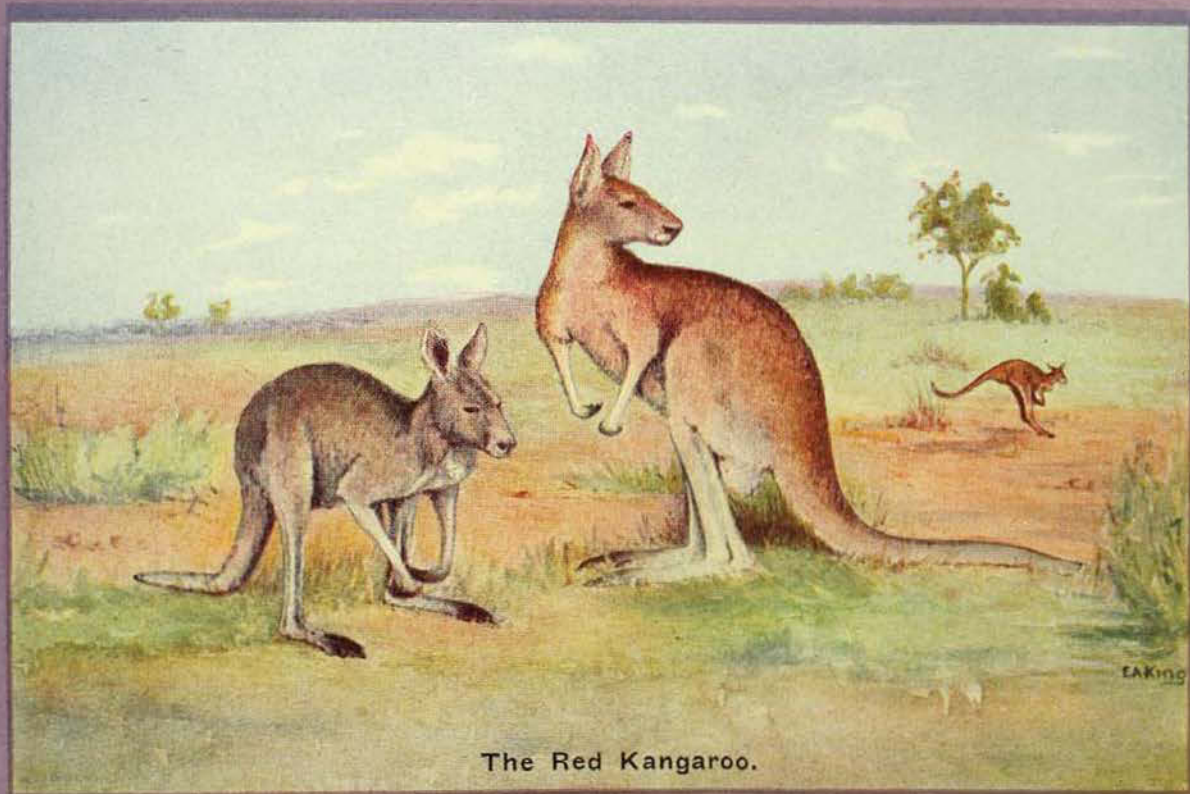


The
AUSTRALIAN
MUSEUM
MAGAZINE

VOL. VII, No. 11.

DECEMBER, 1941—FEBRUARY, 1942.

Price—ONE SHILLING



The Red Kangaroo.

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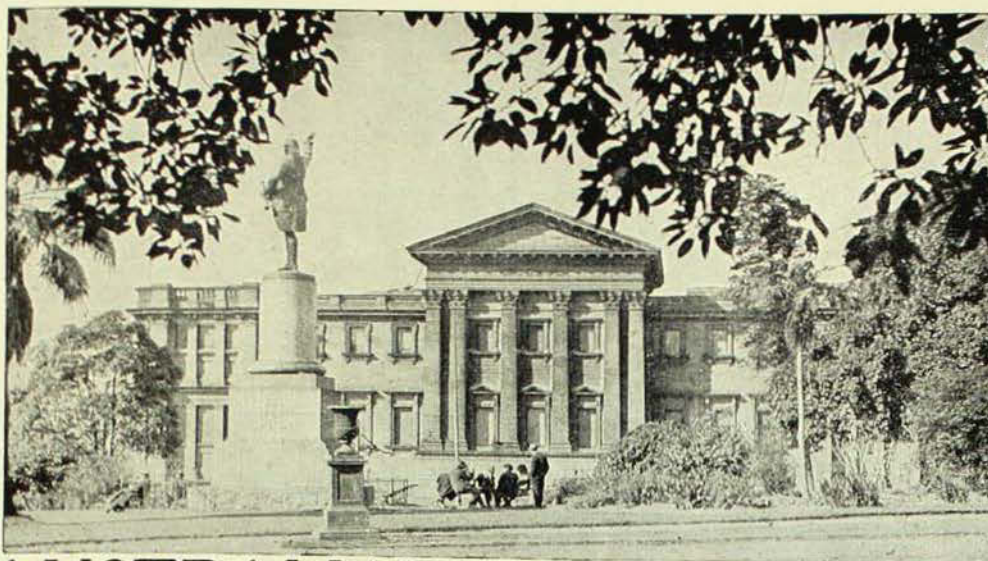
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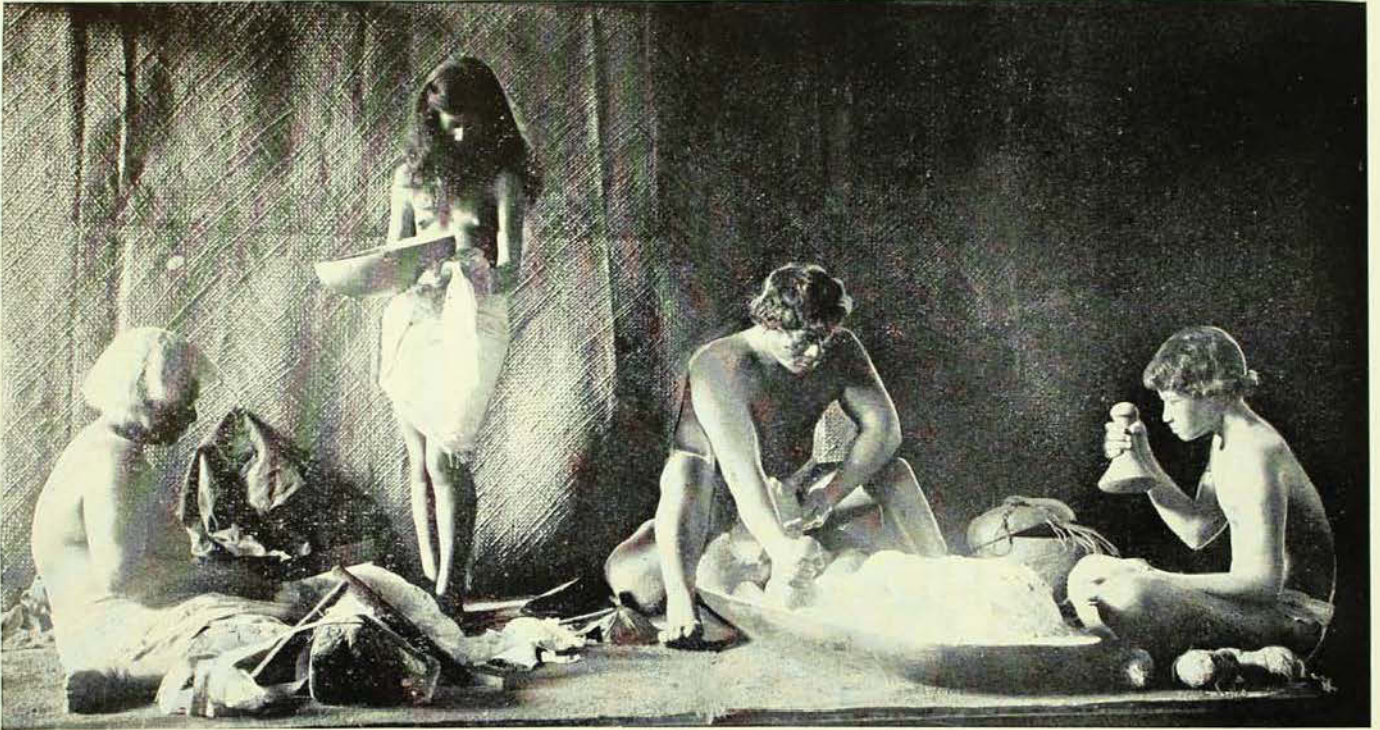
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(Photography, unless otherwise stated, is by G. C. Clutton.)

● OUR FRONT COVER. The Red Kangaroo (*Macropus rufus* Desmarest) is by Ethel A. King. It is one of a series of postcards issued by The Australian Museum. The Red Kangaroo, a powerful, yet gracefully built animal, ranges widely over the plains and tablelands of inland Australia. It usually favours localities where the hard red stony ridges are covered with box trees, or open plains where it can bask in the sun.

The male is reddish above, the female a soft bluish-grey colour, whence it is known as the "Blue Flyer" and "Blue" or "Flying Doe". The colour and texture of its coat and its long bowed nose readily distinguish this kangaroo from its allies.

It usually feeds in small flocks and was formerly numerous in favoured localities, but its numbers have been depleted by pelt hunters, its skin being in demand for the leather trade. Drought is another serious enemy, fences preventing migration from stricken areas.



HAWAIIAN FAMILY GROUP.

Hawaii was first peopled by Polynesians, a race distinguished from other islanders of the Pacific Ocean by brown skin, straight hair, and great stature. This folk spread across the sea to Tahiti, Samoa, and New Zealand. Excelling in navigation and warfare, they were still enlarging their dominions when European invasion interrupted native history. Yet, since they knew neither the art of writing nor working in clay or metals, the Polynesians were only equal in culture to Neolithic people who lived 5,000 years earlier in Europe.

A family is here shown, of the old fashioned life, engaged in their ordinary work. The old woman beats out the bark of the Paper-Mulberry tree with a wooden mallet to make "tapa" or native cloth. The girl who assists her pours water on the material from a gourd basin. Both men are mashing the roots of taro into a "poi" or native porridge.

Australian Museum group exhibit.

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Guide to the Museum Collections

ONE of the many functions of a museum is to provide a certain degree of recreation and of instruction for visitors of all ages and all classes. Perhaps the great majority of those visiting a museum have no very distinct objective but there is little doubt that all desire to know what the exhibits before them are and to have some information about them. Good museum labels are in general quite brief and convey only such information as can be read in the limited space of time devoted by the average visitor to any one exhibit. In a modern museum one objective is to make the specimens on display tell the visitor some part of a story and it is desirable to provide some general background to enable one to obtain a wider appreciation of the exhibits and their stories. One way of accomplishing this is by the issue of a guide book. Such a guide book, as contrasted with a mere catalogue of

exhibits, would tell a connected story, and make it possible for any one to fit individual exhibits into their place in the general scheme.

In 1938 the Trustees of this Museum published a Guide to the Collections which aimed to fulfil this need. The public appreciated this Guide, as was evidenced by the fact that some two thousand copies were sold in less than three years.

This may not seem a very great achievement when it is considered that the number of visitors to the Museum for the twelve months ended 30th June, 1941, exceeded 270,000, but, as the first venture in the provision of such a general guide for the public, it is considered quite a satisfactory result.

A revised edition of the Guide has now been prepared by the Museum staff and published by the Trustees.

A.B.W.

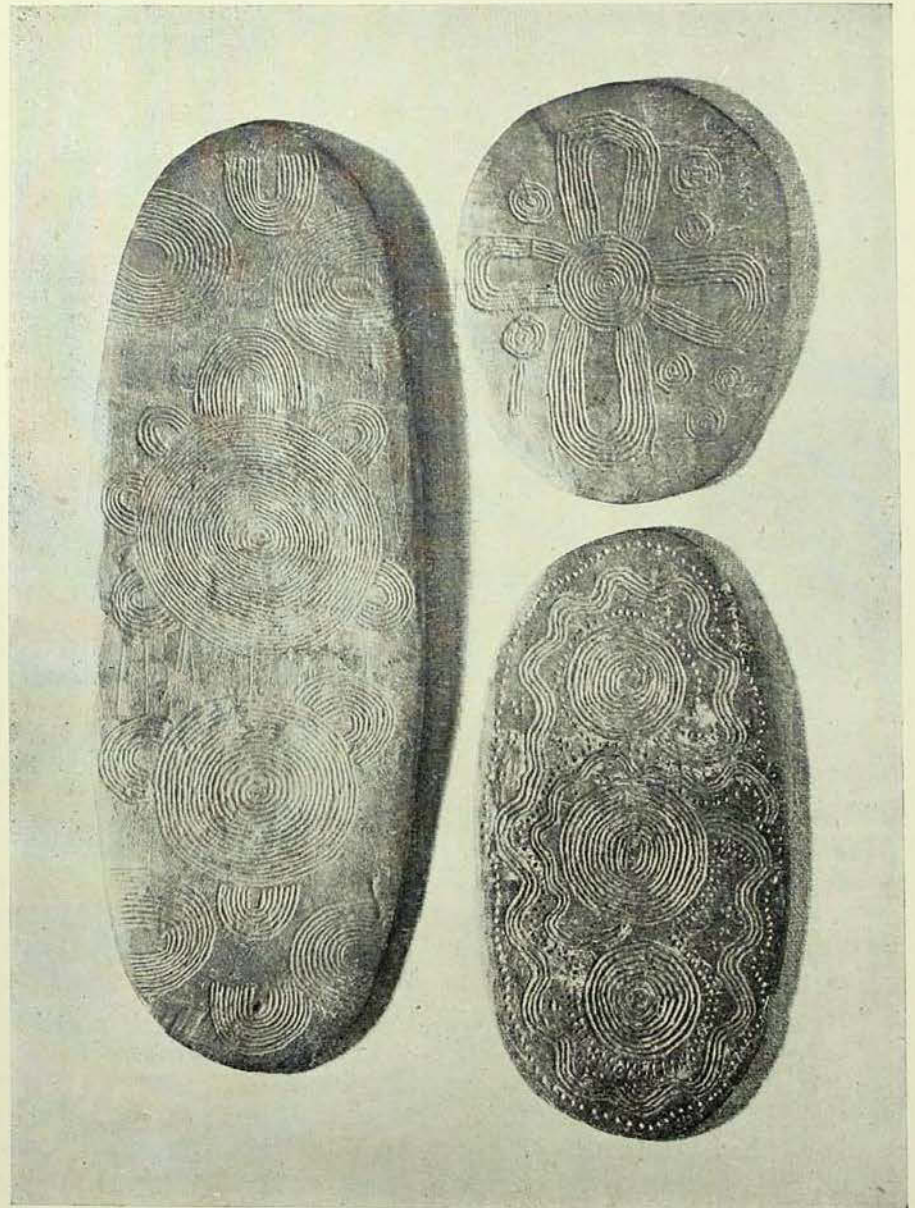
Aboriginal Ritual and Mystery Stones

By FREDERICK D. McCARTHY

IN every continent there have been found stone artifacts used for ritual purposes, and others for which no reasonable explanation may be given of either their use or significance in the

shrouded in a cloak of mystery far greater than their importance merits, mainly because the imagination of collectors and students has been allowed to run riot in advancing theories about them, in

Three Tjuringa, or sacred stones, of the Arunta tribe, Central Australia. The largest specimen represents the Yarumpa or Honey Ant, the medium-sized one the Yalka Bulb totem, while the identity of the third example was not recorded.



culture of the people who fashioned them. Australia has yielded a number of interesting artifacts belonging to these two groups. Some examples of the latter enigmatic group have become

preference to accepting the simple facts that may be deduced. An illustration of the same process of reasoning is associated with Easter Island, concerning which fantastic theories have been

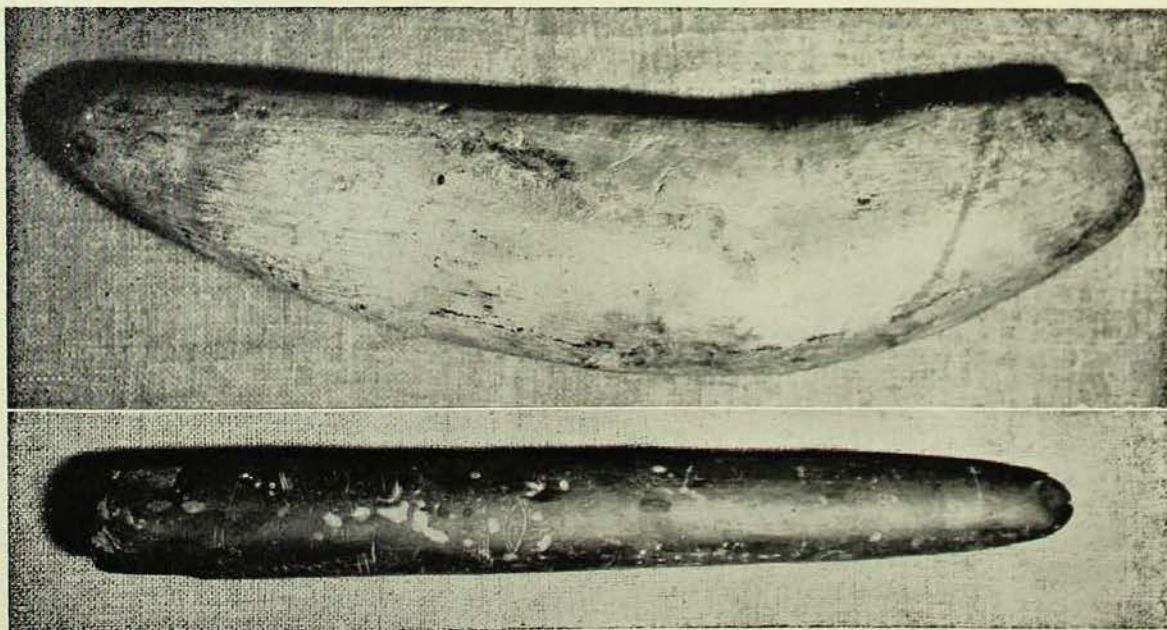
advanced, but scientific research has shown that the culture of this island may be regarded merely as a local variation of the fundamental pattern of Polynesian culture.

