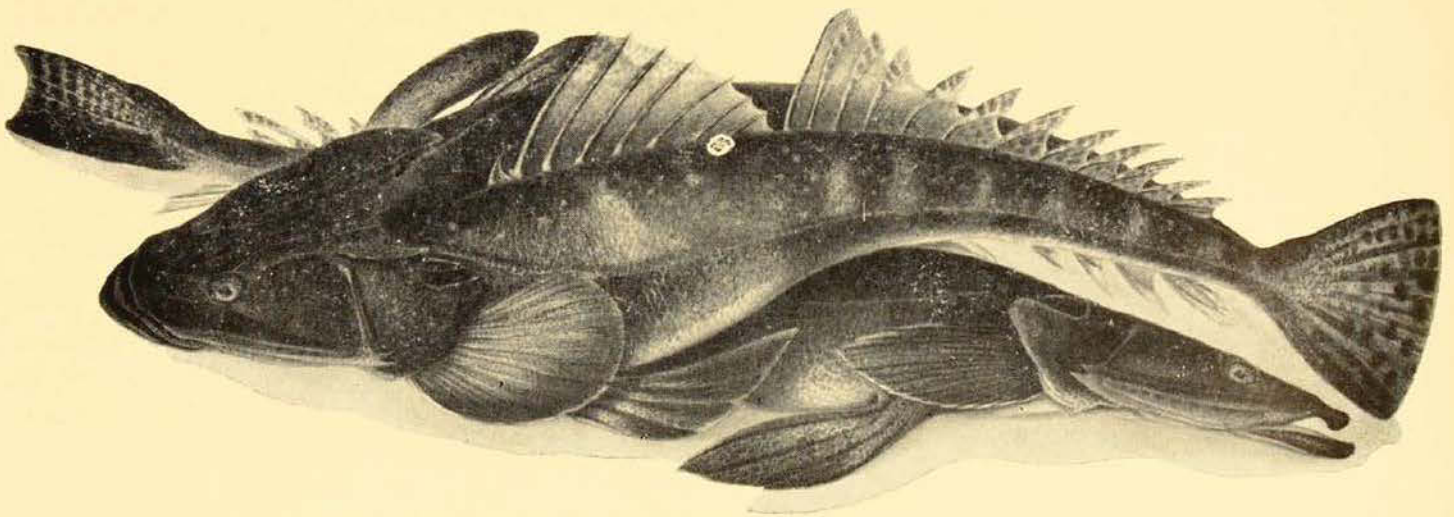
In tropical Australia there is an amazing variety of small flatheads with sculptured or spiny ridges on top of their heads, which are not as flat as in the true *Platycephalus* which, moreover, has smooth

ridges on top. The small tropic ones are the Insidiators or " Crocodiles ", known as Kochi in Japan, and belong to various species of *Suggrundus*, *Repotrudis*, *Levanaora*, *Wakiyus*, *Onigocia*, *Cymbacephalus*, and *Rogadius*. Some have skinny tassels over the eyes; others have characteristic spikes or spines not only on the head but along the front lateral line scales.

The trawlers sometimes secure the quaint Queensland *Elates*, which has an elongate, shallow body and incised membranes to the fins; the tail fin may end as a filament and there is only one spike on each side of the head.

In very deep water the Spook Flatheads of the family Oplichthyidae occur. These have no scales on the body, only naked skin

protected by a row of spiny scutes along each side. They are grotesque creatures which may some day be used as food when we fish their remote haunts, but at present they are quaint rarities. The Ghost Flathead, *Oplichthys ogilbyi*, has the eye-diameter about equal to the preorbital part of the head but the Glassy Flathead, *Rhinoplichthys haswelli*, has more extensive smooth areas in front of and below the eyes. These have four finger-like lower rays of the pectoral fins, rather like the feelers of gurnards, and are found at depths of between 70 and 800 fathoms. Young Oplichthyidae were found in the stomach of a Mackerel Tuna, 8 miles off Shoalhaven, New South Wales, on 20th September, 1951, so they probably pass through a floating juvenile phase.



The depressed head and general form of the body and fins of the Dusky Flathead, *Planiprora fusca*, are shown from above and from the side in this meticulous painting, made more than a century ago by Dr. James Stuart, and kindly lent by the Linnean Society of New South Wales for reproduction here for the first time.

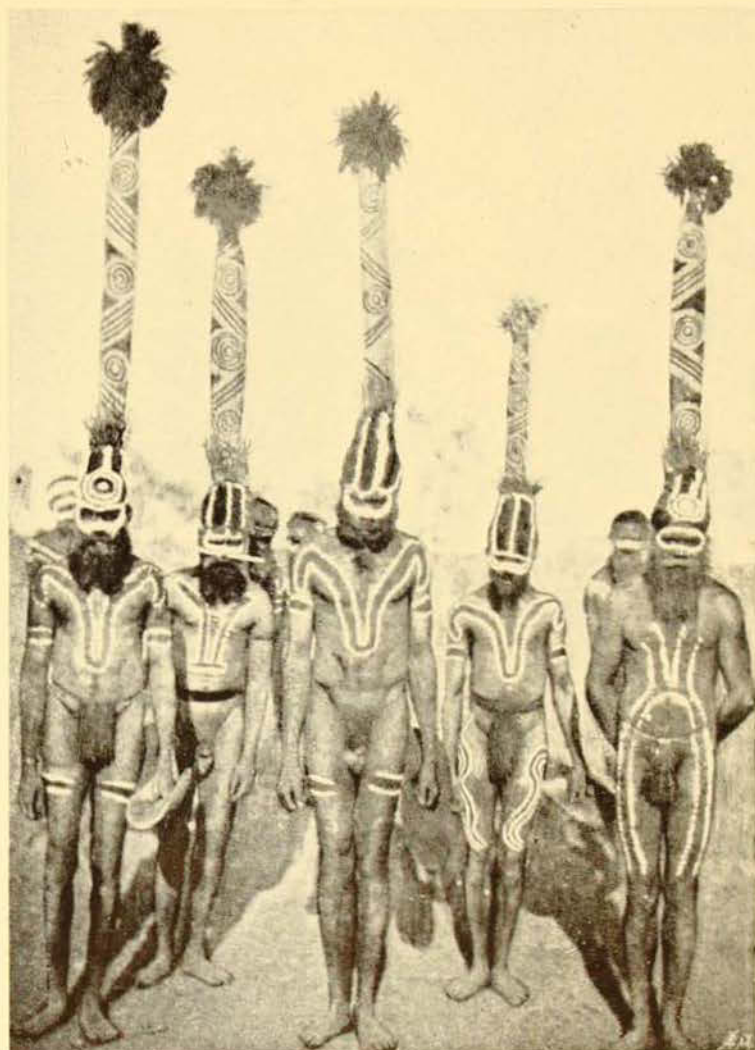


Aboriginal Rain-makers and Their Ways

PART I

By FREDERICK D. McCARTHY

Men of the Aranda tribe of Central Australia decorated for a rain dance.



IN many parts of Australia droughts have an appalling effect upon the sources of food of an aboriginal tribe, just as they do on the crops of our own farms, and it is not surprising to know that both the black and the white man have sought to stimulate nature to greater generosity with her life-giving rains. Throughout the world, in fact, the hunter, food-gatherer, pastoralist and agriculturalist have sought to overcome the rainfall problem with rain-making rites in which their profound belief in magic, which they know can kill and heal, gives them complete assurance provided the procedure is carried out correctly. The Australian aborigines never question the method if it is one connected with the source of their tribal and individual life-giving power manifested through their sky-heroes, the Rainbow-serpent and other huge snakes, or quartz crystals—failure is explained by improper behaviour or someone's neglect to observe a taboo.

The aborigines desire rain at specific times both for individual and for group or collective purposes. A man attempts to create a storm or shower to obliterate footprints when eloping with a woman, or if he is a criminal escaping the vengeance of his victim's friends. The making of rain, however, becomes a serious matter when it is organized by a local group whose reason may be the overwhelming one of survival in a drought-stricken land, or the desire to carry out important seasonal ceremonies upon which the life-giving power of the community depends; a local group may wish to punish another one by sending storms to spoil their hunting and fishing, and when a party of warriors is sent out to revenge the death of one of their kin rain is desired to wipe out their tracks and conceal their movements from the enemy. The group, too, with the aid of these rites, tries to maintain the continuity of the wet seasons and all that they mean in re-vitalizing the country and its

dependent animals, plants, and human beings. R. and C. Berndt pointed out that the Ooldea natives perform rain-magic to freshen the countryside, cool the atmosphere, and assist hunters in tracking game; their supply of drinking water is adequate and taken for granted, but in the Lake Eyre and other districts the sources of drinking water must be replenished and rain-making is a fine art.

The rites are usually performed during the day but the Yaroinga of Queensland have one method in which special songs are sung during the night. The rain-maker uses his deep knowledge of local weather conditions as a guide and performs his rites in seasons and times when rain can reasonably be expected; as a result his efforts are often rewarded with success. In many tribes the rites may be performed by any individual, but as a rule there are one or more rain-makers in a local group who either confine their magical activities to this sphere or are fully initiated medicine-men. In most tribes women cannot witness the rites, in others they participate in some methods or perform a simple type of magical act themselves. Successful rain-makers acquire considerable prestige in their own and other local groups, and are proud of their success; such men may be invited to other camps to perform the rites when the local rain-

makers have failed. A man can pass on his own rain-making methods to his son or to a young man, such as a mother's brother's son, for whom he acted as guardian during initiation.

