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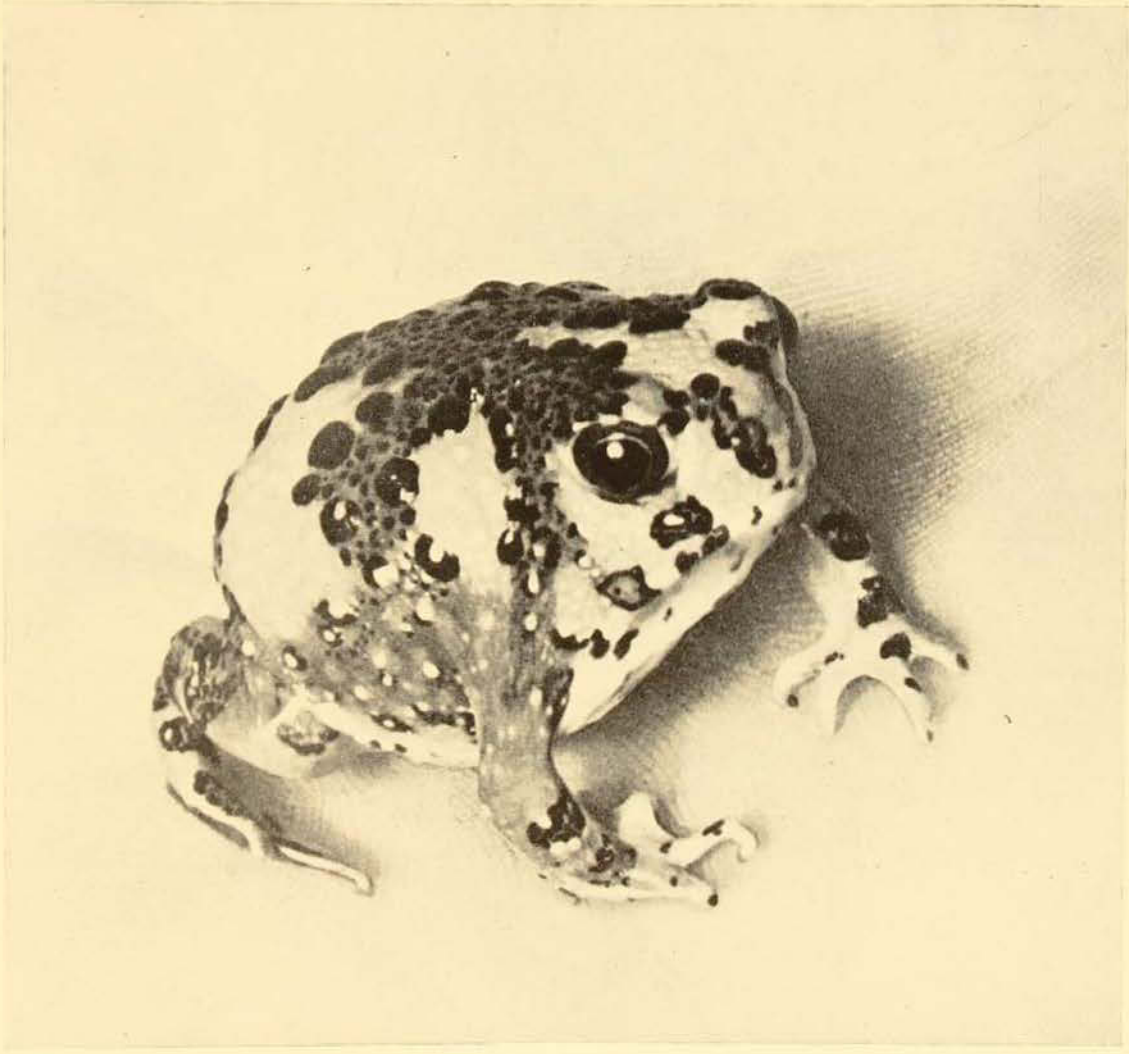

The Cross-bearing Toad.