RITUAL STONES.

The types of ritual stones are not numerous, but they are of interest and importance because they are symbols of the secret life of the initiated men, and associated with them are beliefs too sacred for the women and uninitiated to know. The *tjuringa* of Central Australia form an excellent example of the significance such symbols have in aboriginal life. They are oval, pointed oval, and circular slabs of wood or stone, usually coated with red ochre. There are many different kinds, but their main function in the totemic and religious life of the tribes is that of an abode of the spirit of the owner, or of the species of his or her totem. Power may be exerted over both human beings and totems by means of magico-religious rites in which the *tjuringa* play an important part: these ceremonies may be performed for the increase of food and other useful totems, for initiation purposes, and to portray the lives of spiritual ancestors. The *tjuringa*, therefore, are extremely sacred

objects. On them are incised complex patterns in which are prominent concentric circles and portions thereof; spirals which may end in concentric circles; sets of parallel, straight and curved lines often encircling and winding in and about other elements of the design; lines of chippings, rows and panels of dots, and tracks of birds and animals. Each of the large number of totemic clans has a distinctive traditional arrangement of the above elements which, in turn, is varied in the designs of the sub-clans. Each pattern illustrates the story, or part of it, about the clan's own spiritual ancestors. A more remarkable example of the range of designs that may be assembled with so few elements, and to which different meanings are attached, could not perhaps be found.

The position is quite different in respect to the cylindro-conical stones found mainly in far western New South Wales, along the valley of the Darling River. Unfortunately, scientific investigations were not made concerning them, such as were carried out by Sir W. Baldwin Spencer and F. J. Gillen on the *tjuringa*. The cylindro-conical stones differ from the *tjuringa* both in shape and markings. As their name implies, they are conical in shape, and vary from



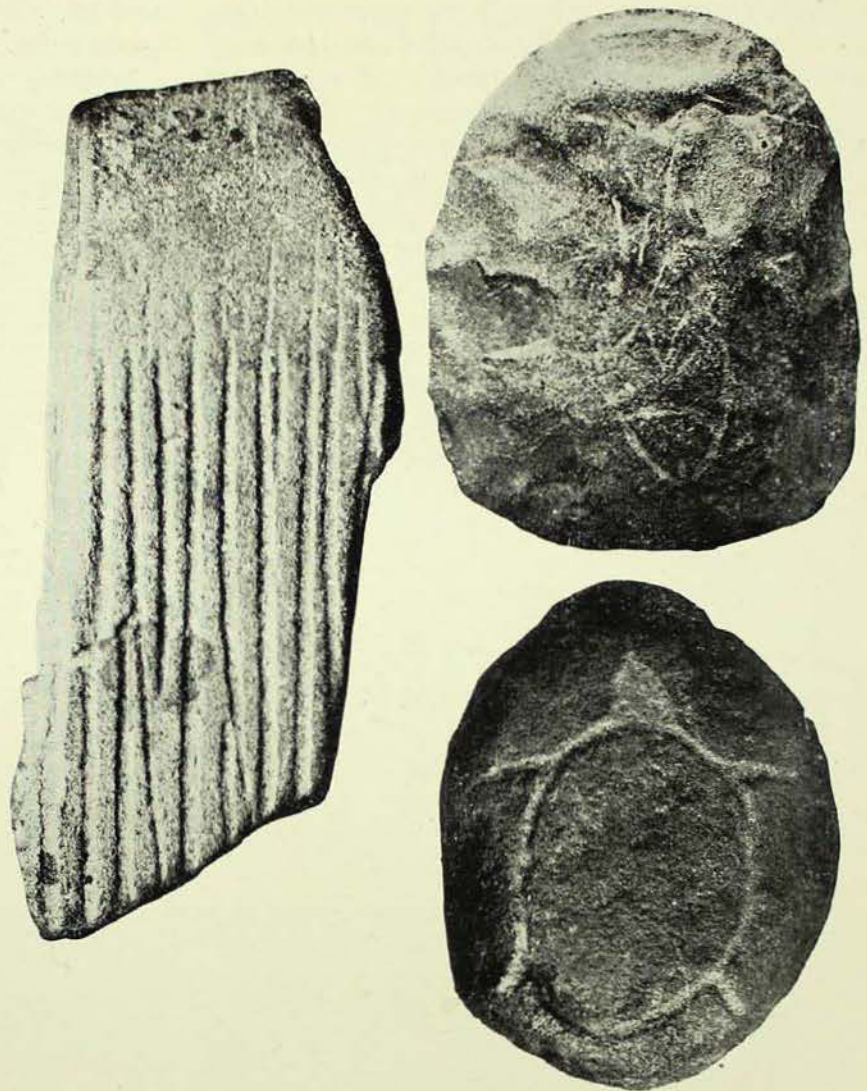
Cylindro-Conical Stones. The lower specimen is a straight example bearing incised markings. The upper specimen is a curved or cornute stone made of kopi. Both are from the Darling River district, western New South Wales.

flattened oval to circular in section. The butt may be either convex, flat or concave, and on some of the latter type are radiating incisions. The other end is usually rounded or pointed, and, in rare cases, bladed. The length varies from a few to thirty-two inches, and the weight

known are made of igneous rocks, by hammer-dressing and polishing.

The incised markings upon many of the cylindro-conical stones comprise innumerable arrangements of sets of short parallel lines, spirals, circles, emu and kangaroo tracks, and others. Some

Incised Stones. The specimen on the left is from Obley, and the one on the top right is a ground-edge axe from Tingha bearing a boomerang on one side and a fish on the other. The pebble on the bottom right bears a tortoise and is from Liverpool. These three localities are in New South Wales.



from one and a quarter to eight pounds. One variety is straight, another is curved. They are made of "kopi" clay, sandstone, phyllite, and slate; the clay ones are carefully smoothed, and the stone ones hammer-dressed and often polished. They are found on the extensive camp-sites in the western districts, though it is uncertain as to whether they were placed with the dead in graves as has been claimed. A variety occurs on the southern tableland area which has one or more transverse grooves, but, as a rule, no incised markings; the examples

of these occur also on the *tjuringa*, among the rock engravings, and on wooden objects. The designs on the *tjuringa* are much more neatly arranged than are those on the cylindro-conical stones, on which they are set out haphazardly as though added at odd times over a long period. The markings on the latter resemble those on the wooden message-sticks more than any other type of decorative art or designs. One interesting point to note is that large chips have been struck off the butt of most of the cylindro-conical stones, and it is prob-

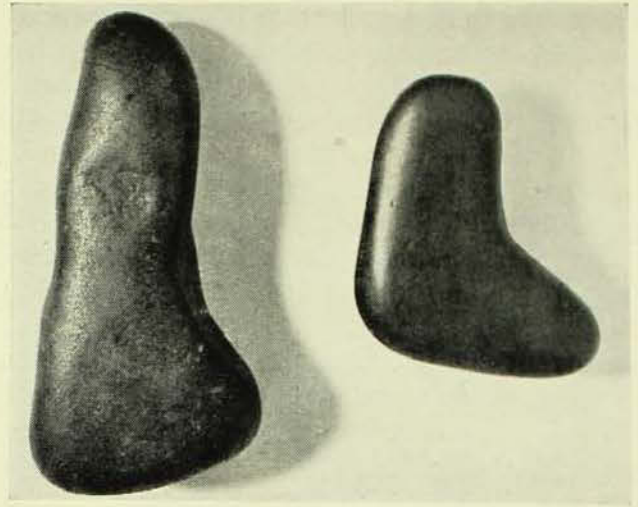
able that such flakes were used for magical purposes; thus a man may have knocked pieces off his stone for use in hunting magic, or to cure illness. It is clear, also, that the cylindro-conical stones were used in the instruction of initiates, as some bear a circumcision ring at the pointed end. It is quite probable that they were, therefore, a type of *tjuringa* under the control of the initiated men.

Care must also be taken when considering the so-called phallic stones. Their main function in Australia is for the instruction of initiates, to whom are explained the operations to be undergone. These stones do not represent a fertility cult, because the aborigines believe that conception is due to the reincarnation of spirits. In some areas such symbols are made of wood.

There is quite a variety of incised pebbles. One type bears arrangements of lines similar to those on the message-sticks. Another type from the Sydney district of New South Wales bears an incised animal, and probably represents the totem stone of an individual. On a ground-edge axe from Tingha, New South Wales, a boomerang is incised on one side and a fish on the other side, but the story associated with it is not known. A tiny red pebble from Maroubra, New South Wales, has a concentric oval incised on one side and a "sun" design on the other side.

The aborigines sometimes picked up natural pebbles or pieces of stone whose shape suggested a mythical origin. The figure shows two examples of this type. The one on the left represents a brown snake to the Macleay River tribe. The one on the right is a symbol of the story of how the moon came to be in the sky. At one time there was no moon, until a great boomerang thrower threw his boomerang into the sky where it became the moon. Natural stones of many kinds and of no particular type are used by the aborigines to represent totems. In increase rites, the pieces of these stones which are distributed represent the spirits of the totems. In this connection it should be borne in

mind that the actual stone, and the story, must be obtained from the natives to whom they belong in order to establish the identity of ritual stones, and, although some of the odd-shaped stones brought into museums might have been so used by the aborigines, they are useless unless authentic evidence has been obtained with them.



Legend Stones. Two examples of natural pebbles with which myths are associated by the Kumbaingeri tribe, Macleay River, New South Wales. On the left is the brown snake stone, and on the right the moon stone.

MAGIC STONES.

The magic stones form in appearance a nondescript series, but nevertheless a most interesting one. Used both by the beneficent medicine-men and by the evil sorcerers, they are most sacred to the individuals who possess them, and a woman would be killed were she to see one; initiated strangers refrain from touching the magic stones of other men. One is given by a medicine man to a novice at the conclusion of the latter's initiation, and since it is believed to be animated with a life-giving power, it is closely guarded throughout the lifetime of the individual. In some tribes the men add to their stock of magic-stones, as they are given one or more for each initiation attended.

The medicine-men and sorcerers obtain magic-stones from secret places where they have been deposited by a mythical being, very often the Rainbow-Serpent, with whose magical power they are

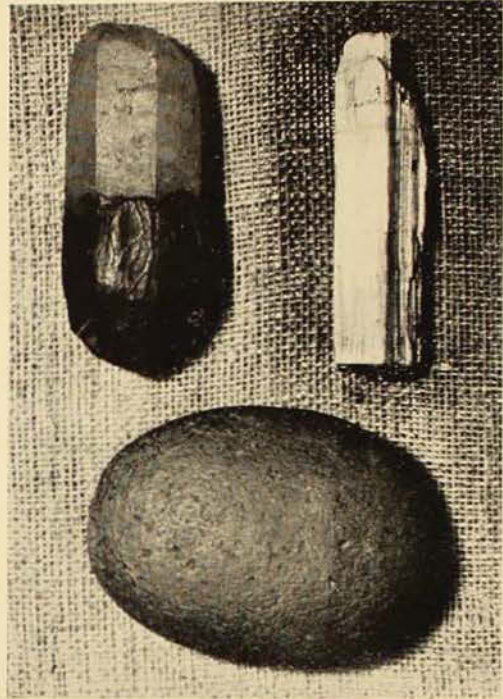
imbued. The magicians, it is believed, carry the stones in their bodies, and are able to produce them at will through their mouth; actually they are kept in a dilly-bag under the arm or attached to the girdle, and their production when accomplished is a skilful sleight-of-hand trick.

Mineral crystals such as quartz, calcite and gypsum form an important type of magic-stones, and small, shiny dark pebbles, obsidian bombs, red and yellow stones and ruddled pebbles make another group. Some stones acquire a reputation of possessing a magical power above all others because of the success attending their use.

The aborigines believe that illnesses of many kinds are due to the evil magic of their enemies, who cause media of death to be lodged in the victim's body. Bits of bone and wood are just as potent as stones, and unless stronger counter-magic is applied by a medicine-man to extract them and neutralize the sorcery, the victim dies. Thus the work of the sorcerers and medicine-men might be likened to a game of shuttlecock in that the former project the magic stones into the victim's body and the latter remove them if possible. The methods employed vary almost from tribe to tribe. The Wirrundjeri tribe, of Victoria, believed that a crystal entered the victim's body during a small whirlwind, and, if the counter-magic was efficacious, that it left in the same manner. In this tribe a quartz crystal was used as a death-pointer; a piece of fur was gummed to one end of the crystal and it was then pointed at the individual concerned so that its evil power entered his body; it was then warmed, covered with fat from a dead body, wrapped in human hair and burnt. Among the Encounter Bay natives of South Australia a black stone shaped like the head of an axe was fixed to a bent stick handle; the sharp edge was used to enchant men and the broad margin women. The victim, while asleep, was tapped on the chest with this weapon of magic, and death ensued. In some tribes pieces of magic stones are crushed up and mixed in the food of the victim, or

the stone itself placed in his or her foot tracks as means of getting the evil power into the person's body.

One interesting use of magic-stones was in love-magic by the Kurnai tribe of Gippsland. A special individual, the *Bunjil-yenjin*, assisted a young man in his magic to entice a girl away from her parents, while another man placed a



Magic Stones. Top left is a quartz crystal, covered with gum at one end, from Cairns, Queensland. Top right is a piece of gypsum used in rain-making rites in the Mount Poole district, New South Wales. At the bottom is a pebble coloured with red ochre from the Lake Eyre district, Central Australia.

crystal on the ground near his spear-thrower which was slanted towards the girl's parents to cause them to fall asleep.

Magic stones have a wide range of function. They are used in rain-making rites, carried by hunters to gain a magical control over game, and dogs are made into good hunters when rubbed with them.

ARTIFACTS OF UNKNOWN SIGNIFICANCE.

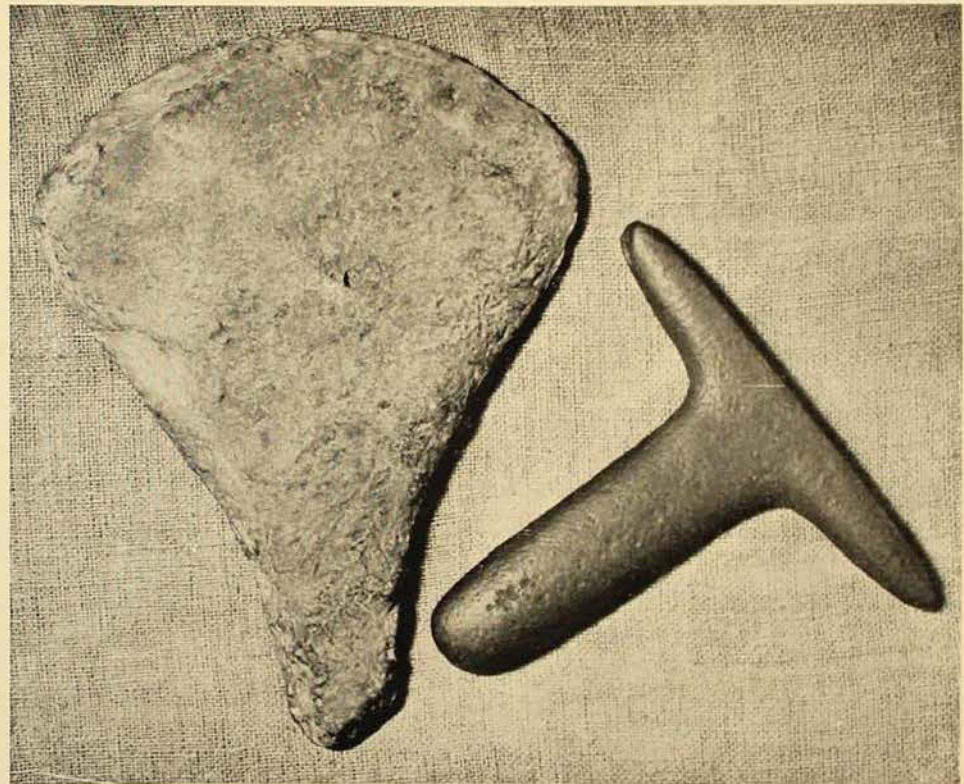
Tanged artifacts have been found in eastern Australia, from South Australia to Queensland. They are quite large in size, ranging from 7.9 to 14.4 inches in length and from 3.1 to 14.4 lb. in weight.