The methods employed by the rain-makers are surprisingly varied, originating as they do in a dream, as a traditional rite performed by the dream-people, or from an incident in daily life which has been followed by rain. Many of the methods are imitative of clouds and falling rain, and of aquatic animals, others seek to persuade the ancestral beings to release the rain, and some medicine-men believe they can go up to the sky to open the clouds. A number of methods are usually known to each local group, and those which fail may be replaced by more successful ones.

The Dieri and other tribes of the Lake Eyre district employ some interesting imitative methods of rain-making. They believe that the *mura-mura*, their spiritual ancestors who made and inhabited the earth in the dream-time prior to man's occupation, now live in the sky, and some of them have to be influenced by ceremonies to release the rain from the clouds. The Dieri inform the *mura-mura* in loud voices that their country is parched and impoverished, the people are starving, and food is difficult to get. In one collective



A rain-maker of the Dieri tribe throws water from his wooden dish to the left and right during a rain-making rite.

A Dieri rain-maker appealing to the ancestral beings to send the rain.



rite the men build a large conical hut, the floor of which is dug out to a depth of two feet, and inside which the old men huddle whilst two medicine-men, who have obtained an inspiration from the *mura-mura*, pierce their arms and allow the blood to drop—the falling of rain—on to the old men, over whom they throw feather-down representing clouds. Two large rain-clouds are symbolized by two stones in the middle of the hut, which are placed in the highest tree nearby after the ceremony. Powdered gypsum thrown into a waterhole is not only falling rain but a request to the *mura-mura* to crack open the rain-cloud, desires expressed also when the men finally butt down the hut with their heads. The women are called to inspect the hut several times. The failure of such a carefully performed rite, charged with the sacred atmosphere, inspiration and co-operation of the ancestral spirits, is explained by the *mura-mura* being angry with the group, or because another local group has nullified the power of the rain-makers.

Another method used in the Lake Eyre district is based on a legend which states that when two *mura-mura* men arrived at Mungeranie during a journey they found the waterhole to be dry and a sign indicating that their wives had left several days

before and gone to another place. They were so angry with this disappointing situation that they threw water they had with them up in the air with the result that a spot of rain fell on them, so they poured the remainder out of their skin-bag into a wooden bowl, dipped their eagle-feather headdress into it and sprinkled the drops on all sides; the rain continued during this sprinkling operation so they danced in the direction from which it came to bring more.

The Dieri rain-maker in this ceremony decorates his body with a feather-down design stuck on with human blood, and wears a feathered hoop on his head to make himself invisible. Other men sit around bowls of water and chant rain songs whilst he dances over his bowl and sprinkles the water about, his headdress making a swishing noise like the falling of rain.

In south-east Australia storms of wind and rain, and also floods, were believed to be sent by enemies to disturb hunting and fishing activities. The Kurnai of Gippsland squirted water from the mouth in the direction from which rain usually came, and sang magical rain chants acquired in dreams by both men and women.

In Arnhem Land pounded bark (used for poisoning fish) is wrapped in grass, weighted in stones, and taken out into either salt or fresh water by a man until his shoulders are covered; here he drops the bundle, sings a song about falling rain, and pushes the water with his hands to represent the rain splashing on its surface. He expects the clouds to form in about

three days and the rain to come on the fourth day after this rite. Here, too, a large bundle of green grass fashioned into a human image is buried and when it swells up rain is expected to fall. The rain is stopped by taking the grass out of the water or ground and spreading it out to dry.



An Insect Calendar

PART II

By A. MURGRAVE

In the first part of this article consideration was given to some of the factors which underlie the seasonal appearance of insects and their dependence upon warmth and humidity, too much or too little of each of these essentials, in a particular environment, determining the future of the insect or the plant upon which it lives.

Climate, therefore, with its changes of temperature, rainfall, humidity, winds and storms, all of which form a varied part of any *Season*, plays a major role in insect life and it is necessary to understand the importance of these changes in retarding or increasing the growth of insects. Therefore, before proceeding to a brief survey of

the Seasons and the dominant insects which accompany them it was necessary to mention climate.

The life-histories of various species of insects of economic importance have appeared for many years in the monthly journals of the Departments of Agriculture in the various States of Australia, and the seasonal significance is usually stressed, but it would appear that only within comparatively recent years has any attempt been made to link meteorology with the seasonal appearances of insects, apart from those few forms cited in the first article of this series.



About Sydney the spring is announced by a floral riot of colour in the parks and gardens. The fruit-trees with their wealth of blossoms are followed by the purple glory of the Wistaria. Elsewhere in Australia spring is indicated by the appearance of young lambs in the paddocks not to mention the plague grasshoppers in their first hopper stage.

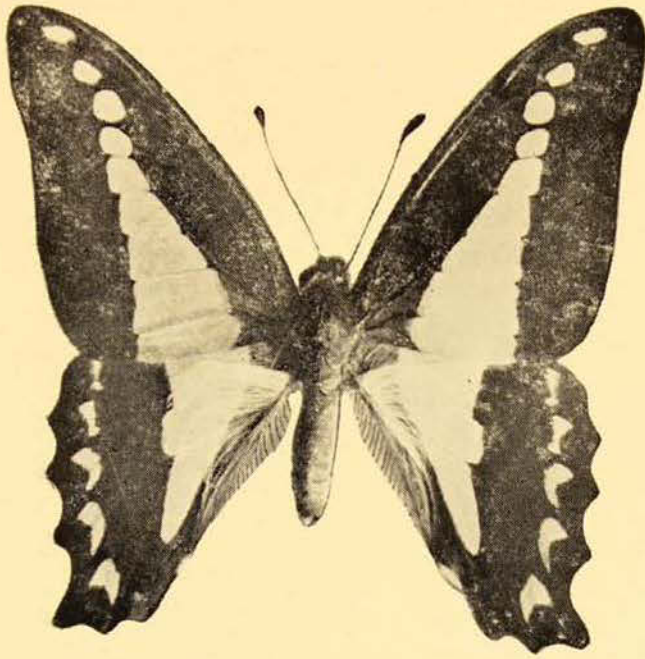
Officially the spring months are September, October and November, but the weather usually breaks about mid-August, and the nor'easterly winds, which commence to blow about 3 p.m. in August, remind us that warmer weather is on the way. In the suburbs of Sydney, the notes of the Pallid Cuckoo going up the chromatic scale also announce that spring is here, like the well-known harbinger of the English spring, but as it keeps up its call so incessantly or with, what Falstaff would term, "damnable iteration", we realize why it is also called the "brain fever" bird. About Gordon, near Sydney, its notes are heard all day long until later in the season it seems to disappear when another larger insectivorous bird, the Koel Cuckoo or Cooee Bird, takes its place with its somewhat mournful but insistent call of "cooee". In Western Australia the Pallid Cuckoo has been used as a pointer to weather conditions in the south-western

part of the State, from June to August, 1949, in a recent paper by Dr. J. Gentilli†.

On the coast and uplands about Sydney towards the end of August and in September, the beautiful heaths of the genus *Epacris* are found blooming. Many flies, which seem to disappear with the approach of summer, are attracted to them. Thus we may find hovering over the flowers flies of the family Nemestrinidae with curiously-veined wings, while small and large bee-like flies of the family Bombyliidae may be met with on the flowers or sunning themselves on sandy patches nearby. In the National Park at Gundamaian one August, we found that the white flowers of *Epacris microphylla* were attracting no less than five species of the genus *Trichophthalma* of the first-named family of flies, of which the most beautiful species, *T. rosca*, predominated. This fly was also captured there during the month of September.

Among the first of the butterflies to appear is the Blue Fanny or Blue Triangle, *Papilio sarpedon choredon*, which is commonly found about Sydney from September to April or from spring to autumn. Here it feeds in the larval state on the young shoots of the Camphor Laurel and the adults may often be seen flying about this tree. Its native foodplant is the Sassafras.

†*Western Australian Naturalist*, ii, 3, 1950.



The Blue Fanny or Blue Triangle, *Papilio sarpedon choredon*, a common visitor to Sydney gardens, where its larvae feed upon the foliage of the Camphor laurel.
Photo.—A. Musgrave.

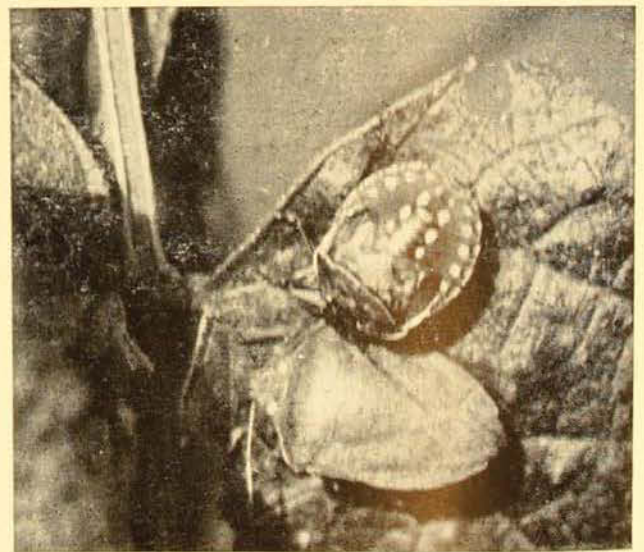
Some years an insect may appear in much greater numbers than usual, local conditions or absence of enemies being favourable for its development. In September, 1947, Mr. W. Kinsella of the *Sydney Morning Herald* showed me at Caringbah, near Cronulla, a number of Stringy-bark gum-trees (either *Eucalyptus scabra* or *globoidea*), which had been almost completely defoliated by the larvae of the Cup Moth, *Doratifera vulnerans*, well-known in the Sydney district. The larva or caterpillar of this moth is soft and slug-like, yellowish or greenish in colour, with rosettes of fleshy tubercles armed with extrusible spines which are situated in groups of four at both ends of the body. These spines can be raised at will and should they come in contact with the skin, may break off and cause a local irritation. They have long been known, not only to those who gather gum-tips, but ever since John Lewin described and figured this insect and its life-history in his book, *Prodromus Entomology. Natural History of Lepidoptera's Insects of New South Wales* (1805). In this book he popularly named it the "Wounding Bombyx". The larva eventually forms a smooth, pear-shaped cocoon attached by the broad end to a branch or twig and the top is capable of

being pushed off by the moth when emerging. The moth itself may measure over an inch across the outspread wings, and its general colour is brown or reddish-brown.