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THE AUSTRALIAN MUSEUM

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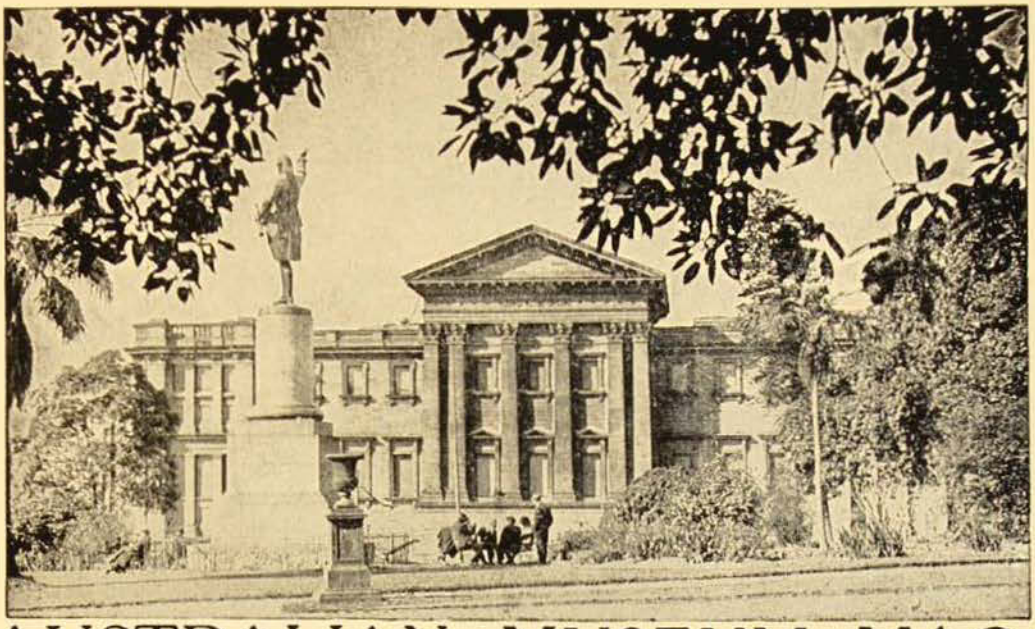

THE AUSTRALIAN MUSEUM MAGAZINE

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

OUR FRONT COVER. The Cross-bearing Toad, *Notaden bennetti*, Gunther. This little toad is found only in the inland areas of New South Wales and southern Queensland. The body colour of the very young is a brilliant yellow, and that of the adult bright green. The cross pattern of the back is made up with large black tubercles, intermixed with small crimson and yellow spots. It grows to two inches in length. Beyond the fact that it is a burrower, little is known of its habits. Its food consists of small beetles and other insects.

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Wild Blacks, last tribe of New South Wales.

(*See* opposite page.)

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VOL. X, No. 6. JUNE 15, 1951.

The Scotia Blacks

By FREDERICK D. McCARTHY.

THE frontispiece is a reproduction of a photograph entitled "Wild Blacks, last tribe of New South Wales", taken by the late Mr. H. R. Heslop at Wentworth on the Darling river in western New South Wales. A fine enlargement of this photograph was recently presented to the Museum by his daughter, Mrs. E. Rasmussen. The perfect physical condition of the group, which consists of five men, eight women and fourteen children, is impressive, and they obviously had no difficulty in securing an ample supply of food; their robust health is indicated by the unusually large number of children. The members of the group were all naked when brought into Wentworth. They were shy and timid, and when whites approached they hid behind bushes; they would not eat rabbit, nor drink tea and sugar. The men are armed with what appear to be bamboo-shafted fish-spears, which are multi-pronged, three of them are carrying boomerangs and one a bladed Lil-lil club. No ornaments are shown, nor are any of the women's bags and other possessions, and the usual patterns of cicatrices are lacking.