Their outline is like the seat of a bicycle, and most of them are convex on both surfaces and lenticular in section. The edge of the broad end on most of the eleven specimens known is blunt and unsuitable for use as an axe. They are made of basalt, schist, indurated sandstone, or limestone materials which vary greatly in hardness and texture. Their size and weight and general unsuitability for cutting use eliminates the idea that they were a specialized form of axe. It is significant that smaller but indential artifacts occur in the Yodda and Bulolo

in Australia it is probable that they were believed by the aborigines to be mysterious objects imbued with magical power, as indeed are ground-edge axes, boomerangs, shell ornaments and other articles in areas where they are not made.

The T-shaped artifact is even rarer than the tanged type, only half a dozen being known, all from the Innisfail district of Queensland. They vary from four to seven inches in length and weigh up to 1½ lb. The broad end may be either concave or convex with a flattened face, and the tang is well marked. A

Tanged Implements. The example on the left is from Oberon, New South Wales, and the one on the right, which is T-shaped, is from Cairns, Queensland.



valleys in New Guinea, and indicates that there may be a connection between the New Guinea and Australian occurrences. Actually the tanged artifact is one of a number of objects and customs introduced into Australia from New Guinea both by trading contacts between the coastal aborigines and Papuan canoe-men, and by the migration of the latter into Arnhem Land and Cape York.

It is considered that the tanged artifact in New Guinea may be a replica in stone of bronze tanged axes (which have been found at Lake Sentani), but

local ritual function may be assigned to them, but unfortunately this is not known.

Both the tanged and T-shaped artifacts have been made in the same way, that is, by flaking a block of stone roughly to shape, hammer-dressing it to final form, and, on the best specimens, finishing it off by polishing. It is strange that most of the examples of both types have been ploughed up and some of them are heavily patinated. These remarks apply also to numerous examples of ground-edge axes and cylindro-conical stones, and have

given rise to a theory that these objects are vestiges of an ancient culture in eastern Australia, a theory which disregards the numerous unweathered specimens of these artifacts found on surface sites.

There are several points of interest which have a bearing on this problem. One is that the hammer-dressing and polishing techniques are, chronologically, the most recent arrivals in Australia. Since both are neolithic methods, they may be considered to have come to Oceania and Australia several thousand years before the beginning of this century. It is to be borne in mind that the hammer-dressing technique made it possible for neolithic craftsmen to produce a great variety of unusual stone objects, often unclassifiable archaeological mysteries, and this is true in many parts of the world. The neolithic stage of culture has been reached by the Pacific islanders, and the metal stage by the Indonesians, and in both regions a wide range of objects is made from axes and adzes to bowls, mortars, bird and human figures, mainly because the hammer-dressing technique made it possible to shape flat or rounded surfaces with ease, although the task is long and monotonous. In New Guinea, New Hebrides, and the Solomon Islands stone objects of this type are found which are undoubtedly prehistoric and not made by the present-day natives.

In Australia it is obvious that the tanged and T-shaped artifacts and the cylindro-conical stones, together with an advanced axe and grindstone industry, belong to the hammer-dressing period with which is combined, though it is a late addition, the polishing of the body of the object. In addition, rock engravings fashioned by

hammer-dressing occur in the region embracing far western New South Wales, south, central and north Australia, in some parts of which they are still made. Many Darling River natives have been questioned by local people and collectors about the cylindro-conical stones, but they have either been unable or unwilling to explain the meaning and significance of the stones.

The point to be remembered is that these characteristics belong to the hammer-dressing culture. Although there is no doubt that a similar culture is prehistoric in New Guinea, even though the technique is still in use, the position is not so clear in Australia. It is possible that the hammer-dressing people of the mid-Darling River Valley and of far western Queensland were overrun by aborigines migrating southwards, even in comparatively recent times, but it is also likely that the culture we are discussing was that of the aborigines when the white man invaded the country. The age of the artifacts and of the culture can be established only by accurate field work by a trained archaeologist; should the former be found in prehistoric deposits excavated scientifically, then their relationship to other characteristics in aboriginal material culture will be established beyond doubt.

An exhibit of the artifacts described in this article is to be seen in the Australian Aboriginal Hall. This is the fourth and last of a series¹ of articles on Australian stone implements.

¹ McCarthy.—The Stone Axes of Australia, THE AUSTRALIAN MUSEUM MAGAZINE, Vol. vii, No. 7, December, 1940–February, 1941, pp. 223–228; Chipped Stone Implements of the Aborigines, *ibid.*, Vol. vii, No. 8, March–May, 1941, pp. 257–263; Aboriginal Grindstones and Mortars, *ibid.*, Vol. vii, No. 10, September–November, 1941, pp. 329–333.

BURIAL TREES, by R. Lindsay Black. (Robertson & Mullens Ltd., Melbourne, 1941. Pp. 38, 25 plates. 2s. 6d.)

This brochure is a record of a series of carved trees, associated with graves, which are still

standing in central New South Wales. Information is given about several additional sites to those described by R. Etheridge in his monograph on the carved trees. An excellent series of illustrations is given.

F.D.McC.

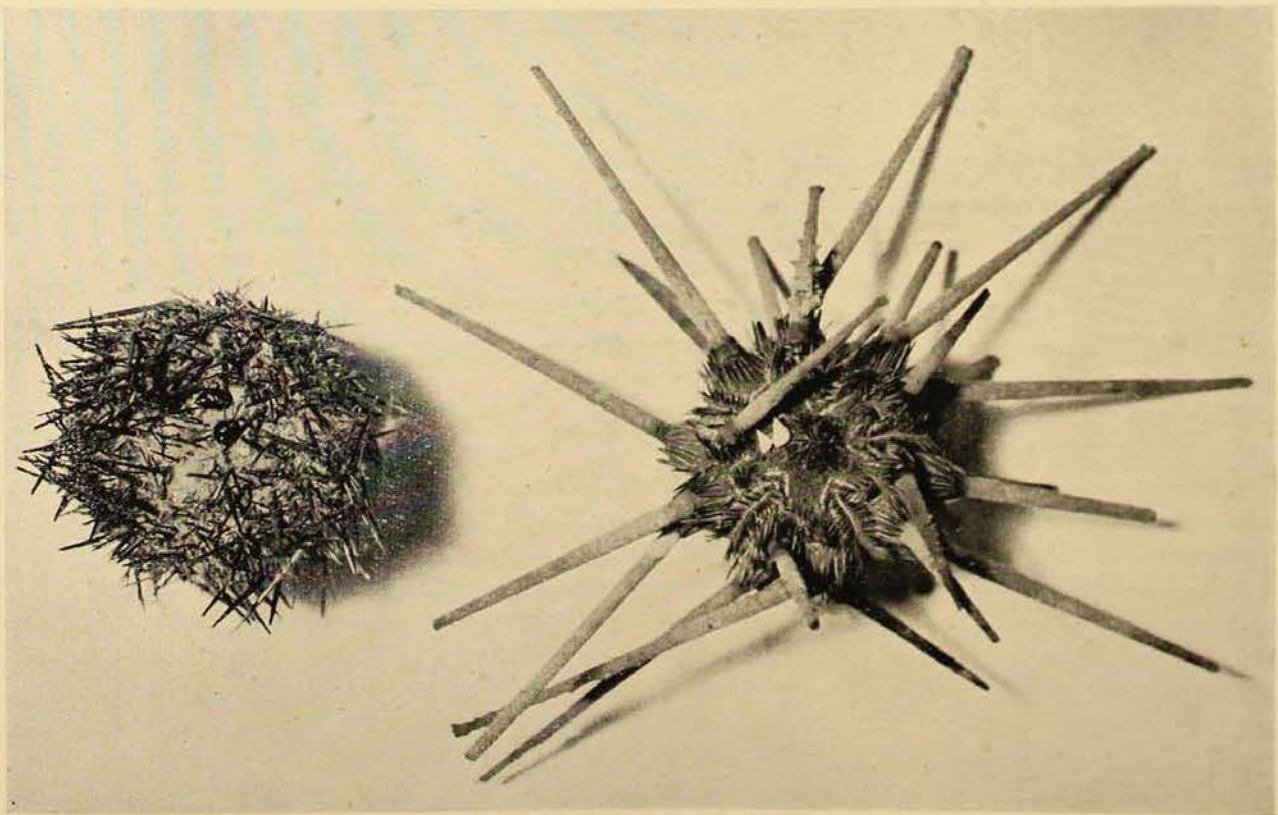
Uninvited Guests

By JOYCE ALLAN

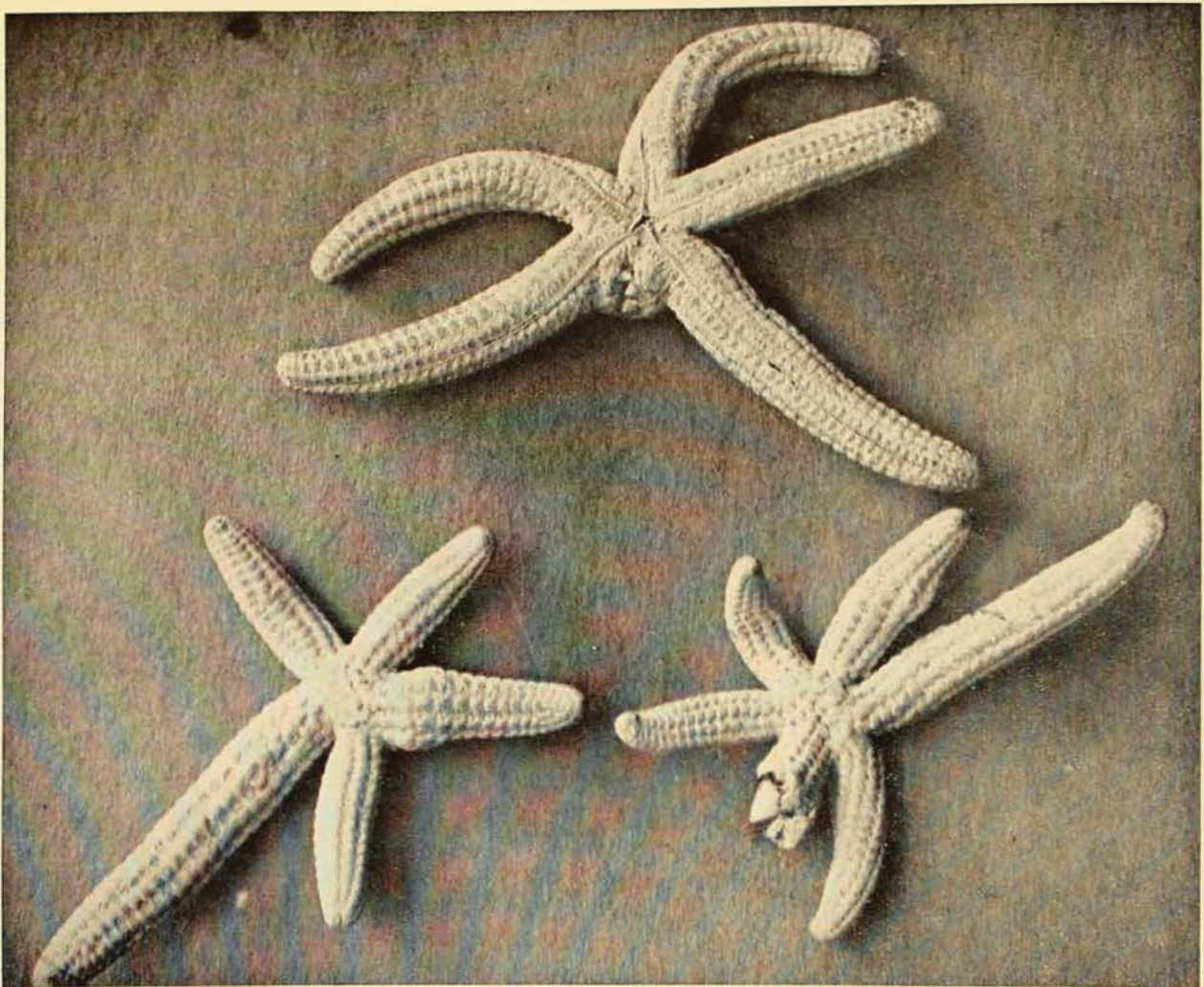
UNDER the influence of various factors, plants and animals in the sea become sorted out into more or less distinct groups or communities, the relationship between the members of any one community being governed to a large extent by their surroundings. In some cases, however, the struggle for existence has brought about a relationship more intimate than normal between certain members in a community. This particularly applies to life in the sea-shore region, where competition amongst the forms is most severe.

Amongst the invertebrates, instances are frequent where animals have taken up a temporary or permanent abode on or within other animals in order to feed

upon them, or share their food, or to obtain protection, and are more or less specialized for the purpose. Such parasites, as these may be broadly called, evolved gradually from free-living ancestors which have associated with certain forms and finally come to depend upon them. There is naturally a great diversity in their form and habits, as specialization is in relationship to the extent of individual inter-dependence. Whether they are *ectoparasites* (fastened to the exterior of a host's body) or *endoparasites* (dwelling within a body), the habit has a marked effect on nearly all animals which practise it. Loss of activity, loss of appendages and sense organs, or development of special organs



Two examples of ectoparasitism. Tiny brown *Styliifer* nestle securely among short green spines of a sea-urchin, dredged in Port Phillip, Victoria, and two white-top shells are protected by the spines of their host, a sea-urchin from the Great Barrier Reef.



An invasion of sea-stars by small gastropod shells, *Stylifer*. In the upper specimen they have settled in the disk between two arms, and in the lower specimens, actually within the arms. A swelling on an arm of the lower left hand sea-star indicates the presence of one or more shells within the tissues.

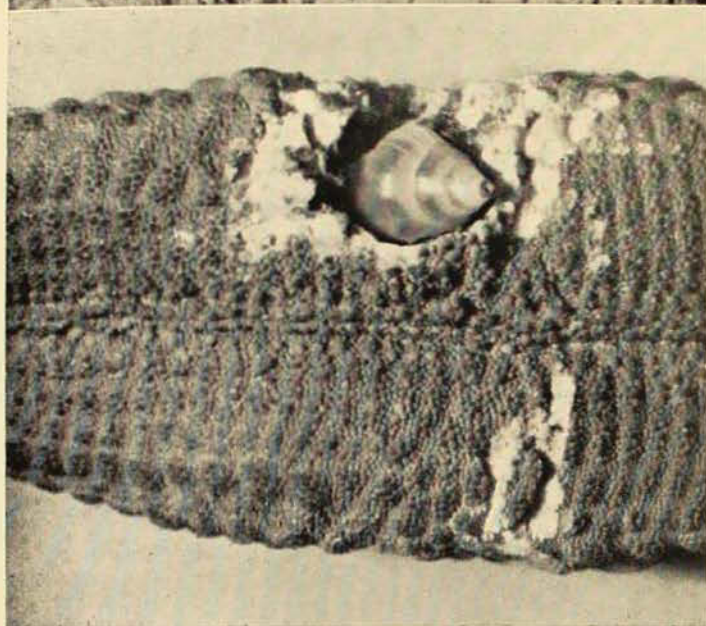
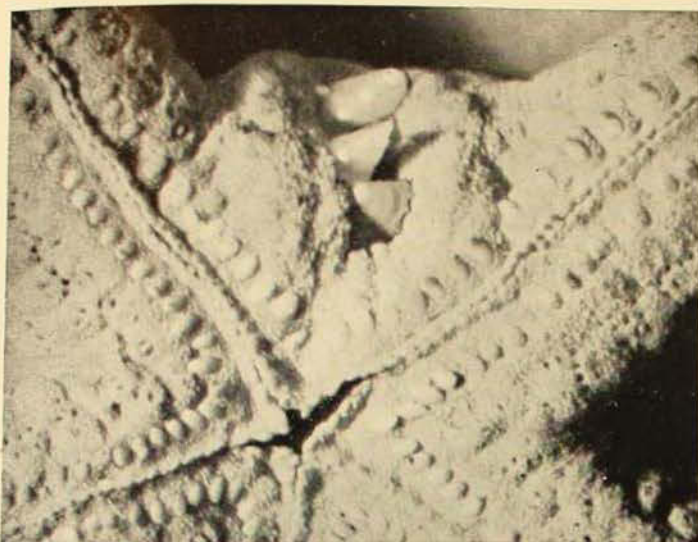
to facilitate adhesion or to assist the entry of the larval parasite, may accompany modification and adaptation to suit the attachment of a parasite to a particular host.