SOME GARDEN INSECTS.

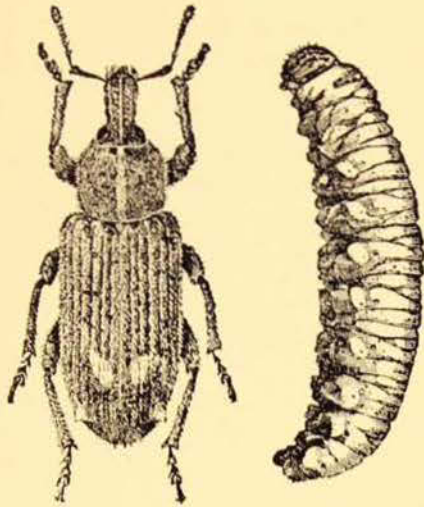
With the spring, as every gardener knows, many insects of economic importance appear in gardens about the city. One of these is the Green Vegetable Bug, *Nezara viridula*, a cosmopolitan pest which attacks beans and tomatoes and is recorded from many fruits and crop plants. The immature and adult bugs suck up the sap from the plants thus causing injury to bean pods which become shrivelled and distorted, while tomato fruits become discoloured. This insect was common in the garden at Gordon. The adult bugs are normally green in colour but change to brown or purple and thus pass the winter hibernating under leaves or the bark of trees. The bugs emerge about the end of August or in September and mate and the eggs, which are glued in clusters on the leaves, are laid in the latter month. As many as four generations may occur in the season, and the life-cycle from egg to adult takes about five to eight weeks. They are said to be most abundant in February and March.

Another introduced species is the Brown Vegetable Weevil, *Listroderes obliquus*,



The introduced Green Vegetable Bug, *Nezara viridula*, is a pest of many kinds of vegetables. The picture shows an immature example (above) and an adult (below) on the leaf of a potato at Gordon, near Sydney.

Photo.—A. Musgrave.



Left: The Brown Vegetable Weevil, *Listroderes obliquus*, a pest in gardens, is an introduced insect. It feeds on a variety of weeds and vegetables. The adults are common in October and November.

Right: The Dicky Rice Weevil, *Maleuterpes spinipes*, is a well-known pest of citrus in New South Wales. The larvae damage the roots and the adult beetles eat the leaves and the rind of young fruit. There are two broods in the year—Spring and February.

Courtesy N.S.W. Department of Agriculture.



which has found Australian conditions to its liking. Economic entomologists of the State Departments of Agriculture, who have studied its habits, tell us that it is a pest of many vegetables such as beetroot, carrots, lettuce, parsnips, radishes, tomatoes, turnips, as well as such weeds as the Cape Weed and Marsh Mallow. Not only the leaves but the stalks and roots may be destroyed. The adult weevils feed only at night and shelter during the day in debris near the base of the plant. The adults emerge from the soil about August and continue to feed until November. They then rest in the soil during the summer months, and lay their eggs in the autumn and winter, the larvae emerging three to four weeks later.

Orchardists who grow citrus fruits for the market prepare early in the season for the reception of a tiny weevil called the Dicky Rice Weevil, *Maleuterpes spinipes*, by banding their trees near the base with a sticky tanglefoot preparation. This traps those adults climbing up the trunks. The weevils emerge from the soil during August, September and October. While the larvae feed on the roots little damage seems to be done to the tree in comparison to that wrought by the adult weevils to the young fruit. There they feed on the skin causing black marks to appear later when the fruit has ripened. It has been estimated that a bad infestation of Dicky Rice Weevils may cause 70 per cent damage by disfiguration, so making the fruit useless for the market.

BUSH FLOWERS OF SPRING.

A walk through the bush about Sydney during the spring reveals many native plants in flower which may rival the introduced forms in beauty. Along the track we may see the yellow flowers of the *Dilwynia* or *Gompholobium*. In certain localities the pink flowers of *Boronia pinnata* or *Boronia serrulata*, the Native Rose, are common on the Hawkesbury sandstone when they have been left unscathed. The beautiful *Eriostemon buxifolius* is another plant which occurs in the same locality with the *Boronia*, while the scarlet heads of the Waratah, *Telopea speciosissima*, may still be found growing not only along the creeks in favourable situations, but even in some Sydney gardens. As spring lengthens into November, the Tick Bush, *Kunzea ambigua*, a tall shrub with short narrow leaves, flowers abundantly in the coastal district. Clinging to the leafy branchlets are the white and sessile flowers, full of honey, the scent of which pervades the air. The almost sickly-sweet aroma is very attractive to insects, especially the small brownish beetles of the genus *Phyllotocus*, members of the great family Scarabaeidae, and is thus one of the favourite plants of the entomologist. The Tea-trees of the genus *Leptospermum*, which belong to the same Family, Myrtaceae, as the Tick Bush, contain certain species which while flowering in November are largely visited by insects. Of these the first to appear is *L. myrtifolium* whose white flowers are suggestive of those of apple trees. Next to blossom



The Common Tea-tree, *Leptospermum flavescens*, occurs on the coast and tablelands of Eastern Australia and in Tasmania. Its creamy flowers are attractive to insects. It usually grows along the banks of streams. Photo.—A. Musgrave.

is the Common Tea-tree, *L. flavescens*, with creamy flowers often in masses. It is visited by a host of small insects, flower wasps, beetles, flies, and bees, and is one of the best plants known to the entomologist for such flower-frequenting forms. Also included in the Myrtaceae are the Bottlebrushes of the genus *Callistemon*, and these are found growing in swampy ground or by the sides of streams. In some species the flowers form dense spikes with crimson filaments. The flowers are very attractive to native bees, and Mr. T. Rayment has recorded the Wasp-like bee, *Hylaeoides concinna*, from the flowers of one of these plants.

THE BOGONG MOTH.

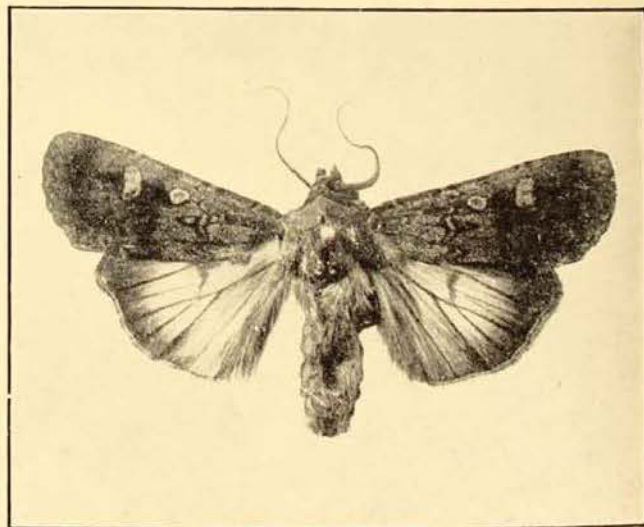
In October and November, during some warm night, thousands of a small dark brown moth may suddenly invade the city and its suburbs, flying madly around the lights of ferry steamers, trams or trains,

invading houses and churches in myriads, while many thousands perish in the sea, their bodies eventually strewing the high water mark of the beaches.

This is the Bogong Moth, *Agrotis infusa*, a member of the family Noctuidae ('Owl Moths'), and perhaps the most abundant of all our moths. In the western parts of New South Wales it has been recorded as a pest in the caterpillar stage. In the adult moth, the wing span is only about 1 $\frac{3}{4}$ inches. Prior to the arrival of the British settler, these moths were regarded as food, and the Bogong Mountains and Mt. Bogong in the Australian Alps, take their names from the presence of the moths. Here, during the summer, the aborigines would foregather and catch them in thousands among the rocks. The wings were afterwards singed off over fires, and the bodies made into a paste before being eaten. About Sydney, after their first wild tumultuous appearance, they seem to loiter about the blossoms in the Turpentine trees for some time, and, during the day, if disturbed, many hundreds may take flight.

THE OLD LADY MOTH.

Another member of the same family is the Old Lady Moth or Silken Spectre, *Sericea spectans*, an insect doubtless familiar to every resident of the Sydney district. It was first described in 1852 by the French naturalist, Achille Guenee, from many specimens stated to have been



The Bogong Moth, *Agrotis infusa*, often visits the coast in countless swarms during the spring months. In the larval state it may destroy grass and cereals in the western parts of New South Wales.



The Old Lady Moth or Silken Spectre, *Sericea spectans*, is a large Noctuid moth that often invades houses, but is quite harmless to all woollen goods.

Photo.—A. Musgrave.

collected in "Tasmania" by Jules Pierre Verreaux, the well-known collector who visited Tasmania and Australia during the years 1842-1846 on behalf of the Natural History Museum, Paris, but his specimens were far more likely to have been taken in New South Wales, since the moth does not occur in Tasmania. The adult moth is with us practically all through the year, and sometimes many individuals may occur in the same room or cellar but they shun the light. They have the facility to arrange themselves in artistic attitudes "on many a vase and jar" and where they often escape detection. Despite the fact that it is so common, the life-history of this moth does not appear to have been worked out.