It is probable that this photograph depicts the "Scotia" blacks, of Maraura tribe, a group which developed from an old man named Nonnia and his two wives who left Popiltah Station in the 1860's and went to live in a dense tract of mallee country along the New South Wales and South Australian border. Mr. A. F. Cudmore succeeded in bringing them back to the station in 1893, after they had lived in concealment for thirty years. He said that their chief food was the black scrub kangaroo which they killed with barbed mallee-shafted spears. They depended chiefly upon mallee and waterbush roots for water but had been known to fill their water-bags, made out of the skin of a kangaroo's leg, at water-tanks on nearby stations. Their small, low huts were made out of mallee boughs thatched on the outside with porcupine or spinifex grass. Fire was made with the simple drill of two sticks but to avoid the labour of this method a smouldering stick was usually carried. In the cold of the winter kangaroo-skin cloaks were worn. White ants formed a tit-bit in their diet; the ants were dug out of their nests, sieved from the earth in a bark coolamon about two feet long, and roasted. One interesting point noted by Mr. Cudmore was that their language differed slightly from that of the river blacks from whom Nonnia originated.

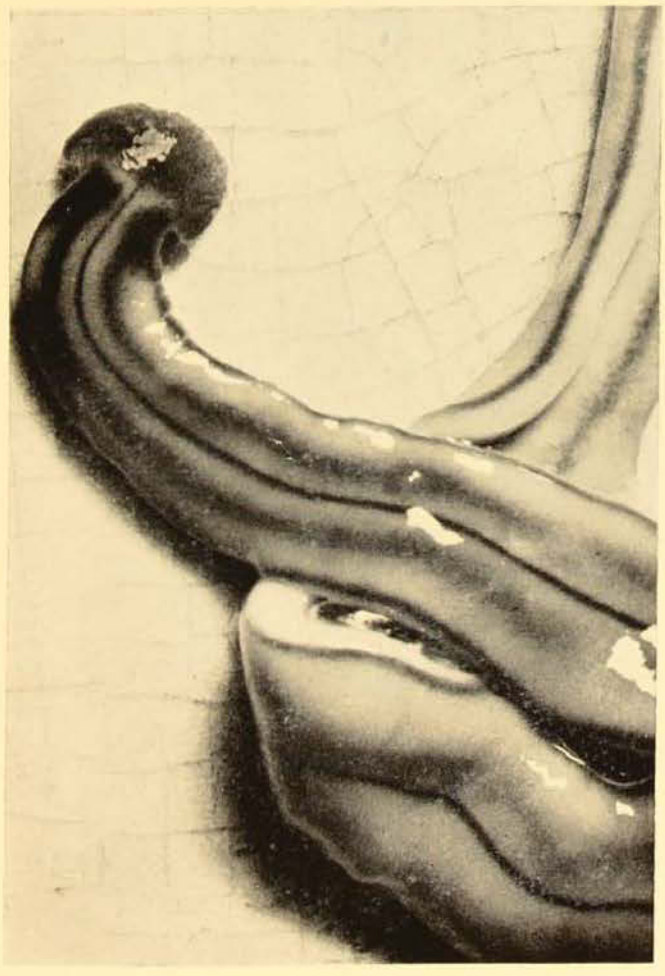
The New South Wales Government issued instructions for this group of natives to be released so that they could return to their mallee home, but they stayed at Popiltah where they went hunting and fishing until, as intended, the men became station hands. Mr. Cudmore said that it was almost impossible to get any information out of them but their knowledge of aboriginal lore and customs in western New South Wales would no doubt have filled volumes—the culture of these tribes is only superficially known to-day.

Meet the Flatworms

By A. J. BEARUP, B.Sc.