Though the effect on some hosts may be severe, some parasites cause little or no inconvenience or recognizable disturbance, except when present in large numbers. It would appear that, in nature, some balance is maintained between host and parasite which tends to limit the amount of injury, since the death of the host would in many cases entail the death of the parasite.

Many examples of close relationship found among such marine animals as crabs, sea-stars, sea-urchins, anemones

and shells may be one form or another of commensalism, which, strictly speaking, is an external partnership between two forms of different kinds. Though in its true sense this should be to the mutual benefit of both forms concerned, very often the advantages resulting from such an association appear to be not equally divided, but entirely on one side.

Among shells, cases of true parasitism are rare. Large numbers of them certainly live in close association with other marine life, among coral, sponges, anemones, and so on, using them either as a shelter, egg repository, or a feeding ground, but even where this condition is permanent, few examples show any serious damage other than possible dis-



Close-up views of two portions of sea-stars, showing the shells in situ. The outside has been scraped away to expose the shells.

comfort to the form acting as a host. In examples where a closer relationship is suggested the shells belong to a few restricted groups. For instance, a small, shiny, flat-spiral gasteropod (*Caledoniella*) and a delicate little bivalve (*Peregrinamor*) have so far been found only among legs and swimmerets of certain mantis shrimps which live on the Great Barrier Reef, some islands of the South Pacific, and in Japanese waters. With these shells, anatomical adaptation has coincided with their unusual habitation. Recently, while collecting at the Clarence River Heads, I continually came across, on the sandy patches in shallow

water at low tide, numbers of a large black Holothurian sea-slug, literally covered with a small, long-spined, white shell belonging to the genus *Eulima*. Although it is known that these shells do attach themselves to Holothurians, it is quite unusual for them to occur so conspicuously, and it suggests that other species of the group may be found to act as hosts for similar shells.

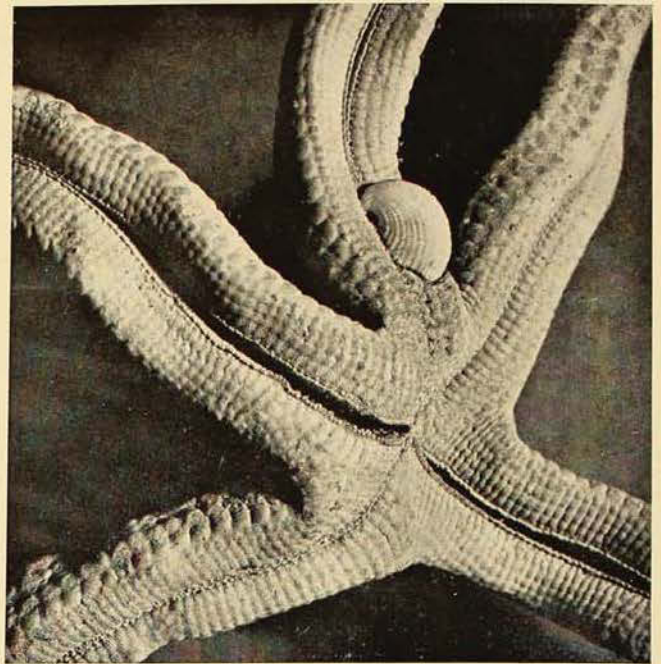
In the Conchological Gallery of this Museum are displayed some interesting examples of shells living *ectoparasitically* on the arm of a sea-star and also on the body among the spines of sea-urchins; and *endoparasitically* within the arms and disk of sea-stars. The ectoparasites, the Cap Limpet (*Thyca*) on the sea-star arm and the two white, top-shaped shells (*Scalenostoma*) were found with their hosts on the Great Barrier Reef, and the small, shiny brown species (*Stylifer*), nestling securely among the short greenish spines of a sea-urchin, were dredged in Port Phillip, Victoria. The examples of the endoparasitic shell (*Stylifer*) living in the arms and disk of the sea-stars were mostly collected by museum officers on the Great Barrier Reef.

The ectoparasitic forms are able to avail themselves of passing food without much effort to themselves; also, and this especially applies to those shells living attached amongst the spines of sea-urchins, they are afforded ample protection so long as their host's life remains unendangered. The relationship between these shells and their hosts appears more that of commensalism than parasitism, but with the endoparasitic species of *Stylifer*, their hosts, the sea-stars, must suffer at least some discomfort, if not more serious injury.

Their presence within the arms or the disk of sea-stars is generally indicated by a swelling on the outside. On removing the calcareous plates round the swelling, the small parasitic shell is found embedded in the tissues of the sea-star, immediately beneath. The various organs of the shell's animal dealing with respiration, digestion, and expulsion of excretory matter, are naturally adapted

to suit their abnormal environment. Nutritive fluid appears to be sucked from the sea-star by means of a strongly developed fleshy proboscis, but whether the sea-star obtains any benefit from the intruder is not known.

Suggestions advanced regarding the manner in which this invasion of the sea-star is brought about are (1) that ova or larvae of the shell find their way into its body and there develop into adults, or (2) that the shell actively attacks the sea-star and dissolves the calcareous plates by means of an acid secretion of the proboscis, thus enabling it to penetrate the underlying tissues. With regard to the latter suggestion, it is further thought that the sea-star, immediately on the defensive, responds to this injury by forming plates round the shell, thus enclosing it. If such is the case, however, the sea-star appears only to do itself an injury in the long run, by permanently enclosing the parasite, and possibly providing it with conditions necessary for its existence. Owing to the comparative rarity of examples of this type of parasitism, sufficient material is not yet available to finalize definitely certain research undertaken by scien-



The ectoparasitic Cap Limpet (*Thyca*) lives attached to the outside of the arms of sea-stars.

tific workers in recent years. Apart from their interest as exhibits, museums are always anxious to obtain specimens of any marine partnerships such as these, for additional material, especially if a type not hitherto represented, may open up an entirely new line of research.

The late Mr. James McKern

MR. JAMES MCKERN, who had been a member of the Board of Trustees of this Museum, as Crown Trustee, from 1919 to 1940, died on 12th September at the age of 87 years. During the latter years of his association with this institution his health had been very indifferent, and it was this fact that ultimately caused him to tender his resignation.

He manifested a keen interest in the

Australian Museum, an interest that was not dimmed by his severance from it. At one stage he had been Chairman of the Finance and House Committee. One could say that he had given a lifetime service to the State, for he had been attached to the N.S.W. Department of Audit, from which he retired as Deputy-Auditor-General. He was also closely identified with philanthropic movements.

Australian Water-rats: Their Origin and Habits

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

AUSTRALIA became known as the land of marsupials, but it is now more generally understood that just as pouched mammals are not entirely restricted to this continent, many native Australian mammals are not marsupials. Readers, however, may be surprised to learn that there are more than eighty species of true rats and mice inhabiting the mainland. Many marsupials have evolved an outwardly rat- or mouse-like appearance, but the rodents are distinguished by their curved chisel-edged incisors, imparting a characteristic bluntness to the head. Also by the long gap between the incisors and molars, allowing for the manipulation of gnawed food.

The disease-carrying "sewer-rat" arrived with the white invasion; also the long-tailed "ship" rat and house-mouse which promptly "took to the bush" as well, so that casual observers usually mistake native rats and mice for the imported nuisances. But the ancestral rodents, like the primitive small marsupials, must have arrived by intermittent land bridges and rafts of debris and logs. Like the marsupials, the primitive rodents developed a number of quaint forms in the process of adaptation to the varying conditions of their new environment.

Some evolved a resemblance to the foreign jerboa-mice, with hopping limbs and long brushy tails to suit semi-desert inland conditions. Another kind, once plentiful on the western plains of New South Wales, built strong stick-nests¹ interwoven with low bushes, protecting them from flesh-eating birds, marsupials, and the dingo. These nests appeared to the explorer Sturt to have

been built by blacks for signal fires, until his dogs disturbed the long-eared "rabbit-rats" within. There are also about thirty species of small native rats and mice, which differ from the introduced kinds by females having only four abdominal teats, instead of six to twelve, and as slower breeders are far less troublesome in health or economic matters.

WATER-RATS: ORIGIN AND DISTRIBUTION.

The native water-rats of the genus *Hydromys* are of great zoological interest because their remarkable adaptation for semi-aquatic life has evolved almost entirely within the Austro-Papuan region, thus providing a unique example of rodent specialization, as well as definite proof of an ancient rodent invasion of the continent. The primitive ancestral stock is believed to have originated in southern Asia, spreading eastward by way of the Philippines and New Guinea to Australia. That the luxuriant waterways of New Guinea must have encouraged this semi-aquatic form of rodent evolution is indicated by the occurrence there of five of the nine known genera, another three being restricted to the Philippines, while the so-called "False Water-Rat" (*Xeromys*) is known only from north-coastal Queensland. Both Australian genera have the more specialized condition of only two molars in each side of the upper and lower jaws.

The primary adaptation common to all these genera of the Hydromyine family is in the character of the molar teeth, which have broad basin-like or depressed crowns instead of the raised cross-ridging of normal rat-molars. There is little doubt that this molar adaptation was associated with a gradual restriction of the habitat to swamps and river banks

¹ Troughton.—AUSTRALIAN MUSEUM MAGAZINE, ii, 1, 1924, pp. 18-23.

where food was mainly composed of small crustaceans and hard-shelled molluscs. The molar teeth were gradually transformed into a crushing instead of a grinding apparatus, gaining added strength for the process by marked reduction or suppression of the rear or third molar; the development of additional roots affords greater stability.

It is notable that although the Queensland False Water-Rat has the two-molar aquatic-diet adaptation, it has not acquired the webbed-feet and other outward aquatic features of the true Australian Water-Rat. The "False" species of the swamps about Mackay is therefore regarded as a land-living rat ancestral to the widely distributed true water-rats of the genus *Hydromys*, which ranges from Tasmania to the Island of Waigen at the western end of Dutch New Guinea.

Outwardly the true water-rats show marked evidences of aquatic adaptation in the stream-lining of the long flattened head, with the nostrils thrust well forward, eyes set high up towards the crown, and the short slender ears which are closed down when under water. Flattening of the skull is associated with the seeking of living food under stones and ledges. The partial webbing of the large feet, obliquely flattened to form most effective paddles, provides the most definite evidence of semi-aquatic existence; the large rodents are at once recognized by the combination of webbed feet and white tip to the well-haired tail. The head and body length averages about twelve inches in adults, and the tail slightly less.

DISCOVERY: AUSTRALIAN SPECIES.

The first specimens of native water-rat were collected on Maria and Bruni Islands, north and south of Hobart in 1802, by the French naturalists, Péron and Levillain, who were with Baudin's expedition on the *Geographe*. Misled by the remarkable variability of the belly colour, which ranges from bright orange-yellow to yellowish-white in neighbouring colonies, Geoffroy of the Paris Museum gave the specific name *chrysogaster* to the Bruni Island specimens in reference to the golden belly, and *leucogaster* to the

white-bellied variety from Maria Island, fifty miles northward. The yellow-bellied name takes priority, though, overlooking such variability, Gould provided beautiful paintings of both a "Golden-bellied Beaver-Rat" from Tasmania, and a "White-bellied" *leucogaster* from New South Wales specimens. This local pale-bellied race, which probably extends into



[After Gould
The Water-Rat (*Hydromys chrysogaster*).

south-eastern Victoria, is now recognized as a distinct coastal subspecies (*H. chrysogaster lutrilla*). The original specimen of *lutrilla*, preserved in the Museum, was obtained by W. S. Macleay on the Sydney foreshores near his historic residence, Elizabeth Bay House. The race is distinguished by the colder buffy-grey tone of the back, whitish belly, and smaller foot. The range of the original Tasmanian *chrysogaster* is extended to the Townsville region of Queensland by another pale-bellied race (*reginae*), having a blacker back and larger foot; a third and brighter coloured race extends into coastal South Australia.

The very distinct south Western Australian species, ranging from about Esperance to the north of Perth, was first collected by Gould's enterprising young collector Gilbert. It is distinguished from all other species by the uniformly sombre coloration, as indicated by the popular and specific names "Sooty Beaver-Rat"

(*fuliginosa*) used by Gould. Six recognizable species have since been described, from the mainland and adjacent islands, including the greyish *caurinus* from the East Kimberley region of the north-west; also the smaller but large-molared *melicertes* of Melville and Bathurst islands, north of Darwin, and doubtless the adjoining coast. During a Museum expedition in 1934 a new species was collected by the writer on Lawn Hill Creek, in the "Gulf Country" south of Burketown, and named *lawnensis* as indicating the place of discovery. On the way back, specimens of the blackish Atherton Tableland species, named *longmani* in honour of the Director of the Queensland Museum, by Oldfield Thomas of the British Museum, were collected in the tangled rain-forests about Lake Barrine. Finally, there are two insular species, described by the writer in 1935, one named *moae* from Moa or Banks Island, marooned on the path of migration through Torres Strait. The other, probably the most distinctive of the eight listed forms, was collected for the Museum near the Groote Island Mission Station, Gulf of Carpentaria, by the late Rev. H. E. Warren, a most helpful voluntary field-worker.

HABITS AND FOOD.

Although native water-rats inhabit the banks of permanently flowing streams, lakes, and the foreshores of the entire mainland, little is known of their general habits because of their secretive nocturnal ways. Their diet mainly consists of mussels, snails, crabs, and the freshwater crayfish known as yabbies. They also favour a fish and meat diet, feeding on water-birds and their eggs, and frogs and small reptiles. A large stone or log, surrounded by water, is often used as a dining table; a family was observed in a backwater of the Snowy River diving after frogs from one of these improvised tables.

In the Macquarie Swamps, according to Mr. F. C. Morse of Garah, New South Wales, cosy nests of shredded weeds are usually made in hollow logs; failing which the rats may make a home in an

old swan's nest, raising the centre to a dome and providing an escape-hole into the water. The rats killed birds and young ducks, and on one occasion he saw a water rat swimming along with a full-grown coot, freshly killed by a bite severing the spine near the head.

Along rivers, however, fairly long burrows are made, running parallel with the bank, with the entrance under roots, and an inner chamber about nine inches high with a nest of bark, twigs, and grasses; an outer chamber is apparently used as a kind of pantry, mostly being full of bones and shells. The breeding burrows, as observed by Mr. Harry Burrell, O.B.E., on the Namoi River, are longer and more elaborate; one ascended 17 ft., in a steep bank, to the nesting-chamber; the tunnel then led to a smaller chamber and thence to a ventilating and escape hole hidden by tussocks.

Because of their mainly nocturnal and unobtrusive habits, little is known of the wild life of these interesting rodents, while their aquatic habits have discouraged attempts at studying them in a captive state. It was with much interest, therefore, that I recently heard through Mr. Ron F. Smith, of Granville, of a little colony of captives in the old Mortlake swimming baths, on the Parramatta River. He kindly drove me out for a meeting with Mr. Fred Ashton, a son of the late baths proprietor, who had shown great ingenuity in rat-proofing the 100 ft. bath, providing gangways to the sleeping quarters, and in simulating natural conditions as far as possible.

A notable instance of Mr. Ashton's foresight was in providing two floating platforms, replacing the natural dining-tables of which he had not previously heard. To these floating tables the rats transported the larger articles of food, odd bones, and even a stray tennis ball, in their mouths. Bread and various fruits and vegetables are eaten; fish is favoured, and corned meat forms a substitute for the wild flesh-diet, while also supplying the salty tang of the favourite sea-food of crabs and mussels. When setting traps for water-rats along the Pandanus-fringed, sand-fly infested rivers

of the Gulf Country one was struck by the numbers of large cleaned-out mussel-shells lying open with undamaged hinges, and wondered concerning the rats' method of opening these succulent but stubborn bivalves.

The simple and now rather obvious explanation was supplied by the observation of Mr. Ashton that, after crushing any immature mussels in their jaws, the rats carried the large shells to the floating tables where the sun's drying heat caused the molluscs to open-up for the feast. Crabs are deftly caught in the very capable hands of the rats and are turned so that the chisel-like lower incisors can rip-off the top or carapace. Late one afternoon, an unwary pigeon was pounced on and quickly killed, the only trace next morning being a layer of feathers spread over the "dining table".