SOME "RITES" AND WRONGS OF SPRING.

During October in 1948 and 1949 millions of winged aphids invaded the metro-

politan area and proved a great torment to man by getting into the ears, eyes, and nostrils. At least three of the Sydney newspapers referred to this plague, which appears as though it may be of seasonal importance. In 1948 the invasion suddenly arrived on the 9th October, but a strong westerly wind on the 11th seems to have dispersed it. Some specimens were taken at the Australian Museum on the 13th October. Aphis swarms are usually followed, as a natural sequence, by their enemies, Ladybird beetles and hover flies, so it is interesting to learn that the officers of the Entomological Branch of the Agricultural Department of New South Wales were able to record the occurrence of thousands of these insects from inland as well as coastal areas. This information was based upon many reports submitted to the Department. The Hover fly was identified as *Xanthogramma grandicornis* and the Ladybird as *Coccinella repanda*. The larvae of both these insects are predaceous upon aphids. An account of these beneficial insects appeared in the *Agricultural Gazette of New South Wales*, December, 1948.

In November, the last month of spring, the mean minimum temperature for Sydney is 59 deg. F., and the mean maximum 74.4 deg. F., or about 12 degrees hotter than August.

The Dwarf Apple, *Angophora cordifolia*, occurs commonly on the Hawkesbury sandstone country about Sydney. Its flowers attract many insects of different orders.

Photo.—A. Musgrave.





THE Australian Summer season, which includes the months of December, January and February, is ushered in by the screech of the cicada. In Eastern Australia, in the coastal districts, the Yellow Monday or Green Grocer, *Cyclochila australasiae*, begins to appear above ground about the end of October or the beginning of November, so that their noisy squawkings have long heralded the approach of the hot months.

Some half dozen species are well-known in the Sydney district of which the best known is that cited above; then follow the Double Drummer or Union Jack, *Thopha saccata*, the Whisky Drinker, Fiddler or Cherry Nose, *Macrotristria angularis*, the Red Eye, *Psaltoda moerens*, the Floury Baker or Floury Miller, *Abricta curvicosta*, and the Mottled Grey Cicada, *Henicopsaltria eydouxii*. Many smaller forms are also to be met with.

Only fragments of the life-history of the Yellow Monday are known, which begins when the female rips up the bark of the topmost branches of the gum tree to deposit her eggs in the incisions she has made. The shrimp-like young make their way to the ground and there work downwards to the roots. Here they spend the greater part of their lives feeding on the sap in the roots of the tree. At the end of three years, so it is believed, because they are most numerous every third year, they tunnel upwards to the surface of the

soil and climb up the fences or tree-trunks where their shells split down the back and the insects emerge. At first the wings are soft and white but they gradually harden and soon the insect is able to fly off and join its companions in the nearby trees.

During the Summer season of 1948-1949 cicadas were so conspicuously absent from the Sydney district that comment to that effect was made in the Press. The 1949-50 season, however, was a "vintage" year for the noisy insects and many of the above-mentioned species were submitted to the Museum for identification.

During the summer of 1947-48 the black and white spotted butterfly popularly termed the Common Australian Crow or Oleander Butterfly, *Euploca core corinna*, which is essentially a tropical insect, came south as far as Victoria. The silvery pupae were frequently sent in to the Museum and the larvae were commonly noted on Oleanders. It is not, however, with us every year and the last seasons of 1948-49, and 1949-50, yielded hardly a specimen from the Sydney District. This insect has already been dealt with in the MUSEUM MAGAZINE and so is only briefly referred to here.

SOME SUMMER FLOWERING PLANTS.

To an entomologist Mid-November and December bring into bloom the creamy-white corymbs of the Dwarf Apple, *Angophora cordifolia*. This rough-barked

shrub is a member of the family Myrtaceae, the group which includes those other plants so attractive to insects: Tick Bush, Bottle-brushes, and Tea-trees. There are at least three other species of Wild Apple found commonly in the Sydney district and all are present on the North Shore Line. These are, the Sydney Red Gum or Smoothbarked Apple, *A. lanceolata*, the Rough-barked Apple, *A. intermedia*, and the Small-leaved Apple, *A. Bakeri*. Angophoras somewhat resemble the Eucalypts in appearance, but the leaves are opposite, not alternate, and the seed capsule is ridged and has no cap. All these when flowering are attractive to insects, but it is the heart-shaped leaved one, or Dwarf Apple, which is the plant which delighted the late J. J. Walker, a former Engineer-Commander in the Navy and an enthusiastic entomologist. In a paper entitled "Antipodean Field Notes, III. A Sketch of the Entomology of Sydney, N.S.W." published in the *Entomologists Monthly Magazine*, vols. xli-xlii (1905-06), he described this plant as "par excellence the favourite of the Australian Coleopterist." In this he did not exaggerate, for not only beetles, but insects of many other orders come from all points of the compass to jostle one another on the corymbs and to partake of the banquet of honey provided. Thus we may expect to find on a bright hot morning many wasps, bees, ants, flies and butterflies attracted to the flowers, while small crab spiders lurk in or about the corymbs to prey on the smaller fry. Common visitors to this plant are the Jewel Beetles (Family Buprestidae) some quite large like *Stigmodera variabilis* and *S. macularia*, while others may measure only a fraction of the size of the larger forms. The Fiddler Beetle, *Eupoecila australasiae*, and another Cetonid beetle, *Polystigma punctata*, are common on the flowers, and so too is the Longicorn beetle, *Aridaeus thoracicus*, which tunnels in wood in the larval state. The late W. W. Froggatt has listed the insects associated with this plant in the *Australian Naturalist*, iii, 1914.

Growing close to the *Angophora* bushes on the sandstone country about Gordon, in ground now rapidly being built over, are



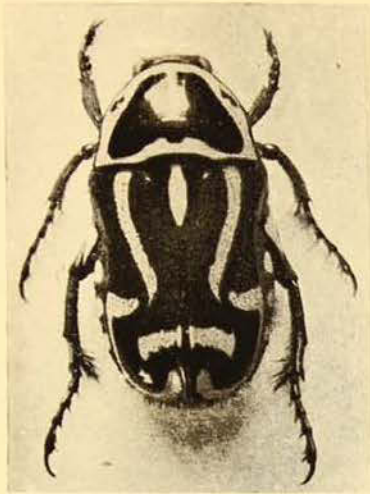
The Yellow Monday Cicada, *Cyclochila australasiae*, may be said to typify the hot summer days, and its incessant notes may even be heard at night. It is common in New South Wales and Victoria.

Photo.—A. Musgrave.

small bushes of *Banksia integrifolia*. On these in December may often be seen the Jewel Beetle, *Cyria imperialis*, which feeds upon the leaves while the larva is said to feed in the stems. This beetle is about 1½ inches in length, shining black in colour with the wing-covers irregularly banded with bright yellow, while the under surface of the body is covered with grey hairs. The beetle is thus a conspicuous insect as it sits on the green leaves of the *Banksia*.

During the summer months gum trees about Sydney are visited by "Christmas" Beetles of the genus *Anoplognathus*. Of these the largest is the King Beetle, *A. viridiaeneus*, measuring more than an inch in length and of a shining metallic-green, while of a large number of smaller species perhaps the best known is The Prince, *A. viriditarsis* (= *analis*) and The Washer-woman, *A. porosus*.

While the Dwarf Apple is nearing the end of its flowering season the flowers of the Christmas Bush, *Ceratopetalum gum-miferum*, have, meanwhile, changed from



The Fiddler Beetle, *Eupoecila australasiae*, is one of the many species of beetles which visit the creamy corymbs of the Dwarf Apple. It lives in the stems of Grass trees in the larval state.

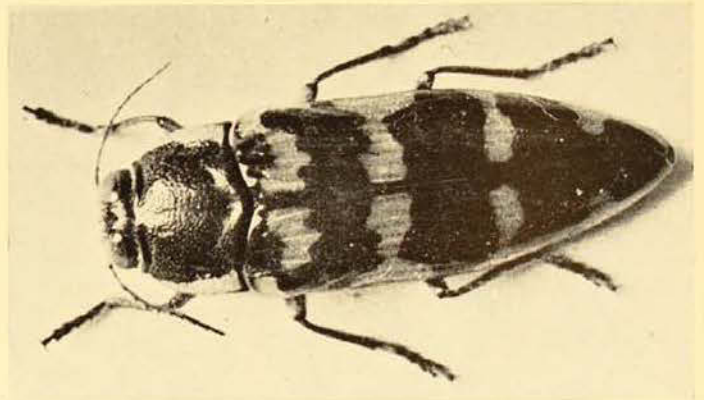
Photo.—A. Musgrave.

cream to pink, and, with the Christmas Bells, *Blandfordia*, whose red and orange flowers show it to be a member of the Liliaceae, provide our chief decorations for the Christmas festival.

A feature of the Australian summer, in the Sydney district, are the bush fires, though these may occur also in the Spring months. These fires ravage the forests and grasslands and may cause losses in stock and dwellings. Elsewhere the great amount of charred wood, leaves and debris left behind by fires may be washed into creeks and rivers after rain. It has been pointed out that silting up may occur in the streams and erosion appear in hillsides as a greater run off is noted from burnt than unburnt

country. The destruction to our fast-disappearing flora and fauna is another of the sad effects of bush fires too often started as a result of carelessness.

After the Dwarf Apple has bloomed, and sometimes the blossoms may last well into January, an insect anti-climax sets in as though Nature had reached a crescendo with the long, hot days of December. This last month of the year provides us with our longest day, 22nd December, when the sun is at its furthest south (Southern Solstice) over the Tropic of Capricorn. Now it begins its return march northwards with its retinue of heat-waves, winds, storms and rain.