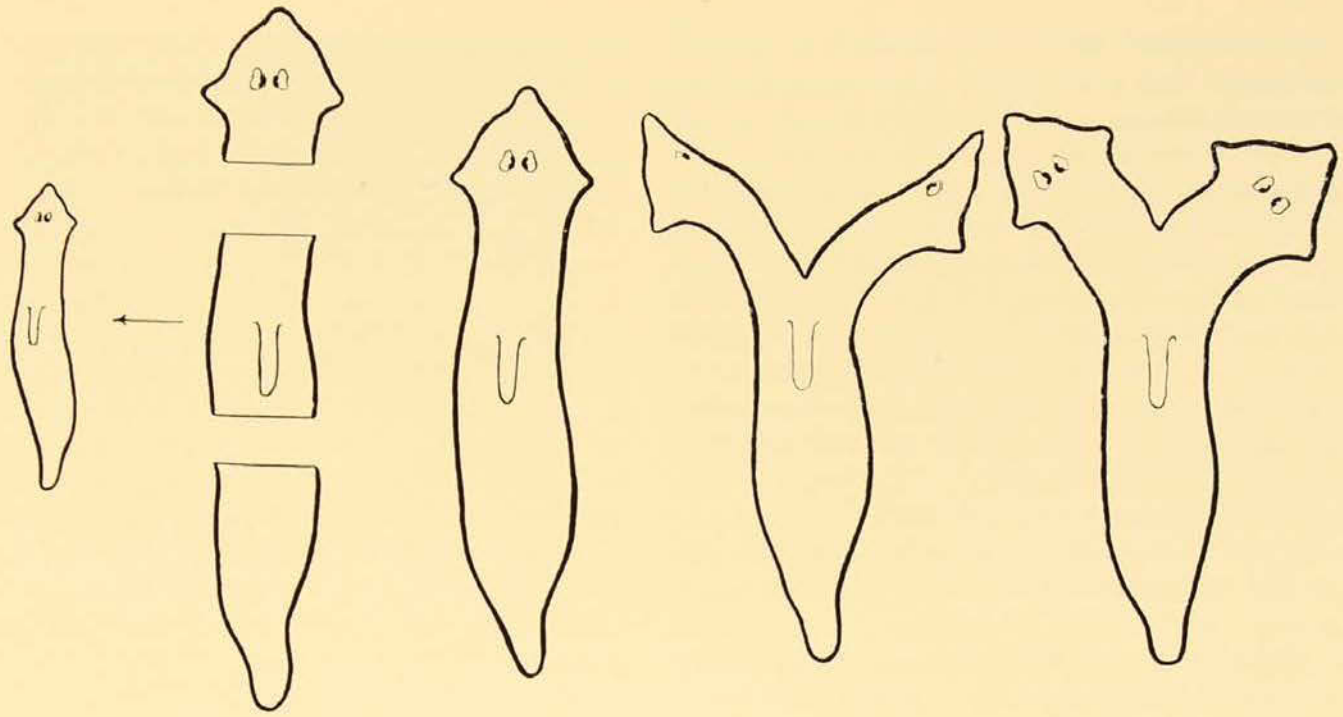
FLATWORMS, or platyhelminthes, as the zoologist calls them, receive more attention than their lowly position in the animal kingdom would seem to merit. This is because some of them are parasites of man or live in domestic animals or in animals which man uses for food. Their bad effects on humans are sufficient to keep at work a number of parasitologists who pry into the private lives of these tiny animals and try to discover ways and means to deliver them a knockout blow at some vulnerable period in their life history.

Not all flatworms are parasites, however. Many species found in moist ground and in fresh and salt waters are—so to speak—more respectable, leading a free and independent existence, pursuing and devouring only those creatures slower and weaker than themselves. These non-parasitic types have also received the close attention of scientists because of their importance in experimental work on growth and development and what is called regeneration. They can be starved, mutilated, or hacked to pieces, yet they rise again. The starved individual gradually breaks down its tissues and organs for food and thus can regress to a larval form. When food is again available, it returns to adult life. If cut in half, one end grows a new head, the other a new tail; or we can make slits in the head region to form a many-headed monster; we may also graft the head of one species on the body of another. It is from such experiments that the forces which mould the shapes of growing animals are studied. The capacity to regenerate lost tissues is well developed in simple animals, but is gradually reduced with the more complex and specialized types till in man it is confined in the main to the mending of broken bones and replacement of wounded tissues.