Other observations have shown that the sight is poor by day and that even by night the rats are guided by the customary position of objects, any change in the location of runway planks, for instance, causing them a great deal of confusion for a while. The habit of instantly shamming death at some sudden disturbance may be sustained for upwards of fifteen minutes, the animals floating limply in various grotesque attitudes. The capability of swimming under water is remarkable, the rats easily traversing the 100 ft. bath at an amazing speed. An interesting fact noted by Mr. Ashton was the rat's method of dashing into the shallows by a series of low hops with the body leaning well over to take the water immediately at swimming depth. It is also notable that although the toes are only partially webbed the feet can be widely splayed in life to almost an inch in width.

EXPLOITATION FOR FUR—AND FARMING.

Unfortunately, in the last few years, the platypus-like fur of these remarkable native rats has been in ever-increasing demand for the fur trade, owing to a falling-off in skin-supplies of American Muskrat or "Musquash", Mink, and other small mammals. The water-rat skins are actually superior to some of the foreign

ones and prices recently attained an average of 7s. a skin, and a maximum of about 120s. per dozen.

Obviously, no highly specialized and slow-breeding animal, naturally bound to a restricted aquatic habitat, can ultimately survive a sustained onslaught caused by ever-increasing trade values. Especially in view of the fact that such values are enhanced by the falling-off in the production of such commercially farmed and far more prolific animals as muskrats, which bear up to thirteen young several times a year! The slower-breeding of water-rats is indicated by females having only four teats or mammae and, as far as known, normally having an *annual* litter of four or five young. The Victorian Government has already declared close seasons during the summer, as water-rats begin breeding in the spring and the young are not fully developed until the following April.

The rats are nowhere plentiful enough for continuous exploitation, and farming them has not as yet even been advanced to an experimental stage. Actually, the farming of the small slow-breeding aquatic rodents hardly seems practicable as a commercial proposition. Observation of the Mortlake Baths captives emphasized their dependence on adequate swimming areas and a proportion of aquatic animal food; also burrowing facilities, without which it is doubtful that the natural quality of the fur would be retained. Proposals for farming the rats in open swamp lands are subject to uncertainty as to whether liberal feeding would maintain colonies in adequate numbers, with the continued disturbance of trapping the animals. An interesting trial of this method is about to be made in Tasmania where the Government has leased a swampy area, beside one of the large Tasmanian lakes, to a Victorian firm of furriers.

This experiment in unfenced "farming" must prove of great interest because many difficulties would be involved in attempting to fence-off large swamp lands. Obvious problems would be to retain the natural aquatic conditions while preventing the escape of the deep-burrowing

animals, and the trapping and handling of the live animals to avoid the loss of breeding females. In any event, water-rats should invariably be caught in cage-traps, and the use of break-back traps prohibited because so many immature animals are killed resulting in wastage of life and prejudicing sales as well.

Exaggerated statements of economic damage by water-rats have coincided with the growing desire to exploit them commercially. The only economic damage by water-rats would be occasional raids on poultry yards for chickens and eggs, by nearby colonies when natural food resources happened to be inadequate. Settlement tends to reduce such colonies, however, and local activities of the rats can be checked by the suitable netting of

poultry runs, and trapping where necessary. Otherwise, water-rats are not only quite harmless to man, but are said to be of actual service in destroying the yabbies which honeycomb irrigation canals. They also probably assist pastoralists by destroying great quantities of pond-snails, which are an intermediate host in carrying the liver-fluke parasite infecting sheep.

Apart from any material questions of economic worth, it is a zoological fact that just as aquatic adaptation has developed the marine seals and whales, and even an aquatic opossum in America, so did the adaptive forces of nature evolve the native water-rats and platypus as Australia's own aquatic marvels.

Review

COASTS OF ADVENTURE: UNTAMED NORTH AUSTRALIA. By Charles Barrett, F.R.Z.S. (Robertson and Mullens Ltd., Melbourne, 1941. 8vo, 216 pp., 1 map, 25 plates. Price 9s.)

Arnhem Land, Port Essington, Wessel Island; these and many more are names which stimulate the imagination—and the wandering instinct—of the naturalist. To most of us they represent a dream unlikely of fulfilment, but in "Coasts of Adventure" Mr. Charles Barrett writes a chatty and entertaining account of a recent journey through the far north of our continent. In style and treatment the book is similar to the same author's "Koonwarra". It tells of places, people, and the strange animal life met with in his wanderings. It is a book about north Australia rather than of it. He has much to tell of the work of the missions, and of the aborigines among which they work; but already these nomadic peoples are falling under the influence of the white man's "civilization", and primitive man, in the true sense, is absent from Mr. Barrett's pages. Referring to the disappearance of the old culture, those accustomed to work with fact and observation will appreciate the author's reference to the work of the

late Sir Baldwin Spencer, "one whose work will never be superseded . . ."

In a brief reference to Australia's half-caste problem, Mr. Barrett suggests "part-aborigine" as an alternative to the term "half-caste"—an academic distinction, perhaps—but, why not accept these unfortunates as Australians, and leave it at that?

As with "Koonwarra", the book is somewhat disappointing to the naturalist, as passing reference only is made to the many fascinating creatures encountered in most instances, without any reference to their habits, some little of which must surely have been observed by the author in his travels. Despite this criticism, the book will be found extremely entertaining by many, and will provide a glimpse of life in Australia's little known "Top End".

Mr. Barrett is a skilled photographer, and many of the illustrations are delightful examples of his work. The publishers are to be congratulated on including the large number of illustrations—forty-five of them—a generous gallery rarely found in a book published in this country. The format of the book is also highly creditable in every way.

Australian Insects. XV

Book-lice, Lice and Thrips

By KEITH C. McKEOWN

THE PSOCIDS OR BOOK-LICE—
ORDER COPEOGNATHA.

THE Book-lice or Psocids are a group of usually very small insects, with the mouth-parts developed into remarkable chisel-like organs, quite unlike anything else found among the insects, despite the almost infinite variety of their feeding organs. The wings of the adults have a quite specialized venation, and are carried roof-wise over the back when the insect is at rest. These curious little insects form the order Copeognatha, a name derived from the Greek *kopeus* a chisel, and *gnathos* a jaw. Many workers call the order Psocoptera. Only some thirty species of Psocids are known from Australia, but it seems certain that many more await discovery if their study is conscientiously undertaken. Three introduced species also occur.

But what of the appearance of these tiny creatures, and what of their lives? The immature forms look very much like minute termites or white ants, and they bear a certain superficial resemblance to the true lice of the following order, the Anoplura—a likeness that has earned them the popular name of "Book-lice". The immature forms are soft and pale-coloured with large rounded heads and slender antennae. They run about with amazing rapidity for such small insects, and hide in cracks and crevices when disturbed. The adults are similar in form to the young, but are provided with two pairs of wings, often blotched and mottled, sometimes quite brightly tinted; they are somewhat moth-like little creatures.

The native species live in the bush and are only rarely—and then accidentally—found in houses. They run about over the trunks of trees or the surfaces of lichen-

covered rocks, and feed upon bark or lichen fragments, bitten off with their chisel jaws; they feed, too, on the thread-like growths of moulds and other fungi. Practically nothing has been recorded of their life-histories so far as the Australian species are concerned, and a wide field for research awaits the student. A fine, and I believe undescribed, species deposits its large coppery eggs on the leaves of citrus trees on the Irrigation Areas, and the young Psocids appear to feed upon the black, sooty fungus or Fumagine that often covers the foliage of scale-infested trees, growing upon the excreted honey-dew. The adult insect has dark brown mottled wings.

Broadly outlined, the Psocid life-history is as follows: the eggs are laid in small masses on the bark or foliage, and are covered over by the parent with a sheet of exceedingly fine, glistening silk. This production of silk by the perfect insect is deserving of far more attention than has hitherto been devoted to it. The young Psocids grow by a series of moults, of which there are usually four, tiny wing-buds appearing at the second, and maturity being attained with the fourth.

The largest of all the Australian Psocids is *Amphigerontia formosa*, which measures 15 millimetres across its blotched wings; it is found in southern Queensland. Other beautiful species are in the genus *Cladioncra*.

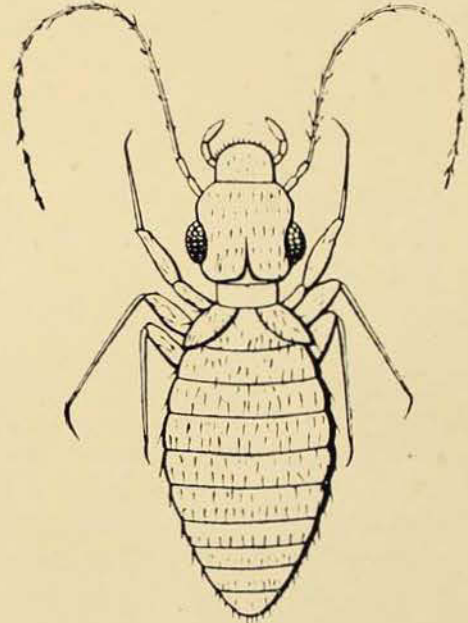
The introduced species are often found in houses, museums and libraries; these are *Atropos pulsatoria*, *Lepinotus inquilinus*, and the exceedingly minute *Troctes divinatorius*; they feed upon the surface fibres of old papers, dried plants, and collections of insect and other natural history specimens. Among the latter they are capable of causing

immense destruction, for, by reason of their minute size, they are very difficult to exclude from cabinets and store boxes, and their presence is seldom detected until the damage has been done. Among papers they appear to cause negligible damage. In houses they also infest cane furniture, and may often be seen running about over polished tables or radio sets for no reason that is apparent. They are sometimes accused of damaging marble and bronze statuary, a feat far beyond the powers even of an insect equipped with chisel jaws! When the insects appear in houses they usually arouse fears for the damage they may inflict, or lest they should prove to be those abhorred creatures, the true lice. Their control is usually easily accomplished by means of liberal applications of any of the commercial fly sprays. Sometimes the book-lice may invade houses in immense numbers, greatly disturbing the peace of mind of the occupants, and in some cases have even caused the vacation of the premises. When newly constructed buildings are invaded in this manner, the insects are almost certainly attracted by, and live upon, minute fungi which grow on the damp plaster of the walls.

The book lice *Atropos pulsatoria* and *Troctes divinatorius* have been associated with the, to the superstitious, ominous night-time sound, the ticking of the "Death Watch". This sound is definitely caused by a furniture beetle (*Anobium punctatum*), but some observers contend that the book-lice are also involved in the production of the sound, although it is difficult to associate such a tiny creature with so loud a noise. It is stated that the calling book-louse rests upon a sheet of paper and at regular intervals taps its head down on its support, which also serves as a resonator for the clicking sounds so produced. Further careful observation is necessary before the matter can be definitely settled, but for the moment the book-louse must be charged as an accomplice, at least, in the "crime" of disturbing the rest of the nervous—even though it is only by tapping out a message of love and assignation to its mate!

THE BITING AND SUCKLING LICE—
ORDER ANOPLURA.

Reference to "lice" is not generally considered to be a "nice" subject for discussion, but Science pays no heed to such prejudices—all creatures, whatever their habit, are worthy of study, and since a number of species of the group are of the greatest importance to man, as they are carriers of disease both to himself and his domesticated animals, their study has been intensive, especially since the war



The small soft-bodied Book Louse (Psocidae) taps out signals upon paper and other objects, using its head as a drum-stick.

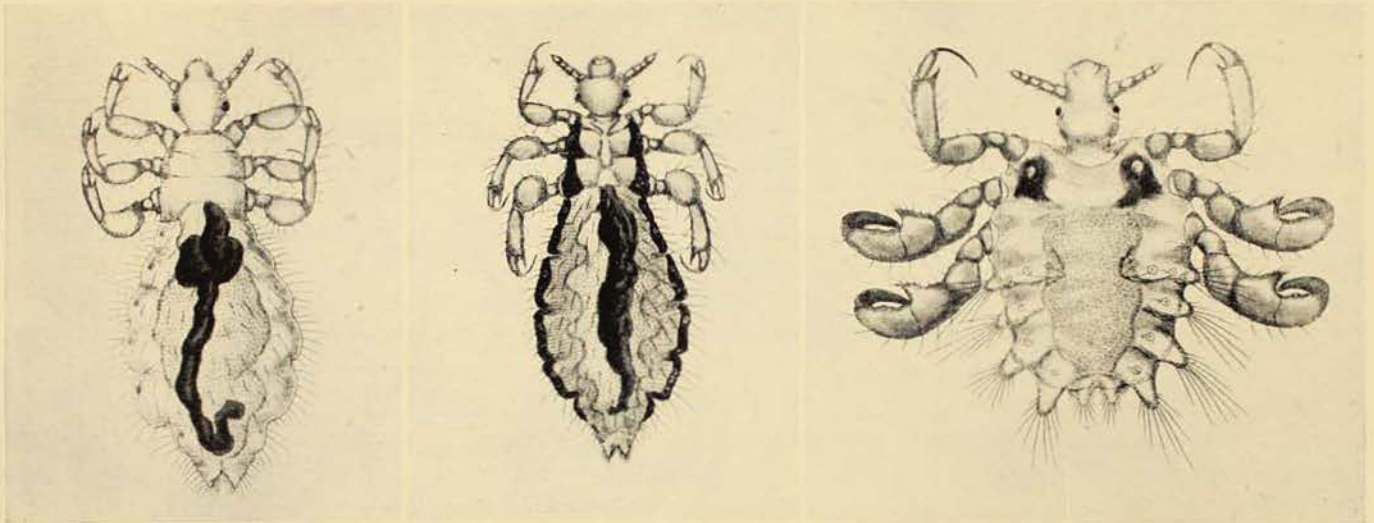
After Lefroy.

of 1914–1918. There is little doubt that there is something repulsive in the habits of lice, but one cannot but be impressed by their amazing adaptations which fit them so perfectly for their mode of life. Formerly the lice were placed in two distinct orders, the Biting Lice in the Mallophaga, and the Sucking Lice in the Siphunculata, an arrangement still retained by some workers. It is now generally conceded that they form but a single order—the Anoplura—despite the wide divergence in the form of the mouth-parts of the two groups, which are now accepted as suborders. All lice are parasitic on mammals and birds. They are of small size, wingless throughout their lives, and flattened from above; they are clothed with rows of sparse hairs or spines, and rarely with flattened scales.

The Biting Lice are provided with stout mandibles, and feed upon fragments of fur and feather on their mammalian or bird hosts, and on small fragments of dried skin. It is possible that they sometimes secure blood from abraded surfaces. In the Sucking Lice the mouth-parts are reduced to fine stylets, and they feed by piercing the skin and sucking the blood. They are parasitic on mammals only. A number of species in both suborders have been introduced to Australia from other lands.

one host often indicates the affinities of that animal with other host species.

Among the Biting Lice the common Poultry Louse (*Menopon gallinae*) is a widely distributed species introduced from overseas. The family Boopidae is, as far as is known, confined to Australia where it infests marsupials; *Boopia notafusca*, a common species, infests kangaroos, as also do the two species included in the genus *Laticephalum*. Their detailed study may reveal many interesting features in their lives and affinities. The family Philopteridae con-



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

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

The Crab Louse, *Phthirus pubis*, Linne.
After H. Denny.

The life-history in both suborders is very similar in general characteristics. The eggs, which are comparatively large, are cemented to the fur or feathers of the host, or, in the case of man, sometimes attached to his clothes. The larvae on hatching from the eggs are miniatures of their parents, and moult their skins four times before attaining maturity. They spend their whole lives clinging to their host by means of their specialized claws. On the death of the host the lice soon perish unless they can find a new one within a short space of time. Many species of louse are rigidly restricted to one particular host, or at most a few closely related species, and it has been found that the type of louse living upon

tains the majority of our species, all of which are parasitic on birds, being found crawling about among the feathers; some of them are of comparatively large size. Some twenty introduced species are included in this family, belonging to the genera *Goniodes* and *Lipurus*, which are parasites on poultry. Native forms infest the Native Companion, geese, black swan and ibis, while others are found on the Kookaburra, lyre-birds, and cockatoos. Sea birds are usually very heavily infested. The Australian genera are *Goniodes*, *Lipurus*, *Degeeriella*, and *Philopterus*. The family Trichodectidae is represented in Australia only by introduced forms, but these include several pests of considerable economic import-

ance. *Trichodectes ovis*, the Sheep Louse, costs the pastoralist many thousands of pounds annually in dipping for its control, and loss of condition in the animals from "louse worry", while fleeces are often ruined by the infested sheep rubbing themselves against trees and fences in an attempt to allay the irritation. *T. bovis* is a pest of cattle, and *T. pilosus*, of the horse.