The Banksia Jewel Beetle, *Cyria imperialis*, occurs commonly on the Small Banksia, *Banksia asplenifolia*, at Gordon, and is reported feeding in the stems in the larval state.

Photo.—A. Musgrave.

Review

NATURAL HISTORY SPECIMENS. Their Collection and Preservation. Handbook No. 2. Published by the Western Australian Naturalists' Club, Perth. Sv. *Perth*, pp. 40, 6 ffs. 1951. Price 3/6.

This Handbook, edited by J. Gentilli with the collaboration of the Western Australian Naturalists' Club, is designed to take the place of the *Natural History Specimens* handbook. This new edition is one of the Club's contributions to the Jubilee celebrations of 1951.

This little book should be extremely useful for any collector or collectors working in the field and who may not be familiar with the collecting techniques employed in other groups.

Some idea of the scope of this collecting manual may be gleaned from the sectional headings: Natural History Collecting; Flowering Plants,

Ferns and Mosses; Seaweeds; Fungi (Mushrooms, Toadstools, etc.); Microscopic Water Life; Sponges, Anemones, Starfish, etc.; Peripatus; Centipedes, Millipedes, Scorpions and Spiders; Crustaceans; Insects; Molluscs; Fishes; Amphibians and Reptiles; Birds and Mammals; Geological Specimens.

Under each sectional heading is given the equipment required in the collecting and preserving of the specimens, and the setting and mounting of plants or zoological specimens.

Such a work, as the Introduction by Dr. Gentilli points out, "is suitable for Australian conditions generally," and so it is hoped that Australian collectors will purchase the Handbook and benefit from its teachings.

A. MUSGRAVE.

The Kangaroo Family

The Pademelons or Scrub-Wallabies—Part II

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

THE DAMA PADEMELO, OR TAMMAR OF WESTERN AUSTRALIA.

This widely-distributed coastal species not only has the distinction of being the first of the kangaroo family of which an authentic account was provided, but it is also apparently the first Australian marsupial made known to the civilized world. The Dutch navigator Pelsart made his observations of this wallaby in 1629, when shipwrecked on Houtman's Abrolhos, Western Australia, about 150 years before Captain Cook's party recorded kangaroos from the eastern coast at Cooktown. But the Dutchman's account was overlooked for almost two centuries, and this species was actually named in 1817 from specimens taken by French naturalists on St. Peter Island, which they called L'île Eugene, in Nuyts' Archipelago, off the South Australian coast, towards the south-eastern limit of its remarkably extensive range.

It has not been possible to decide whether separate sub-species existed in South Australia, because of the extinction of the pademelon on St. Peter Island and the loss of the original specimens in the Paris Museum, together with its rapid disappearance from the mainland after settlement. There seems no doubt, however, from the original description, and notes of the naturalist-collector Péron, that only a single species was represented and that the specific name *eugenii* is correctly used for all geographical races of the Dama Pademelon or Tamar of Western Australia.

There is a general uniformity of coloration, and intergrading of cranial and dental features, which makes the definition of sub-species rather doubtful in spite of the vast geographical range of the species. But such was the confusion arising from the study by various authorities of specimens collected from numerous island and mainland localities, that no less than seven distinct specific names were given to Western

Australian specimens. Of these but two are now recognized, the one from the south-western mainland and Garden Island off Fremantle, for which the earliest available name is *derbiana* (1837), and the insular race seen by Pelsart on the Abrolhos off Geraldton, named *houtmanni* by Gould in 1844.

The species is fortunately abundant on Kangaroo Island at the eastern end of its range, where it is represented by a larger and paler-limbed race, with distinctive cranial features. This insular race (*Thylagale eugenii decres*), based on specimens in the Australian Museum collected by the author, was named in allusion to the name (Decres) given Kangaroo Island by the Baudin Expedition. Its habits are characteristic of pademelon-wallabies over the vast coastal and insular range of the group. The small kangaroos travel almost silently through their scrubland mazes but produce a warning thump with the feet when alarmed, a signal common to most gregarious members of the family. Another habit is that of resting with the tail forward between the legs in the attitude assumed by female kangaroos when the young are born.

As noted in previous articles on marsupial birth,¹ interest in Australia has concentrated on the kangaroo family because of the amazing discrepancy in size between the newly-born and the parent. And so, in the earliest known observations, made by Captain Pelsart in 1629 about the Houtman's Abrolhos race, the enterprising Dutchman stated that the young—attached to nipples within the pouch—"were only the size of a bean, though at the same time perfectly proportioned." Misled by the relative minuteness of the pouch-embryos, Pelsart expressed the view that "it seems

¹Troughton, E. LeG., THE AUSTRALIAN MUSEUM MAGAZINE, ii, 11, July-Sept., 1926, p. 387; and viii, 2, Sept.-November, 1942, p. 40.

certain that they grow there out of the nipples of the mammae, from which they draw their food."

Appropriately enough, it was a race of the same species which provided the first known observation of the unaided journey of the newly-born kangaroo to the pouch, and its subsequent self-attachment to the teat. The facts as recorded by Surgeon Alexander Collie in the *Zoological Journal* of London for 1830, concerned females of the Tammar wallaby taken from Garden Island when his ship H.M. Sloop *Sulphur* was anchored in Cockburn Sound off the port now known as Fremantle. After expressing his delight at the capture of kangaroos with young at the teats, the trained anatomist was not to be side-tracked by any superficial comparison and referred to the dissecting-out of embryos from the parent "very near to the termination of the period of gestation . . . about the size of the smallest young already mentioned as being in the abdominal sac." His account also refers to an actual observation of the birth of a wallaby and the creeping of the diminutive young towards the pouch-opening, while the mother "with her head turned towards her tender offspring, seemed to watch its progress, which was about as expeditious as a snail."

Referring to the supposed inactivity of the attached pouch-embryo, Collie gave several instances of voluntary re-attachment and actually succeeded by gentle pressure in removing one, about 1¼ in. long, from the teat, which stretched for about 1 in. and had a bulbous tip for retention by the closed-in lips of the infant. An hour after being left in the pouch it was unattached, but two hours later it had re-grasped the teat and was again actively suckling. These remarkable observations, overlooked for more than a century, and appearing only twenty-four years after the first proof of the unaided transference of newly-born American opossums, are of much interest to any nature-loving Australian.

On the mainland of south Western Australia the Tammar was reported in 1909 as rapidly disappearing in settled areas,

but it fortunately appears to be plentiful still on Houtman's Abrolhos where in 1629 Pelsart was so fascinated by the wallabies' movements and method of transporting the young. According to Professor Wood Jones, prior to 1924, the "Dama" pademelon had almost disappeared from the South Australian mainland. Probably some linger on the extremity of Eyre Peninsula and in the south-eastern districts, but it has gone altogether from places where about thirty years before landowners had held annual shooting drives. A most attractive small kangaroo, which is readily kept in captivity, the survival of the Kangaroo Island race seems assured, solely because of the Flinders Chase reservation.

FLINDERS ISLAND PADEMELON.

The vital importance of adequately controlling the larger coastal islands as sanctuaries for the conservation of native flora and fauna is stressed by the sad fate of this elegantly-built and prettily-coloured paler relative of the Dama Pademelon. Once a great favourite with people who liked to see wallabies about their grounds, the species had been exhibited in the Adelaide Zoo years before it was named *Thylogale flindersi* by Wood Jones in 1924. In 1802 they were reported as numerous by Matthew Flinders when he shot five in addition to those killed by the botanists and their attendants. It is reported that many thousands were subsequently killed on Flinders Island and residents believed it to be extinct by 1920, after a bush-fire in 1910 swept through the island.

However, when Wood Jones visited there in 1924, a small colony of a hundred or so inhabited the small area of bush remaining after various attempts at cultivation by residents. These survivors' hold on existence was then less than secure as high cliffs leave no retreat from bush-fires, and food-destroying rabbits and introduced cats menace their survival. In January the young were seen to be entirely independent of the mothers, and the colony had noticeably increased, but because of the various obstacles to survival, it is keenly to be hoped that conservationists will carry

on the good work of Professor Wood Jones, by endeavouring to establish small colonies of this wallaby on suitable islands, such as St. Peters or L'île Eugene of Nuyts' Archipelago whence its first-named relative *eugenii* long since disappeared.

THE PARMA OR WHITE-THROATED PADEMELON.

It will come as a regrettable surprise to many readers that a beautifully-coloured pademelon wallaby once plentiful in the Illawarra district south of Sydney has apparently been extinct for many years, and is probably represented by only five museum examples, of which three are in the British and two in the Australian Museum. In 1856 Gould wrote that it:

. . . is so very distinct from all the other small Halmaturi wallabies inhabiting New South Wales, that the aborigines who hunt these animals recognise it immediately by the native term I have selected as a specific appellation; this remark applies more particularly to the natives of Illawarra, in which district I myself saw it in a state of nature. In these extensive brushes it doubtless still exists. . . . How far its range may extend westwardly towards Port Phillip, or eastwardly in the direction of Moreton Bay, I am unable to state.

This uncertainty of range, expressed with the doubtful geographical orientation which has frequently confused overseas workers on the Australian fauna, may never be settled since the species must have vanished from north of Sydney long before its rapid disappearance from the South Coast. This apparently lost species was the eastern representative of the *Dama* or Tammar group of pademelons (*eugenii*). It differed in having a more uniformly reddish back and pure white throat sharply contrasting with the sides of the neck, while the white cheek-mark and dark neck-stripe were more pronounced.

Also inhabiting the Cambewarra Mountain district of the South Coast, the last of two Australian Museum specimens was received in 1889 and it seems to represent yet another tragic disappearance of a marsupial so plentiful during early settlement that the need for preservation was not realised until too late. One can only hope that in spite of the fox and other hazards, small colonies may yet survive in some secluded parts of the South Coast and residents, especially in mountainous country, would perform a very real service by noting whether the size and coloration of any local wallaby fits this brief description, with a view to the rediscovery and conservation of this "lost" pademelon.



One of the smallest of the kangaroo family, the Short-tailed Pademelon-Wallaby (*Setonix brachyurus*) inhabits the swampy tracts and thickets of the south-west of Western Australia, where it is known by the aboriginal name "Quokka."

THE QUOKKA OR WESTERN SHORT-TAILED PADEMELON.

Apart from its small size, which is slightly less than that of a hare, the Quokka of south Western Australia differs from all other pademelon wallabies by the shortness of the tail which is barely twice the length of the head. The foot is also shorter, not exceeding 4 inches, while the short rounded ears scarcely project above the long fur. Its nearest relative is the decidedly larger Red-bellied Pademelon (*billardieri*) of the S.E. corner of the mainland and Tasmania, which it resembles in the comparative shortness of the ears and tail, and the sombre brown and rather shaggy coat—indicative of the generally similar habitat and climate.

It is the distinctive dentition, however, which places this odd little wallaby (*Setonix brachyurus*) in a genus all to itself. The remarkably stout permanent premolar is twice as long as the third upper incisor, is as broad in front as behind, with a well-marked inner basal ledge, and three to four vertical outer grooves. This combination of enlarged premolars and small low-crowned molars provides a marked distinction from all pademelons of the genus *Thylogale*, and is in keeping with an outward similarity to the rat-kangaroo group of the family. The dental differences have evidently evolved from somewhat different feeding habits from those of ordinary pademelons, the diet having a greater proportion of foliage and swamp-herbage owing to the rather restricted habitat in the south-west.

The unique little wallaby has the double historical distinction of being not only the second species of kangaroo, but also the second marsupial, definitely to be recorded from Australia, the first being the Tammar or Dama Pademelon observed by Pelsart in 1629. The reference, by another Dutchman Samuel Volckersen, occurs in a brief

account published in 1658 concerning Rottnest (rat-nest) Island, off Fremantle, and the presence of "two seals and a wild cat, resembling a civet-cat, but with browner hair." The "wild cat" was actually the short-tailed pademelon which was not specifically named until 1830 when the French naturalists Quoy and Gaimard described it from a dead one found on sandhills at King George's Sound.

In the *Australian Zoologist* for 1936, David H. Fleay, confirmed previous observations on marsupial birth when noting that a mother made no attempt to assist the newly-born, which seemed instinctively to follow a path along a central line of the abdominal fur to the pouch, shortened by the squatting attitude of the parent. It is stated that only one pouch-embryo is carried at a time, its growth being more rapid than in the larger wallabies, and becoming quite independent after four months. So short are the ears and hind-legs of adults that they are easily mistaken for rats in their maze of runways amongst tussocks and dense undergrowth.

During early settlement, Gould's collector John Gilbert found it abundant in all the swampy tracts and thickets skirting the south-western coast, where it was known as "Quak-a" by the blacks, who destroyed it in great numbers by firing the bush and spearing the escaping wallabies. It is indeed fortunate that this unique small kangaroo managed to survive such age-old perils, as well as the spread of the introduced fox and all other disadvantages of modern settlement. On the fox-free island sanctuary of Rottnest, my ichthyologist colleague Gilbert Whitley found the Quokka plentiful as rabbits in the maze of scrub-runways, and even on beaches and about the schoolyard.

A Marine Curiosity

By K. H. BARNARD, D.Sc., F.L.S.*

RECENTLY a bale of rubber, approximately 20 x 14 x 12 inches, was found washed ashore near Kleinmond (Caledon Division, Cape Province, South Africa), which had been pierced by two Marlins or Spearfishes (*Makaira*). The larger spear is 20 inches in length, with a diameter of 2 inches at the larger end; it has pierced through the bale; the exit hole is about 1½ inches in diameter, but the point of the spear has been broken off. The base of the spear is much splintered. The smaller spear measures 5 inches in length and about ½ inch in diameter. Part of the outer layer of rubber has been cut away to expose the smaller spear, as shown in the photograph.



The bale was originally bound with three straps (presumably iron), of which the middle one has left the deepest impression. The point of entry of the smaller spear just misses this groove, but that of the larger spear is in the groove; consequently the attack was made after the strap had become loose (or rusted away). How long

the bale had been floating or where it originally came from is impossible to say. The attack may possibly have been made in the Indian Ocean, and the bale subsequently carried down the coast of Africa by the Mozambique and Agulhas currents. Only the outer surface of the rubber to a depth of about ¼-½ inch appears to have perished.

Numerous cases of Swordfishes and Spearfishes attacking ships and boats are on record,¹ but an attack on a bale of rubber is rather unusual.

The specimen is exhibited in the South African Museum.

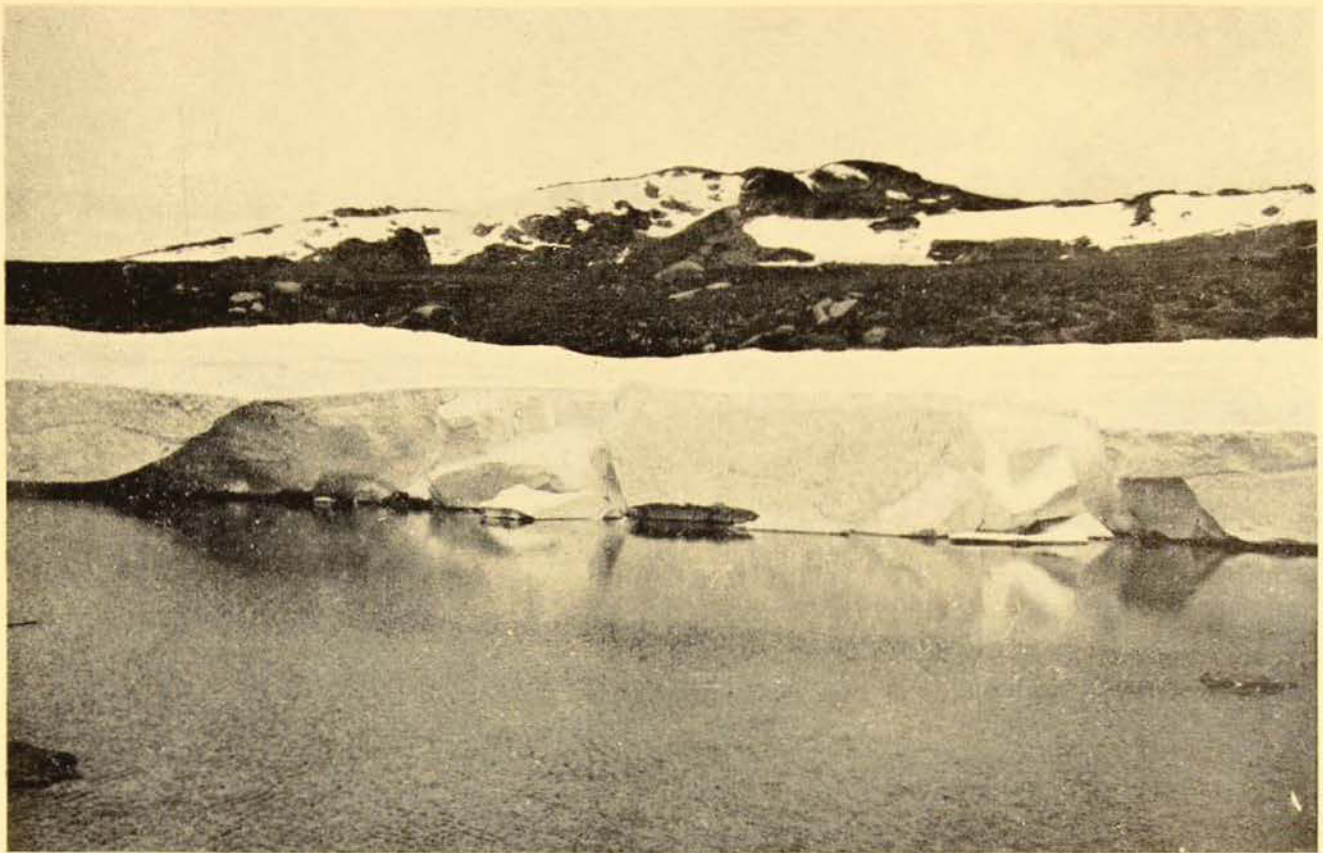
Another case could be added to the one recorded above, since the following paragraph appeared in the *West Australian* newspaper (Perth), 22nd January, 1945:—

“Albany, Jan. 19.—While at Two People Bay, 25 miles east of Albany recently, Mr. H. Pearson picked up a piece of rubber, about 12 inches thick, cast upon the beach. This was unique in that embedded in the find was a large Marlin spike. No trace of the large fish could be found, and it is surmised that this had charged at the rubber and had subsequently broken its spike in struggling to free itself of this entanglement. The finder reported the occurrence to the local Fisheries Inspector (Mr. J. Munro) on his return to Albany.”

At that time, it is noteworthy that hundreds of bales of rubber were being washed ashore on many Western Australian beaches, possibly as the result of shipwreck or wartime casualty.

* Director, South African Museum.