The Sucking Lice include many interesting forms, and several of outstanding importance to the health of man himself. The family Echinophthiridae contains three amazing species in which the body is clothed with scales—all three are parasitic upon marine animals: one occurs on the Sea-lion, another on the Sea-leopard, and the third upon the Sea-elephant. Little seems to be known regarding the possession of any special adaptations to their marine life, a very great part of which must be spent under water. Only one native species of the family Haematopinidae is known, *Polyplax bidentatus*, which is found on the Australian Water Rat (*Hydromys chryso-gaster*), but a number of introduced species occur on domesticated animals. *Linognathus ovillus* and *L. pedalis* infest sheep, the former living on the body, and the latter in the short wool of the legs and face, especially in those breeds with black faces and legs. *Haematopinus eurystomus* attacks cattle, and *H. suis*, the pig; the latter is a large, broad-bodied insect, and is conspicuous on its sparsely haired host. *Linognathus piliferus* sometimes occurs in large numbers on dogs, and the parasites, temporarily transferring themselves to the owners of the pets, cause considerable irritation. The family Pediculidae includes the two notorious parasites of man, the Human Louse (*Pediculus humanus*) and the Crab Louse (*Phthirus pubis*). The Human Louse was formerly considered to be two distinct species, the Head Louse (*P. capitis*) and the Body Louse (*P. corporis*), but recent research has shown that the two forms interbreed freely, and that one form, if transferred to the habitat of the other, gradually assumes

its characters. They are now classed as subspecies of *P. humanus*, *P. humanus capitis* and *P. humanus corporis*. This insect is the proved carrier of typhus, relapsing fever, and trench fever. The Crab Louse is restricted to certain areas of the body, and has not, as yet, been definitely associated with the transmission of any disease. These insects have recently been discussed by Mr. A. Musgrave in this MAGAZINE (Vol. vii, 6, Sept.-Nov., 1940), so need not be dealt with in detail here. In times of war or famine, when large numbers of people are crowded together without adequate methods of hygiene, the lice increase rapidly, and this increase is frequently accompanied by epidemics of louse-borne disease, which may be accompanied by high mortality.

THE THRIPS—ORDER THYSANOPTERA.

Australia is rich in the minute insects of the order Thysanoptera, popularly known as Thrips, and the described native species comprise about a fifth of the world's total. Most of the thrips are of small size and retiring habit, and readily escape detection, but pull apart a rose or some other flower from the garden, and it is rarely that at least a few of the minute, elongate, usually greyish insects will not be seen running rapidly about over the petals and seeking shelter. Under the microscope the insects are beautiful objects, with two pairs of slender wings fringed on each side with long hairs. The feet terminate in a remarkable bladder-like organ. The mouth parts are of particular interest, since they are adapted not only for piercing and sucking up the sap, but also for scraping the surface of the plant tissue, and feeding on pollen.

The eggs are rather bean-shaped, and are deposited either on the surface or embedded in the tissues of the host plant. The larvae are miniature replicas of their parents, but are completely wingless. The moults are few, and are frequently preceded by a resting-stage in which the insect hides away among the foliage and takes no food. The resting stage prior to attainment of maturity is often pro-

longed, and may be sent in a clay cell in the soil; it approaches closely to a true pupa, or may even enter that state.

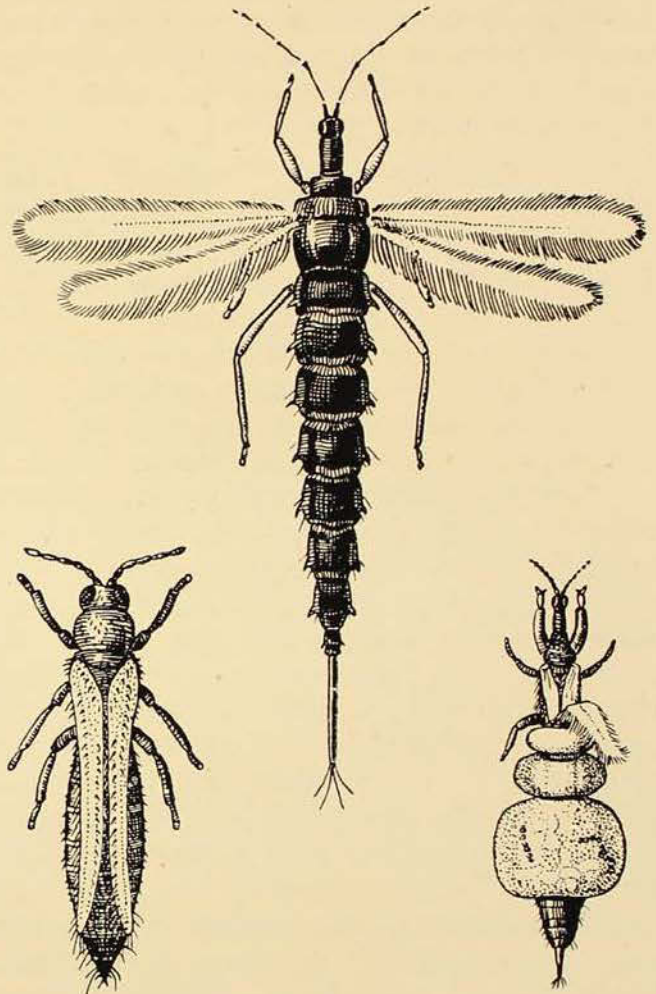
None of the native thrips have become pests, but a number of introduced species are economic pests of considerable importance, attacking fruit trees and other cultivated plants. A heavy infestation may prevent the setting of fruit, and where setting takes place the resulting fruit may be misshapen, or badly blemished on the skin. The petals of roses and other flowers often turn brown as the result of the scraping of the mandibles of the insects in a heavy infestation. The insects increase rapidly in hot, dry weather, and soon attain immense numbers. Males are almost always much rarer than the females, and in some species the males are as yet unknown. Parthenogenesis occurs frequently among the thrips.

Thrips imuginis is perhaps the commonest and most widely distributed of the pest species, and much confusion has occurred in the past as to its correct identification. *Thrips haemorrhoidalis*, in which the tip of the abdomen is reddish, as its name implies, infests ornamental shrubs, and at times injures the surface of citrus fruits. *Taeniothrips simplex* is a pest of gladioli.

The world's largest thrips occurs in Australia; this is *Idolothrips spectrum*, a slender black insect which measures up to half an inch in length. It was first captured by Charles Darwin when he visited Australia in 1836. It is usually to be found in the coastal areas, in the summer months, sheltering in all stages under dead eucalyptus foliage lying on the ground. The insects are usually sluggish, but when disturbed run about over the ground, often with the abdomen turned upwards over the back. Little appears to be known regarding its life-history and habits. Other Australian genera are *Phloeothrips*, *Haplothrips*, and *Heliothrips*.

In the dry inland areas some of the native thrips have evolved a remarkable habit, possibly as a protection against

the heat of the sun and the desiccating effects of hot winds; they construct galls on the foliage of the boree, mulga, and other trees in which to live and shelter. *Phloeothrips tepperi* forms a rounded



Top: Giant Thrips (*Idolothrips spectrum*).
Left: Plague Thrips (*Thrips imuginis*).
Right: A female Gall-making Thrips (*Kladothrips* sp.).

N. B. Adams, del.

gall on the leaves of the mulga (*Acacia aneura*), while another species (*Kladothrips rugosus*) forms an irregular spiny gall on the boree. Another remarkable form (*Kladothrips* sp.) forms a thin-walled, bubble-like gall on the foliage of the boree in south-western New South Wales. The female thrips deposits her eggs in the tissue of the leaf, which proceeds to swell up into a gall. Each of these swellings contains one or more mature females together with a mass of eggs, young in all stages, and cast skins. As many as 1,000 individuals have been counted in one gall. These little family

parties have no means of access to the outer world, and remain close prisoners until the gall dries and splits. The mature female is a remarkable creature, with the thin connecting membrane of the abdominal segments swollen out into transparent bladder-like globes through which intimate glimpses of her internal

economy may be seen. So great is the swelling that the wings are usually crumpled and pushed out of position. The details of the life-history of these strange insects are not known, and should form a fascinating study for those who may be favourably placed to carry out the investigation.

Review

FURRED ANIMALS OF AUSTRALIA. By Ellis Troughton, F.R.Z.S., C.M.Z.S. With twenty-five plates in colour by Neville W. Cayley, F.R.Z.S. (Angus and Robertson Ltd., Sydney, 1941.) 8vo. pp. xxvii + 374, 25 coloured plates. 14s. 6d.

Under the intriguing title of the "Furred Animals of Australia", Mr. Ellis Troughton has written a fascinating account of this island-continent's unique mammalian fauna.

With the publication of this new work the author introduces his readers to the great group of furred animals which he has made his own particular field in Australian zoology. In a text of absorbing interest he devotes his attention to the egg-laying Platypus and Spiny Ant-eater or Echidna, to the pouched-mammals or marsupials with their strange but true birth-story, and to the higher mammals which all too frequently are passed over in complete silence.

Here, within the compass of 360 pages, are rich fields of interesting material for the general reader, the student and the scientist. The whole of the subject matter is dealt with in a most readable and attractive manner, whether the author is describing the discovery of the first Australian marsupial, or recording the observations of eye-witnesses present at the actual birth of a kangaroo. The writing is always direct, vigorous and simply expressed; in fact, Mr. Troughton has brought such a wealth of knowledge to bear on his subject that there is never a dull moment between the two covers.

This, then, is a book to read straight through, or, if the mood is upon you, to dip into; in either case there will always be found new and strange items of interest in which history and natural history go hand in hand.

The furred animals of Australia, Tasmania and New Guinea fall into three groups. Naturally, the primitive egg-laying Platypus and Echidna occupy the early part of the book; then come twelve chapters on the marsupials with a wealth of detail concerning their distri-

bution, discovery and little-known habits. The variety of forms observed among these marsupials is truly amazing; they range from the tiny mouse-like possums to the "old men" kangaroos over nine and a half feet in length.

A most valuable section of the book deals with the higher mammals. It will no doubt come as a surprise to many readers to learn that there are over a hundred species of non-marsupial rats and bats inhabiting the mainland of Australia. To this list must also be added the marine mammals such as the whales, seals and dugong. Mr. Troughton has even found space for some interesting notes on the dingo, rabbit and hare, besides discussing at considerable length the properties of ambergris—that morbid product of the sperm whale. His description and tests should go a long way towards clearing up the mystery of this substance, which is considered to be the result of biliary irritation or digestive disorder set up within the whale.

The text is fully illustrated. Mr. Neville Cayley has specially prepared 170 drawings in natural colours and these, arranged in twenty-five plates, form a noteworthy addition to the pictorial record of our Australian furred animals. Such illustrations greatly enhance the descriptive sections of the book; they enable the reader to recognize readily the major groups of the mammals, and to identify with a little practice a very large number of different though closely-related forms.

There is a very full and well-arranged index which includes the subject matter of the text as well as the scientific names of the Australian mammals; names of races and of subspecies are inset beneath their individual species.

This review would be incomplete without congratulating the author, artist and publishers on their team work. The publishers not only have produced a splendidly printed and strongly bound book—no easy task under wartime conditions—but have added a most attractively designed and coloured dust jacket.

E.A.B.

New Parrot Fish Exhibits

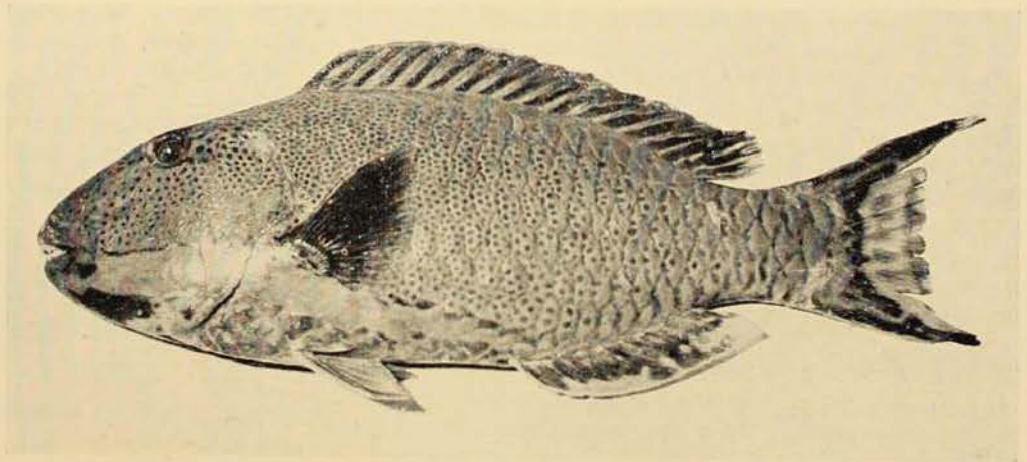
By GILBERT P. WHITLEY

HAVE you seen the new casts of parrot fishes which have recently been added to the Fish Gallery in the Australian Museum? These fishes, named for their beautiful colours and parrot-like jaws, rival in pattern and radiance the most brilliant birds and butterflies. This year the Museum received from Mr. H. C. Mac-Stewart (through the good offices of Captain W. Wilding of the M.V. *Malaita*) two fine fresh parrot fishes from the Gizo district, British Solomon Islands. As soon as they arrived, coloured drawings were made by Miss M. Soady. Casts of the fishes were next made and coloured to life-semblance, and the result is a very attractive addition to the fine exhibited collection of fishes.

puce, crimson, orange, and peacock-blue and green. The chin was salmon-pink and the ventral fins, below the body, were pinkish like a sliced water-melon. This striking parrot fish is known to science as *Pseudoscarus pulchellus*. First made known from the Red Sea, over a century ago, it has since been taken in many localities between Eritrea and the Indo-Pacific islands. This one is the first to be recorded from the Solomons, and the species may now also be added to the Australian fauna, since Mr. T. C. Marshall showed me one in the Queensland Museum, Brisbane, from Cape Upstart, Queensland.

The smaller parrot fish from the Solomons is *Pseudoscarus quoyi*, appar-

A beautiful Parrot Fish, *Pseudoscarus pulchellus*, from the Solomon Islands, recently added to the Australian Museum's collections.

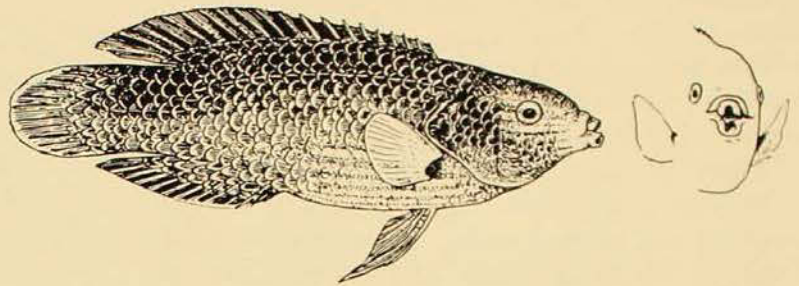


The larger parrot fish, 19½ inches long, had so complex a pattern that it defies brief description. The ground-colour was light emerald or apple-green. A pink band extended from the mouth backwards, and above this the body and head were dense with rose spots. The margins of the scales were also scarlet to rosy, with bands and blotches of red on thorax and fins. The latter also had peacock-blue fringes; the pectoral fins were mostly mauve, but the tail-fin was afire with

ently a commoner and smaller species than the other. It is of a more modest sage-green, its scales edged with bronze and its fins relieved with tan bands. A conspicuous light area on the cheeks, edged with blue, gives rather the effect of a person's face bandaged up for tooth-ache.

Apart from the above, the Museum has several Australian parrot fishes of interest; amongst these are the gaudy little Macaw Fish (*Lienardella*) of the

The Tubelip, *Labrichthys cyanotaenia*, from Indo-Pacific Seas, has U-shaped lips which form a tube-like mouth. Half natural size; Palm Island, Queensland.
G. P. Whitley, del.



Great Barrier Reef, various species of *Pseudolabrus* from Sydney, the Blue-spotted Groper or Tusk-fish, the Red and Blue Gropers and many others. Some of the Lord Howe Island types are shown swimming in the Coral Pool Group.

There are hundreds of different kinds of parrot fishes in various seas of the world, but most are found in warm and temperate waters. They live mostly in shallow water, amongst rocks, coral or weeds, or "the slimy caverns of the populous deep", but may sometimes migrate to deeper water.

The true parrot fishes have a beak rather like a parrot's, formed by fused teeth which may be white, rosy, or greenish in colour, but the term parrot fish is also used for many brightly coloured allied forms (*e.g.*, Wrasses) with separate teeth, the latter sometimes tusk-like or even curling outwards. They feed on weeds, chunks of coral, or marine animals (crustacea, molluscs, worms, and even crinoids), which are smashed to pieces on grinders in the throat (the pharyngeal teeth), so that the notion amongst the ancients that the fish was a ruminant was not without some basis. The scales are large and brightly coloured like the head and fins, and the colours vary so much with growth, or sex, that one species has often been given several different names. For example, the White-spotted Parrot Fish of the Sydney district is merely the young Crimson-banded Parrot Fish. Males sometimes develop a fatty hump on the head. At Lord Howe Island, the Double Head (*Coris cyanea*) when adult has a bump on its forehead which acts as a shock-absorber when it digs into the coral, its bright blue back gleaming half out of water.