¹ Gudger, E. W., *Mem. Roy. Asiat. Soc.*, Bengal, xii, 2, pp. 215-315, April, 1940; Whitley, G. P., *AUSTRAL. MUS. MAG.*, vii, 7, pp. 238-242, December, 1940.



Thick ice on the bank of the Snowy River near its source.

Photo.—C. Adamson.

The Snowy Mountains of New South Wales

PART I

By H. O. FLETCHER

IN the far southern part of New South Wales and west of Cooma are thousands of square miles of rugged alpine territory known as the Snowy Mountains. This great elevated plateau is often referred to as the "Roof of Australia" and rises to heights above sea-level of more than 7,000 feet. The highest point, and incidentally the highest point in Australia, is Mount Kosciusko towering to a height of 7,313 feet¹, while nearby are the lofty outstanding peaks of Mount Townsend (7,236 feet), Mount Twynam (7,200 feet) and Ramshead (7,173 feet).

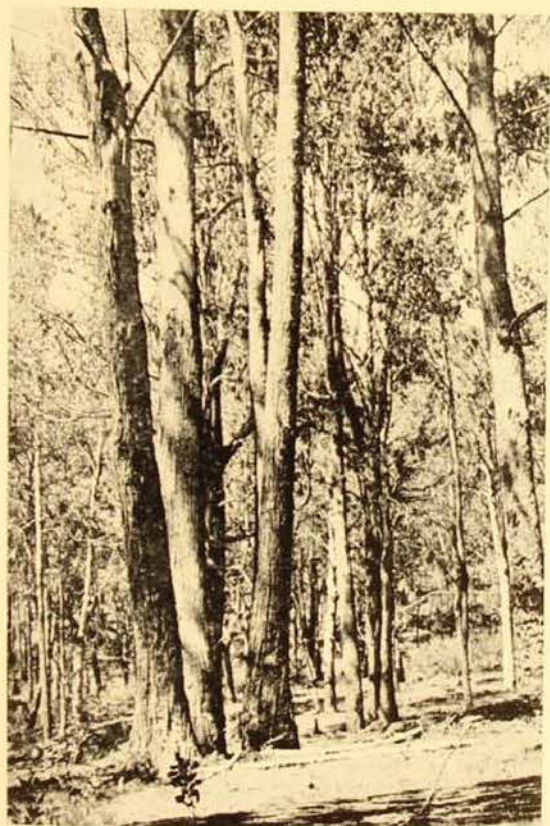
The Snowy Mountains area is one of Australia's most spectacular and popular "playgrounds" and, during the six or

seven months of the year when it is completely snow-clad, is admirably suited for all winter sports. In the summer months it is possible to reach the highest point by road where a visitor is rewarded with mountain scenery of a rugged grandeur unsurpassed elsewhere in Australia.

The Snowy Mountains were discovered by Count de Strzelecki, in 1839, while carrying out an exploratory trip through the Monaro country. The Snowy River was first sighted south of the present town of Jindabyne, where it has cut a sinuous course through elevated country and is deeply entrenched. Strzelecki shortly

¹This is the recently corrected figure.

afterwards, from the Murray side of the range, reached what he thought was the highest point of the range and named it Mount Kosciusko after the Polish patriot. Strzelecki described this peak which, according to his observations, was 6,500 feet in height, in the following words:—"Conspicuously elevated above all the heights hitherto noticed in this cursory view, and swollen by many rugged protuberances, the snowy and craggy sienitic cone of Mount Kosciusko is seen cresting the Australian Alps, in all the sublimity of mountain scenery." Later and more accurate surveys of this area suggest that a nearby peak was higher than the one selected by Strzelecki and his name was transferred to it. The peak described by him is now known as Mount Townsend.



Left: Thick growth of Mountain Ash near Musical Hill, between the Tooma River and Oglivie's Creek.

Photo.—M. Hall.

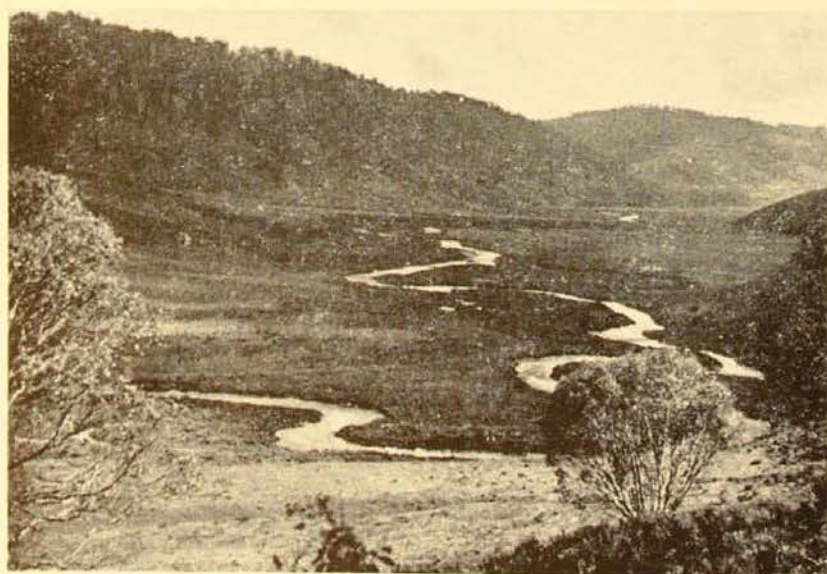
Right: The upper reaches of the Tooma River flowing through the alluviated valley of Pretty Plain.

Photo.—C. Adamson.

The alpine zone of the Snowy Mountains is usually recognized as the country between the tree-line and the highest altitude and it is deeply dissected by numerous tributaries which feed the major rivers of the area. This zone is too rugged for any form of cultivation, although grazing is possible on isolated pastures during the summer months. The "Snow Gums" and "Black Sallys" are the only trees of any importance which thrive on this elevated and usually badly drained and very poor country.

A belt of lower and less rugged sub-alpine slope country succeeds the elevated alpine region to the north and to the west. Its surface is undulating to steep with occasional fairly large areas of relatively flat and open land. These naturally clear and beautiful plains are clothed with a luxuriant growth of snow-grass and herbage. They are subdivided into "snow-leases" and are used extensively during the summer months for the grazing of sheep and cattle.

In the spring-time the open plains are a riot of colour from a wide variety of flowers which almost cover the whole of the country-side. White and yellow snow-daisies and vivid yellow butter-cups grow in profusion and are a special feature of the flowering plants of both the sub-alpine and alpine zones of the Snowy Mountains. Other shrubs which add beauty to the landscape include a local type of Hopbush, Dwarf Grevilleas, Acacias and an abundance of Prostantheras. Many of





Looking towards the summit of Mt. Kosciusko (7,313 ft.) from the Ramshead Range (7,193 ft.)

Photo.—M. Hall.

these flowering plants thrive above the 6,000 feet level and associated with them on the more elevated country is the unique Mountain Celery with its spiny palm-like leaves and white flowers. The most fragrant and strongly perfumed of all is a small mat-herb with yellow star-shaped flowers known as *Stackhousea*. It abounds amongst the Snow-grass.

The sub-alpine zone comprises the lower slopes of the plateau, extends from approximately 3,000 feet to 5,000 feet, and is heavily timbered with a variety of highland types of trees. These include the Alpine Ash, Mountain and Ribbon Gums and the Narrow-leaf Peppermint. Some of these trees attain large dimensions, particularly those growing on good granite and basalt soils which are well drained.

The Snowy Mountains in comparison with the greater mountain ranges of the world are of minor importance, but to Australia the value of this upland area as a potential source of hydro-electric power and irrigation is inestimable.

Thousands of square miles of the Snowy Mountains are covered with snow every year from May until November, while the rainfall averages approximately fifty inches each year. The major rivers which have their source in the Snowy Mountains are the Snowy, the Murray, the Murrumbidgee and the Tumut. These are continually fed by this reliable and inexhaustible source of supply of water.

Although the value of this area had been realized for some time, it was not until 1949 that a vast project to harness the

waters was set in motion by the Snowy Mountains Hydro-electric Authority. Some idea of the immensity of the scheme which will make the "Roof of Australia" a most important factor in the future development of Australia is provided in the following approximate figures. Construction originally was to include seven major dams, eighty-six miles of tunnels, 490 miles of race-lines and sixteen power stations. The estimated electricity which will be provided by the completed scheme includes 2,750,000 kilowatts which will be supplied to the Commonwealth for defence purposes and for consumption in the Australian Capital Territory. The surplus power will then be supplied to New South Wales and Victoria, the former receiving two-thirds and the latter one-third. Extra water in the Murray and Murrumbidgee valleys will, when the scheme is completed, reach the enormous figure of 2,100,000 acre feet each year, an acre foot of water being approximately 272,000 gallons.

The Snowy River alone drains 700 square miles of the eastern Alps as it follows its eccentric course east, north, south, west, then south again before entering the sea near Orbost, in Victoria. In its three-hundred-mile dash to the sea the Snowy River falls 7,000 feet and it has been well named Australia's "madeap" river. Its flow when it enters the planned Jindabyne Reservoir will be 8,050 gallons per second. The wall of the Jindabyne dam will also stem the waters of the Eucumbene and Craackenback Rivers. It is to be constructed two miles downstream from the little township of Jindabyne and the stored waters

will encompass the whole of the beautiful Jindabyne valley, including the township itself.

Away on the other side of the range and slightly south of Mount Kosciusko, a deep gorge plunges almost perpendicularly for more than 5,000 feet and at its base is found the Swampy Plain River, a major tributary of the Murray River which runs for 1,200 miles along the Victorian border before entering the sea at Goolwa, in South Australia. Steep mountainous country flanks the Murray from its source almost to Albury, at which point the river enters the first part of its attenuated plain environment. Swampy Plain Valley is of particular beauty and is separated from the Murrumbidgee waters by the wide range of mountains surmounted by the more spectacular residual mounts of the Grey Mare, Rocky Bogong, Jagungal and Round Mountain.