Parrot fishes are not regarded as very good food fishes and some of the tropical ones are reputed to be poisonous at times after eating certain foods. Yet the *Scarus cretensis* of the Romans was much prized for feasts and the fish was carefully "farmed" in different parts of the Mediterranean.

Remarkable attitudes are adopted by some Parrot Fishes. They can be seen in aquaria "sleeping" on their sides and looking like dead fish on the bottom. Or they may be soothed to stillness by stroking their bodies. The Keelheaded Parrot Fish (*Novaculichthys*) not only assumes comical attitudes, but dives quickly into sand, with its knife-edged head foremost, when alarmed. In Bermuda, William Beebe noted that after getting its face rather messy from feeding on living coral, a Giant Parrot Fish (*Pseudoscarus guacamaia*) upends itself in midwater and allows small wrasses (other sorts of parrot fish) to clean its teeth and scales of adhering debris—rather like the Crocodile bird which cleans the teeth of the ferocious saurians of the Nile.

Both males and females of some species make nests of weeds, shells, etc. In the Taronga Park Aquarium, a kind known as the Pigfish (*Verreo*) has been puffing holes in the sand for years without, however, making a proper nest. Some parrot fishes have floating (pelagic), others sinking (demersal) eggs.

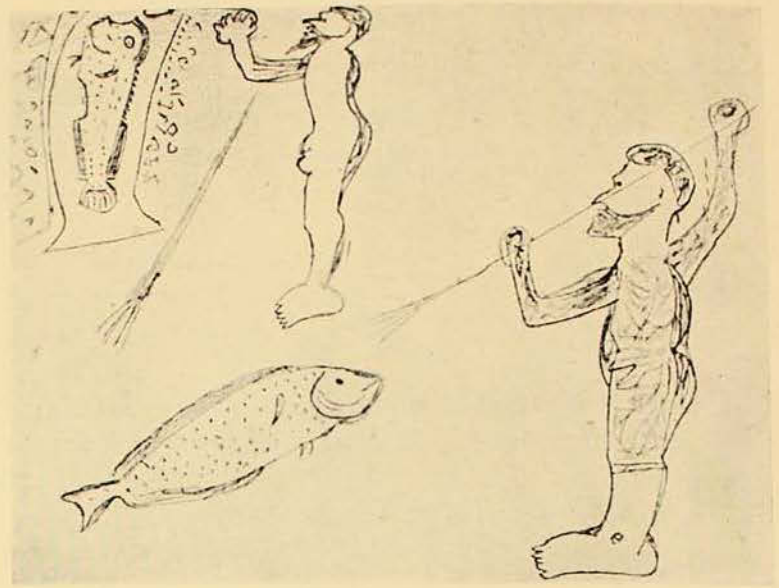
There are so many kinds of parrot fishes in Australia alone that there are not enough names to go round for them. Perhaps we can borrow some from their namesakes amongst the birds. Thus we may call *Scarichthys*, a green, soft-spined one, the Budgerigah Fish. Our species of *Pseudoscarus* are the Flame-

breasted, the Lory, and a dozen others. The South Australian Rainbow Fish (*Heteroscarus*) has a name whilst the Senator (*Pictilabrus*) may have been so-called because of his showy cloak.

Then in one of the Wrasse families (Coridae), we have the elongate Cigar Wrasse (*Cheilio*), the beautiful Comb Fish or Banana Fish (*Ctenocorissa*) of which we exhibit a striking cast specimen, and the Double Head, previously mentioned, besides our Maori (*Ophthalmolepis*), so called because of his "tattooed" cheeks. I suggest the names Spotty and Pretty Polly for the southern *Lunolabrus* and *Dotalabrus* respectively. The Surfer (*Hemigymnus*) wears dark "bathing trunks" on his body and is found on the Great Barrier Reef, where, too, under stones and coral at low water may be caught a variety of Slippery Dicks, Senioritas, Hinalea and other small wrasses of the Julid group. The Bridled Beauty (*Labroides bicinctus*) is bright blue with a broad black lateral stripe and is found in Queensland. Mr. A. A. Cameron, one of our enthusiastic collectors, has discovered this fish in the Clarence River, a new record for New South Wales, and I recently saw several specimens browsing over rocks at the entrance of the Tweed River on the Queensland-New South Wales border.

The tuskfishes (*Choerodon*) have as many as four different gaudy colours in each eye—a useful recognition feature in the various species when alive.

Several species of *Cheilinus* may be called Dots and Dashes because of their morse-like markings, whilst the remarkable little Birdfish or Snipefish (*Gomphosus*), not yet known from Australia, has a long bird-like snout. The Tubelip, a little parrot fish (*Labrichthys*) recently discovered in Queensland, has the lips forming a tube. Another kind,



Drawings by a Torres Strait native of a man fishing for one kind of parrot fish in a rock-pool and another species being speared.

After A. C. Haddon.

green and with a crest-like dorsal fin, is the Cockatiel Fish (*Duymaeria*), a new addition to the Queensland coastal fauna; the C.S.I.R. vessel *Warreen* recently netted specimens off Frazer Island, Queensland.

The Jawslinger (*Epibulus*) has a remarkable mouth which can be vastly extended and pushed forwards to engulf its prey; it is usually brown in colour, but yellow and other varieties occur.

Allied to the parrot fishes are the southern Rock Whiting, Stranger or Grass Whiting (*Neoodax*), the Herring Cale (*Olisthops*) and the New Zealand Butterfish (*Coridodax*), a selection from which is shown in the Museum.

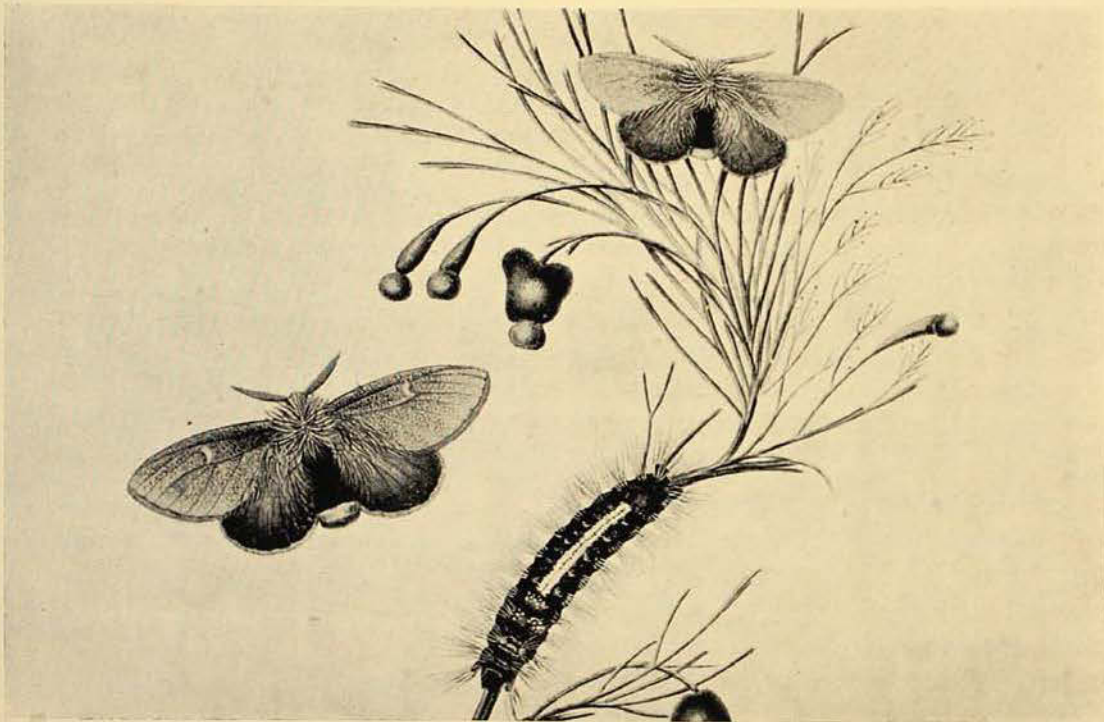
Perhaps the quaintest cousin of the parrot fishes is *Siphonognathus*, the Tubemouth, found from Western Australia to Tasmania. It is as slender as a pipefish and the upper jaw ends in a long, pointed, skinny appendage, the use of which is not known.

Harmful Moth Caterpillars

By A. MUSGRAVE

A MOTH, about whose habits little seems to have been written, has recently made its appearance in the Sydney district and, through the irritating effects of the hairs of its caterpillars, has come into conflict with man. The object of this article is to draw attention to this insect, and to state what is at present known of its life-history.

authority on the group. In the library of the Australian Museum is an unpublished plate, prepared for the late Dr. A. W. Scott, by his daughter Harriett Morgan, depicting the life-history of this moth, and showing the larva feeding on native cherry. In 1924 I referred to this moth in THE AUSTRALIAN MUSEUM MAGAZINE, but did not figure it. Since that time



Adults of *Euproctis edwardsii* Newman, also its larva depicted feeding on Wild Cherry. It usually feeds on various kinds of Mistletoe (*Loranthus*). From an unpublished plate.

Harriett Morgan, del.

This moth, *Euproctis edwardsii* Newman, a member of the family Lymantriidae (Tussock Moths), has, apart from its scientific description, been described only from the medico-entomological point of view by Dr. J. B. Cleland. He has shown that the larva possesses hairs capable of causing an irritating rash in human beings. Specimens of the moth bred by Dr. Cleland were identified by Dr. A. J. Turner, the Australian

I have not been called upon to identify any specimens of the moth or its larvae, nor has any reference, so far as I am aware, appeared in literature as to the poisonous effects of the hairs of the larvae.

On the 3rd March, 1941, however, three inquiries were made at the Australian Museum regarding caterpillars injurious to man at localities near Sydney, *viz.*: (1) Meadowbank, by the Department of Works and Local Government; (2) Glen-

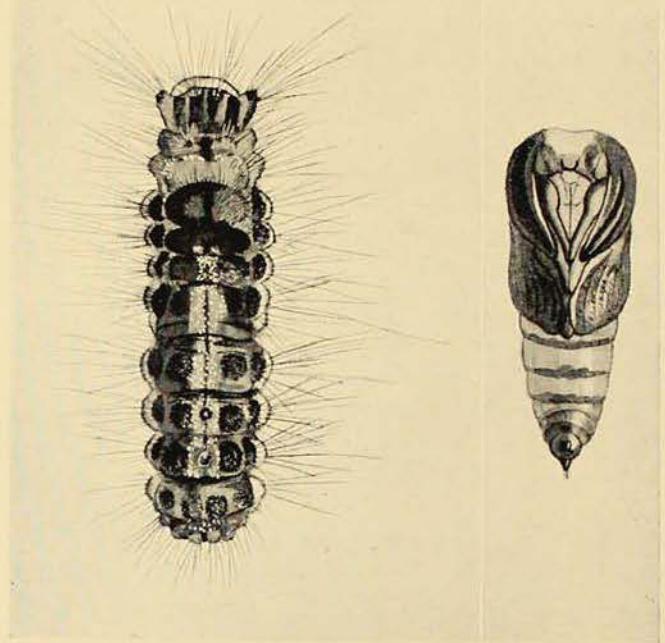
field, by Dr. C. E. Cook; and (3) Holdsworth, by Dr. J. I. Loewenthal. In the afternoon of that day I accompanied Messrs. A. W. E. Robson and J. J. Purcell, of the Department of Works and Local Government, to Meadowbank Park, where a number of men were engaged in reclamation work. The corrugated iron huts, containing offices and equipment, had been built under some tall gum trees, and the caterpillars, which had evidently been feeding on the Mistletoe (*Loranthus*) growing on the trees, were now all about to enter the pupal state. Everywhere on the trees nearby we found pupae, with the old larval skin adhering, common under the bark, as well as in the grooves of the corrugated iron sheds near and on the floor.

THE RASH.

One hut, which had been used as a storeroom for cement bags, had been invaded by the caterpillars to pupate, and all who had occasion to visit the room or the area near the trees suffered from a papulo-urticarial rash. Even during our brief visit, which could not have been longer than twenty to thirty minutes, some of the men and members of the party developed the rashes.

The rash attacked the forearms, neck, and back of the legs, and produced a hot, burning sensation like that of nettle-rash or prickly heat, and very itchy. One of the workmen, we were told, walked into the river in order to relieve the irritation. I did not escape from the wind-borne poisonous spicules, my right forearm suffering slightly, but in no way comparable to that of Mr. Purcell, who had accompanied me round the buildings. During the night, however, the rash appeared on other parts of my body, round the neck, the ears, behind the knees, while a few spots appeared on my chest. The irritation fortunately did not persist at any one part, but was intermittent. In the early morning hours the irritation became particularly persistent, the warmth of the bed clothes doubtless assisting, and relief could only be obtained by the liberal application of a

lotion. One could not help thinking of those workmen whose duties compelled them to remain all day in the vicinity of the trees. The weather during the past month had been very dry, and no doubt a rainstorm would clear the air and wash away the poisonous hairs. The removal of all mistletoe from the nearby trees should prevent a recurrence of the outbreak. To cut down the trees would be needlessly destructive.



Larva or caterpillar and pupa of *Euproctis edwardsii* Newman, from Meadowbank, near Sydney. Note the white line down the back of the larva and the round apertures of the osmeteria on the 6th and 7th abdominal segments.

Miss N. B. Adams, del.

Through the courtesy of the Department of Works and Local Government, I have been permitted to see copies of statements from three of the men engaged in work at Meadowbank. These are interesting as they describe the reactions of the men to the pest, and are valuable in corroborating my own experience. One of these reports from the Supervising Engineer, Mr. W. L. Cameron, dated 12th March, 1941, describes the outbreak and the methods adopted to combat it:

About the 19th February last, men working about the job store and offices became firstly affected with a skin irritation and itch. Every man in the vicinity of the sheds became

infected, particularly those entering sheds containing cement bags.

Although I did not enter the cement sheds, I was affected on the hands, arms and legs. While standing in the open near a caterpillar-infested tree, my neck became badly swollen inside of two minutes. The skin broke into small blisters several days after and very little improvement was shown a week later.

Two men received attention at Ryde Hospital. The hospital authorities were unable to diagnose the complaint or treat it effectively. The opinion expressed was that the complaint could be dangerous. The Health Inspector of Ryde Council also called at the job and investigated, but was unable to suggest or to do anything.

It is practically certain that the complaint had its origin in a large number of hairy caterpillars noted in and around the sheds and trees. The appearance of these was coincident with the outbreaks. It is not necessary to contact the caterpillars to contract the complaint; the air in the vicinity of the caterpillar-infested area appears to be affected, due probably to fine particles of hair from caterpillars floating around and about. Several men have been infected within a few minutes of being in the area. The rash and itch, which can quickly affect the whole of the body, are of particularly virulent types, rendering men affected to any considerable extent unfit for work. Several lotions, such as picric acid, turpentine and peroxide, were used as treatment without much success; best results were obtained with a mixture of calamine and tar water.

Unsuccessful attempts were made to eradicate the caterpillars and their effects by fumigating with burning tar. Sheds, however, were but temporarily free of the complaint owing to infected air from outside entering the sheds and the appearance of fresh caterpillars.

The complaint at Charity Creek appears to be confined to the area in Meadowbank Park, the job headquarters and that portion of field work using cement bags from the job store. Similar caterpillars are reported in other areas containing gum trees in the outer suburbs. . . .

The other statements from Mr. E. Moore, storekeeper, and Mr. J. Tafe, time-keeper, confirm the harmful effects of the hairs, both having suffered from the rash for a month at the time of writing, *viz.*, 5th March, 1941. The former points out: "At one stage, men refused to load cement here, giving as their reason that the prevalence of the distributors of this itch was a distinct menace to their health."

While we read in the Press from time to time of trouble arising in country districts as a result of caterpillar dust or

their spines affecting the vision or the well-being of men engaged in agricultural pursuits, complaints from the metropolitan area appear to be rare.

Dr. G. A. Waterhouse, Honorary Entomologist of the Australian Museum, whose work on the Rhopalocera (butterflies) is well known, has kindly furnished me with the following notes:

As I have searched Mistletoe (*Loranthus*) for over forty years to find the caterpillars of *Ogyris*, which are some of our most handsome butterflies, I have naturally come in contact with the urticating caterpillars of this moth.

My first experience was from a number of caterpillars at Como. I placed these in a box and reared the moths. Some time later on I wanted to use the box again and cleaned it out, blowing out the last traces of the dust left. In an instant my face, neck and hands began to swell and I was in considerable pain for some time. The swelling did not subside for two or three days. At another time at Mosman, when I was climbing a tree my hands came in contact with the dead caterpillars and suffered considerably. Almost every year I find these urticating caterpillars, but as I am more careful, I do not suffer much inconvenience.

I have for long been of the opinion that the living caterpillars do not produce much irritation, this being caused by the dried skins the caterpillars cast from time to time.

In order to test this I searched on 13th September, 1941, for caterpillars near my home at Killara. I found about 150 which were about half an inch long. These had eaten almost every leaf of the Mistletoe. They had probably had two moults already, but there was one which had had another moult. I brought it home with some of the smaller ones and destroyed the remainder. On reaching home I placed my right hand and wrist in cold water, which always intensifies the irritation, but although I had handled many pieces of bark on which were many caterpillars, I felt no discomfort and could not see any rash. I then took the large caterpillar in my forceps and rubbed it on the soft part of my left wrist several times. After an hour I could see three slight red patches, but did not have the slightest irritation. These red patches had disappeared the next day. It seems therefore that the young live caterpillars do not produce any ill effects on the skin, unless perhaps I am somewhat immune.

About a week later some of the caterpillars had moulted and when the skins had dried I also rubbed the dried skins on my wrist. Very soon some blisters appeared, with a slight irritation which passed off in two hours, and the blisters also disappeared leaving a slight red patch. This definitely shows that the irritating effects are caused by the dried hairs.

The caterpillars feed at night and hide by day under pieces of bark or any other suitable place. As far as I can find out, there is only one brood during the year, the caterpillars being full fed at about the end of the year. For the following three months, then, they are at their worst and have to be treated with the greatest of care. Should they be touched by the hands, one's eyes should not be rubbed, as the eyes would be very much affected.

I have found a mixture of carbolic and camphor relieves the irritation. This is used in England in the case of the caterpillars of a somewhat similar moth. Water does not help to any great extent.

To control the caterpillars themselves, the mistletoe should be taken from the trees in all parks in the early spring, when there would be little trouble, if any. It would be impossible to remove the mistletoe from all the trees around Sydney, but it should not be a great expense to remove it from the parks and also the military camps that have been set up at various spots near Sydney and in the country.

This September I have found the young larvae feeding on at least two different kinds of mistletoe.

THE CATERPILLAR.

The larva or caterpillar measures when fully grown about $1\frac{9}{16}$ inches or 40 mm. in length, and about $\frac{1}{4}$ inch or 6 mm. in breadth. It is dark reddish-brown in colour, covered with long hairs; the head, bases of the three thoracic segments, the five pairs of abdominal legs (prolegs) and sides of segments are yellowish. A whitish median line on the dorsum of abdominal segments 3-7 readily serves to identify the larva. On the 1st and 2nd abdominal segments are two elevations, blackish-brown in colour, in which are situated the poisonous spicules described by Dr. Cleland. An elevation similar in structure occurs on the 8th abdominal segment. The 3rd to 6th abdominal segments carry abdominal prolegs, and another pair is present on the 10th segment.

On the 6th and 7th abdominal segments are the round openings of the two eversible glands (osmeteria), a characteristic feature of the larvae of the Lymantriidae.

The hairs of the body vary in size and structure, and resemble in most particulars those described and figured by Dr. H. Eltringham in his account of the larva of the European Tussock Moth,

Porthesia similis Fuess. Long hairs, about 10 mm. in length, spring from the two large forwardly-directed papillae on either side of the 1st thoracic segment, from protuberances on the 1st-3rd thoracic segments, and from others along the sides of the body. Shorter hairs, about a third of the length of the long ones, are interspersed with them, while other types of hairs are distributed over the body. All are "barbed", *i.e.*, the longer hairs have finer hairs arranged along their length directed forwards and outwards from the base of the bristle. Flat white scale-like structures, which constitute the white dorsal line of the abdomen, and which may be homologous with the "white plume-like structures" described by Dr. Eltringham, are seen, at a magnification of 35 diameters, to resemble white down feathers in miniature, and appear to increase in length particularly on the 7th segment. They give rise to a hair of different appearance, darker and with longer "barbs", and which are placed towards the outer side of the median line of the abdomen. The poisonous spicules have been described by Dr. Eltringham (for *Porthesia similis* Fuess.) and by Dr. Cleland (for *Euproctis edwardsii* Newm.). They are golden in hue, forming tufts which give a yellowish tone to the dorsum of the 1st and 2nd abdominal segments in the living larva, and occur also at the sides of the 6th and 7th abdominal segments, and on the 8th. In juvenile examples from Killara, these golden spicules seem to be confined to the pads on the 1st, 2nd, and 8th abdominal segments.

THE PUPA.

The pupa of the moth measures about $\frac{5}{8}$ inch or 15.4 mm. in length, and about $\frac{1}{4}$ inch or 5.8 mm. across the thorax; other specimens may measure 17.7 mm. in length, and 6.17 mm. in breadth. The head and thorax are shining black; the dorsum of the thorax and abdomen, black to reddish-brown; abdominal segments beneath, blackish and reddish-brown; the dorsum of body and abdominal segments below are provided with tufts

of fine golden hairs. The cremaster is usually fastened into the old larval skin. The specimens collected at Meadowbank emerged about 17th–21st March, 1941; the three larvae from Glenfield, which had pupated about the 4th March, emerged about the 27th–28th March; so that the period of pupation is about three to four weeks.

THE MOTH.

The moth, *Euproctis edwardsii* Newman, was first described in 1856 from the Mt. Alexander Range near Melbourne, Victoria. Dr. Turner has recorded it also from Queensland, New South Wales, and South Australia. Dr. Cleland's records were for Lindfield (in firewood), and Mosman, Sydney (under bark). Dr. Turner has also re-described the moth in his paper, and the following description is based on that given by him.

The male measures from $1\frac{9}{16}$ –2 inches (40–50 mm.) across the outspread wings, and the female from $2\frac{1}{16}$ – $2\frac{3}{16}$ inches (53–55 mm.).

The male varies in coloration. The head and thorax are orange-ochraceous, ochraceous, or greyish-ochraceous, the antennae pale ochraceous or whitish. The abdomen is blackish, while the tuft and underside are ochraceous. The legs are pale ochraceous. The forewings are oval-triangular, and pale-grey. The hind wings have the hind border strongly rounded. The female is darker in coloration than the male.

PARASITES AND PREDATORS.

In view of the numerical abundance of the species, it was only to be expected that insect enemies would be present. At Meadowbank I found that the active larvae of the Bacon Beetle, *Dermestes cadaverinus* Fabr., an introduced insect, were attacking and eating the pupae, and dead larvae and empty pupal and larval skins were everywhere in evidence. The largest examined measured 13 mm. in length. Each larva moults several times before reaching maturity. These elongate hairy larvae have a conspicuous curved spine at the end of the body, and they

were doubtless playing an important part in reducing the numbers of the moths. The adult beetle measures from 7.5–8 mm. and is black in colour on the upper surface. Ganglbauer records the allied *Dermestes lardarius* Linn., from the nests of the caterpillars of the European Processionary Moth, and figures the larva, which resembles that of *D. cadaverinus*. He also points out that *Dermestes erichsoni* Gangl. (= *D. tessellatus* Erichs. nec Fabr.) was recorded from the nests of *Euproctis chrysorrhoea* by Prof. Rosenhauer.

In addition to the beetles, two Ichneumonid wasps were bred from pupae; these proved to be males of *Echthromorphā intricatoria* (Fab.), a well-known Australian and Tasmanian species. Some micro-Hymenoptera of the family Chalcididae emerged from white cocoons clustered under the bark of one of the trees at Meadowbank.

OTHER HARMFUL MOTH CATERPILLARS.

The larvae of certain moths have long been known to possess hairs with urticating properties, rendering them a source of annoyance to man and sometimes the cause of serious injuries.

In Europe at least two moths of the family Lymantriidae (popularly termed Tussock Moths) are known to possess larvae whose caterpillars have urticating hairs. These are the "Gold Tail", *Porthesia similis* Fuess., and the "Brown Tail", *Euproctis chrysorrhoea* L., which last-named was introduced into the United States of America with the "Gipsy Moth", *Lymantria dispar* L., to become serious pests.

In Australia some of the larvae of the Limacodidae (Cup Moths), which feed on the foliage of the gum trees, possess spines which, upon coming in contact with the skin, set up an irritation.

The larvae of the "Bag-shelter Moth", *Ochrogaster contraria* (Walker, 1855), a species placed in the Notodontidae by Turner, and the Lymantriidae by Strand, has been recorded by Froggatt and by Hindmarsh as harmful to man and stock.

The larvae of *Lewinibombyx lewini* (Lewin, Bombyx, 1805), a species placed in the Bombycidae by Turner, and in the Lymantriidae by Strand, has been described by Froggatt as harmful to man and stock.

The larvae of the large brown moth, *Chelepteryx collesi* (Grey, 1835), a member of the family Anthelidae, are covered with sharp hairs which are also incorporated in the whitish cocoon, and serve as a means of protection. They do not appear to cause a rash.

Another moth of the same family, *Anthela nicothoe* Bdv., has been recorded by Fleay as possessing larvae whose spines "give rise to a maddening irritation".

Wigglesworth, in his work *The Principles of Insect Physiology*, states: "the urticating substances secreted into the hollow cavities of the fragile detachable barbed hairs of many caterpillars; these

are of unknown nature, but they are often thought to be related to cantharidin" ($C_{10}H_{12}O_4$).

A. D. Imms in his work, *A General Textbook of Entomology*, 3rd Ed., says: "Larvae of the common European 'Gold Tail' (*Porthesia similis* Fuess.) are provided with urticating hairs composed of barbed spicules. It appears uncertain whether their irritating properties are mechanical only, or are partly due to a poisonous secretion bathing these spicules. Eltringham has shown that the female collects the spicules, which are present on the cocoon, by brushing the latter with the anal tuft, and subsequently distributes them over the egg mass."

It would thus seem that much work of an experimental nature requires to be carried out before the true function of the various types of hairs in these harmful caterpillars is fully understood.

Review

BY THEIR WORKS: Illustrated from the Collections in the Buffalo Museum of Science. By H. Phelps Clawson. (Buffalo Society of Natural Sciences, Buffalo, New York, 1941.) 4to, pp. 260, 107 plates. \$4.00.

This handbook describes the history and culture of the various peoples represented in the archaeological and ethnological collections of the Buffalo Museum of Science. Its publication was made possible through a grant from the Rockefeller Foundation. It is written in condensed style, and forms a handy reference work for lecturers, teachers and students; it describes a period of 25,000 years of human history of great interest to the general reader. A résumé is given of the Old Stone Age, Transition Period, New Stone Age, Early Metal Age, Early Egypt, Prehistoric Asia, Greece during the Geometric Age, and the Americas. There are chapters on Chinese Jades, Luristan,

Ordos, and Syro-Hittite bronzes and terracottas. In addition, five chapters are devoted to the living native peoples of Africa, Indonesia, Melanesia, Polynesia, Australia, and the Americas.

The Buffalo Museum is to be congratulated not only on the excellent make-up of this book, but also for the wise and logical manner in which it has built up its collections with the aim of presenting to the citizens of Buffalo, and to other visitors to its galleries, a composite picture of the history of the world as revealed by the archaeologist and anthropologist. Some of the sections are meagre, and some cultures are unrepresented, but those described in the book form an adequate series. The aspect of the general problem most emphasized is art, and the beautiful illustrations reveal many treasures possessed by this Museum.

F.D.McC.

Strange Insect Meals

An Entomological By-way

By KEITH C. McKEOWN

NOT least among the fascinations of the study of insect life is the discovery of the unusual, and therefore surprising, in the habits and behaviour of the inhabitants of what must always be to us a strange world. Insect behaviour runs more or less to a standardised pattern, and any deviation from this routine—or what we consider, perhaps incorrectly, to be a deviation—is of exceptional interest, and is always well worth placing on record.

In THE AUSTRALIAN MUSEUM MAGAZINE (vii, 6, September–November, 1940), in an account of the Long-horned Grasshoppers, I referred to the huge King Crickets (*Anastostoma australasiae*) and our lack of information regarding their habits. In a letter dated 28 October, 1940, Mr. W. E. Smith, of Cape Cleveland, Queensland, sent an extremely interesting observation on an unrecorded habit of these strange insects. "About twenty years ago", he writes, "a friend and I went fishing at a deep pool at the top of the falls on Skeen's Creek, at Montville. After darkness had set in, we lit a fire near the water, and continued to fish, landing a few eels.

"After a time we heard the crunching of flesh (as near as I can express the sound) and found, to our amazement, huge crickets eating the eels. We tried to frighten them away, but they had no fear, and struck a fighting attitude, at the same time hissing loudly.

"They were larger than three inches; I'm sure they were more than five inches; their heads alone seemed to be about two inches. They were so horrible to look at and so fearless, and could cut up eels so easily, that we thought it wise to move off.

"No one would believe our story, as no such crickets had been seen in that dis-

trict. The spot mentioned is often visited by day, but rarely, if ever, by night, the track being dangerous at night."

The scene described by Mr. Smith can be imagined. The fearsome-looking creatures tearing at the dead eels would tend to look even larger than their actual size in the flickering light of the fire. Their pugnacious attitude is familiar, and their allies, the Long-horned Tree-Crickets, make a distinct sharp sound which can be described as a hiss, so that the King Cricket, no doubt, makes the same noise. While eels cannot possibly form any part of the natural food of these insects, it is possible that their diet consists of other insects, and the bodies of dead birds or animals might prove a windfall which would be exploited to the full.

Some members of the order (Orthoptera) to which the King Crickets belong are purely carnivorous, while others seem to vary a generally vegetarian menu with a little meat, if this happens to be available, and even attack living prey, sometimes members of orders higher in the scale of life than themselves.

At a meeting of the Linnean Society of New South Wales, on 31 May, 1911, W. W. Froggatt exhibited a specimen of a large wingless grasshopper, caught in a house at Mount Tambourine, southern Queensland. It had invaded a mouse's nest, and, after frightening the mother away, was feeding upon a young one when captured. Unfortunately, the insect does not seem to have been identified.

Even the Praying Mantis, that voracious destroyer of insects, has been known to capture vertebrates as food.

E. J. Banfield, the "Beachcomber", in his book *Tropic Days*, after describing some bush tragedies and battles he had seen, writes: "A still more singular bush

conflict was witnessed by a friend. He heard, not without concern, the pleading of a frog from the assaults of an enemy, but having far too many of them about the premises decided on non-interference, thinking that the hungry snake would soon silence the clamour. But the cries becoming shriller and more piteous, he investigated, finding among the leaves of a creeper on the verandah a large green Mantis—*religiosa* too—voraciously making a meal off the hind-leg of a little green frog, which it grasped firmly. Almost the whole of the flesh of the limb had been eaten, and the observer was of the opinion that there would have been little left of the screaming frog if he had not interfered."

An even more astonishing happening was reported by the late B. S. Morse, of Moree, in the *Emu* for July 1922, as follows:

"The following remarkable story was told me recently by a man in whose testimony I can place every reliance. A pair of (what I take to be by his description) Yellow-rumped Tits (*Acan-*

thiza chrysochloris) had built a nest in a vine growing round the verandah of his house on the Barwon River.

"The distressed state of the birds attracted his attention one morning, and looking into the vine he saw a large mantis with a tiny naked bird securely grasped in its spiked arms and apparently eating at its head. Thinking the occurrence most unusual, and needing a second witness to the act, he jumped on his horse and rode after a friend who had just left. Together they came back and made further investigation. The mantis had gone, but it had dropped its prey, which they found lying under the bush with three other tiny birds, each one of which had a tiny round hole in the top of its head and all the brains extracted therefrom."

Tragedies such as this are rare, but they show in no unmistakable manner the ability—and readiness—of the insect to exploit any circumstance offering an opportunity to secure food, even if it should be of a nature differing from that to which it is accustomed.

THE Department of Anthropology has received several interesting and valuable acquisitions during the last quarter. A collection of 196 specimens presented by the Administration of the Territory of New Guinea has filled a number of gaps in our material from that island; specimens of outstanding interest include prehistoric stone mortars and pestles from Whagi Valley, canoe models from Tami and Anchorite Islands, flutes, canoe prow carvings, and skin drums from the Sepik River, pottery and a clay drum from the Markham River, a large fish-trap from Blanche Bay, spinning tops from the Chimbu Valley, wooden bowls from Tami Island and the Madang district.

The late Mr. A. E. Ivatt, of Bathurst and Cronulla, presented his collection of Australian stone implements; it includes a fine series of flake implements from the

Bathurst district, uniface pebble implements from the Snowy River and south coast of New South Wales, and a series of ground-edge axes from various localities.

MR. J. KINGSLEY, of the preparatorial staff of the Australian Museum, recently returned from a visit to the United States of America where, as a recipient of a travelling grant from the Carnegie Corporation of New York, he had been studying advanced methods of preparation and museum technique. During his visit to that country Mr. Kingsley worked in the Californian Academy of Sciences under Mr. Frank Tose who, it will be remembered, spent some months in the Commonwealth in 1937. Mr. Kingsley also toured the States inspecting the leading museums.