The Snowy-Murray main diversion scheme envisages a main tunnel about 39 miles long which will carry the eastern flowing waters of the Snowy River impounded in the Jindabyne Dam, west to the Murray River, via Swampy Plain River. In this way water, after it has been utilized for power at various power stations en route, will be made available for irrigation purposes from the Murray River.

Approaching the township of Adaminaby along the main Cooma-Kiandra road, one can readily see evidence of the vast amount of preliminary work being carried out by the Snowy Mountains Authority on the Tumut Scheme. This part of the main

scheme visualizes seven power stations developing 1,020,000 kw of hydro-electric power while at the same time providing additional water to the Murrumbidgee River for valuable irrigation work.

Use has already been made of the Murrumbidgee waters and the Burrinjuck Dam in providing water for the Murrumbidgee Irrigation Area, which now supports a population of 20,000 people as against not more than 20 or 30 persons in 1912. The dam has a water surface of 12,784 acres and a capacity of 771,641 acre feet of water, interesting figures when compared with the potential water storage under the Snowy-Tumut Scheme. The hydro-electric power developed at Burrinjuck is 20,000 kw from power-houses at the foot of the dam.

The Tumut Scheme which will enrich the waters of the Murrumbidgee will include the following main works. Four large dams, 45 miles of tunnels, and 160 miles of race-lines. Briefly this scheme means damming the Upper Eucumbene River at Adaminaby, where a storage will be effected of more than 1,000,000 acre feet of water. This water will then be diverted to flow to the Upper Tumut River, at Tumut Pond, by means of a tunnel about 15 miles long and more than 30 feet in diameter. From this point the tunnel line extends beneath the Tumut Valley for 12 miles to the Lobb's Hole Dam. It is in this section that the great fall necessary to generate power is made and power stations will be constructed along this

The majestic Mt. Jagungal
(6,758 ft.).

Photo.—M. Hall.



line. The Tooma River, a tributary of the Murray River, will also have some of its waters diverted to the Tumut by a tunnel 5 miles long and more than 25 feet in diameter. Both these rivers carry large and inexhaustible quantities of water, but their upper valleys are unsuitable for large storage dams. It will also be possible when necessary to turn the flow of the Upper Tumut and the Tooma back through the Tumut-Eucumbene tunnel to the dam at Adaminaby.

The Tumut River is a tributary of the Murrumbidgee and the diversion of Tooma and Eucumbene waters into it will make

available a large amount of additional water for irrigation and also allow for the generation of power.

An extension of the Tumut Scheme is the damming of the Upper Murrumbidgee near Tantangara. From this storage dam water will be diverted into the Tumut Valley, thus permitting the generation of still additional power. Some figures supplied by the Snowy Mountains Authority on water power are of interest. Four gallons of water per second with a drop of 3,000 feet will generate 132 kw of power. A kilowatt equals 1,000 watts and is approximately one and one-third horse-power.

Te Baïtari—An Edible Jellyfish from Tarawa

By ELIZABETH C. POPE, M.Sc.



A Tarawa native holds up two *Tamoya* jellyfish to show their shape and size.

Photo.—Dr. R. Catala.

DURING a recent visit to the Australian Museum, Dr. and Mme. Catala of New Caledonia brought a jellyfish for identification and told an interesting story about it. It seems that this particular species of jellyfish appears in swarms at regular and, provided that the wind and weather conditions are normal, predictable intervals in the surface waters round the Gilbert Islands. Since the jellies are much prized as food, the natives catch as many as possible, eating some and treating the surplus so that they can be stored and used later.

Although the specimen submitted for identification had collapsed to some extent during its journey from Tarawa to Sydney, it was sufficiently well preserved for us to make a reasonably sure identification. In spite of its large size, which may be seen in the accompanying photograph, it seems to belong to the order Carybdeida, the members of which are generally small. It has the typical flattened, four-sided bell which is squarish in cross section, and from each of the four corners hangs the kind of tentacle typical for this group. The sense organs and velar diaphragm are also

Not handkerchief day at the laundry but a line full of jellyfish drying in the sun at Tarawa.

Photo.—Dr. R. Catala.



of the Carybdeid type. By a stroke of good luck we were able to take the identification still further for an expert in jellyfish happened to visit the Museum just after the jellyfish had come into our possession. He was Dr. K. L. Kramp on his way home to Copenhagen after nine months' service with the Danish Deep Sea Expedition on the "Galathea". It was his opinion that the jellyfish belonged to the genus *Tamoya*.

The Carybdeid group of jellyfish are ordinarily noted for their potent stinging qualities and have earned for themselves the popular name, Sea Wasps. One particular genus, *Chiropsalmus*, according to Dr. Libbie Hyman, is greatly feared by Philippine and Japanese fishermen who call it the Fire Medusa. It is a member of this genus which is suspected of causing several mysterious deaths of bathers in the tropical waters of Australia. It seems peculiar, therefore, to learn of natives actually seeking out and gathering and handling carybdeid jellyfish in large quantities and it seems stranger still that the Gilbertese should be able to eat them without coming to harm.

At Tarawa the natives may eat the jellies soon after capture, in which case they

scrape away the "bell" and tentacle portions of the body with a blunt knife and boil what is left before they eat it. Mme. Catala likens the taste of this boiled jellyfish to that of tripe. If more jellies are captured than can be used immediately some may be dried in the sun and stored for later use. They are scraped first and the centre parts (the manubrium and some of the internal organs) are hung over a line for drying. The accompanying photograph shows a line full of these jellyfish "tripes" looking like washing as they dry.

Before use the dried flesh must be reconstituted (as with most dried foods) by soaking it in water and then it is ready for use. Mme. Catala had taken some of the boiled jellyfish, drained them of the surplus water and then cooked them in hot oil till they became brown and crisp like pork crackling. Jellies treated in this manner were absolutely delicious according to Dr. Catala. So it is no wonder that the natives will risk a sting or two to gather this delicacy which they call Te Baïtari.

Dr. Catala stated that the swarms of jellies appeared in the shallows always seven days before the full moon, except for occasions (which are comparatively

rare) when strong winds blew them offshore. Apparently the coming of *Te Baitari* is as predictable as is the coming of the Palolo Worm, with the added advantage that the jellies appear much oftener and the Gilbert islanders make good use of their knowledge.

I am greatly indebted to my friends Dr. and Mme. Catala both for supplying me with this information and for allowing me to publish it. The excellent photographs which illustrate the story were also supplied by Dr. Catala.

Review

"ECOLOGICAL ANIMAL GEOGRAPHY."

Second Edition by W. C. Allee and Karl P. Schmidt. An authorized edition, re-written and revised, based on "Tiergeographie auf oekologischer Grundlage" by the late Richard Hesse. John Wiley and Sons Inc., New York. Chapman and Hall, Ltd., London. Pp. 715, + xiii, 142 illustrations. Price, \$9.50.

The revision by Allee and Schmidt of this comprehensive textbook will be welcomed by all who are interested either in the ecology of animals or in their geographical distributions. In it a great deal of material from a wide variety of sources is brought together for handy reference.

The first section of the book deals with the ecological factors which influence the existence and distribution of animals such as barriers to their free dispersal and effects of geographical isolation. Terms in ecology are defined and the main classification of animals according to environments is set out. The remaining three sections of the book discuss the ecological geography of the three types of animals—marine, freshwater (that is, those of inland waters) and land.

The second section on marine animals is comprehensive. The two main types of biotic community—the pelagial and benthal—are described, in shallower seas and the abyssal depths. The various adaptations of animals found both on depositing shores and on eroding shores are described in some detail. In the section on coral reefs it is pleasing to find that the very latest researches at Bikini atoll have been mentioned and their bearing on the theories of the formation of coral atolls have received attention. In view of this it is surprising that the latest discussions on the universal features of zoning on eroding shores by T. A. Stephenson has been passed over without comment and that only the earlier works of this author have been listed in the bibliographies.

In the account of freshwater organisms the greater variability in the environmental factors available (for example, running water and still water), as compared with the oceans, is related to some of the differences found in the freshwater organisms, both pedonic and limnetic, from their corresponding marine groups—the benthal and pelagial. Consideration is also given to such special cases as tropical and polar freshwater animals, alpine freshwater communities and also creatures living in brine, humus water or in hot and cold springs.

The fourth and largest section of the book opens with a detailed account of the more important factors influencing terrestrial animals. Then follow accounts of the various types of animal communities found on the land—forest, grasslands, deserts, swamps and shores, and also those of the alpine regions—together with the adaptations which appear in each of them. Two special types of land communities dealt with separately, as they do not fit easily into any systematic ecological category, are the animal communities of islands and those found in subterranean spaces such as caves, mine shafts and so on. The book concludes with a discussion of the effect of Man and his activities on the distribution of other animals and the parts played by deforestation, building, agriculture and pollution of streams are assessed. One feels somewhat surprised that no mention is made in this section of the problem of overfishing, for it is of economic importance in most parts of the world.

From this abbreviated list of contents it will be realized that this book offers something to everyone who has the slightest interest in natural history and, since it is admirably presented and well indexed, it can be used by amateurs and professionals with equal facility. To anyone teaching biology it offers additional matter to clothe the sometimes dry facts of conventional biology syllabuses with interest and so help to sustain the pupil's attention. It is a book which can be thoroughly recommended.

E. POPE, M.Sc.