Planarians, as the non-parasitic flatworms are commonly called, occur in the sea, in fresh water, and on land. Land planarians are found in damp places or under stones or logs. Some are glistening, black worms, and some have brightly coloured longitudinal stripes on colorful backgrounds. They shun light and, if disturbed, glide away to new cover leaving a slimy trail of mucus. In Australia there are more than forty species, most belonging to the genus *Geoplana*, but we also have the cosmopolitan *Placocephalus kewensis*, probably introduced with imported plants.

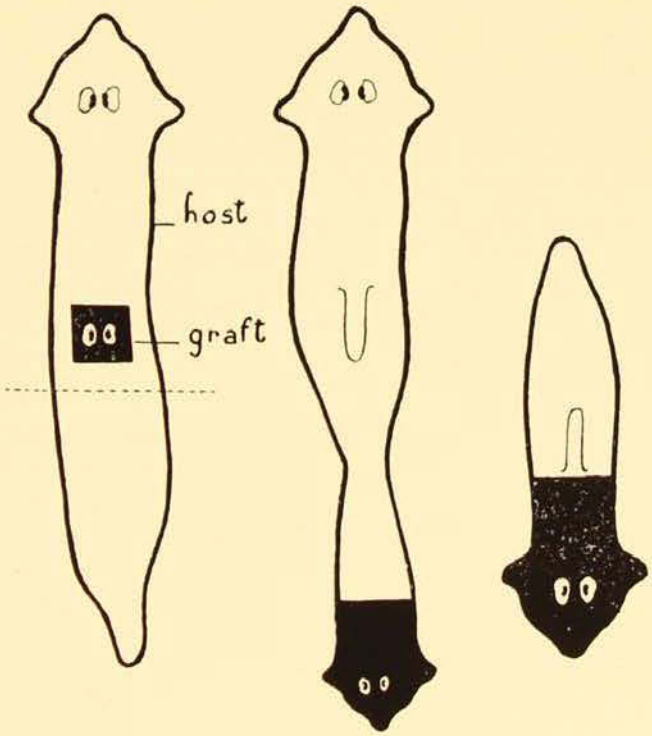
The head end of *Placocephalus kewensis* (*Bipalium kewense*) crawling over the moistened surface of a kitchen plate. Note the peculiar shovel-shaped head and the five darkened bands on the body. The white patches are due to glistening light on the slimy mucus which covers the body.



Two experiments which illustrate the planarian's powers of regeneration. The central figure is the ordinary adult worm with its eyes and feeding tube (or pharynx) clearly shown. If the worm be cut into portions as indicated to the left of the central figure, then the middle portion can regenerate a new head and tail. The two drawings on the right show what happens when the head of a planarian is slit down the central line—two heads develop. After Child.

Freshwater planarians may be found under stones or on water plants in still pools. A bait of liver left in the water for a few hours generally will attract a few of the common black species. The microscope reveals that the characteristic gliding movement is due to numerous hair-like cilia projecting from the under surface of the body. The lashing of these cilia causes turbulence in the water and this has given the scientific name "Turbellaria" to the group.

Planarians are also common in the sea. Often brightly coloured, some may grow to a length of six or more inches. One, *Leptoplana australis*, known as the Wafer Worm, is believed to be a pest of the estuarine oyster beds. A closely related class, "Temnocephala", is probably familiar to anyone who has hunted "yabbies" in our freshwater streams, for one often finds several of the little creatures on the surface of these crustaceans, attached by their posterior suckers and waving a characteristic group of five finger-like tentacles at the free end. They feed on small water life and apparently the only benefit derived from the "host" on which they live is free transport.



Another growth experiment to show the effect of grafting portion of the head of another worm into the body of a host planarian in the region of the pharynx (figure on the left). The host's pharynx was removed. When the graft had taken, the host's tail was removed at the dotted line. The central figure shows the graft growing as a new head; the host has regenerated its lost pharynx and the new worm is beginning to separate itself from the host. The figure on the right is the new worm whose body shows which parts regenerated from the graft tissue and which from the tissue of the host.

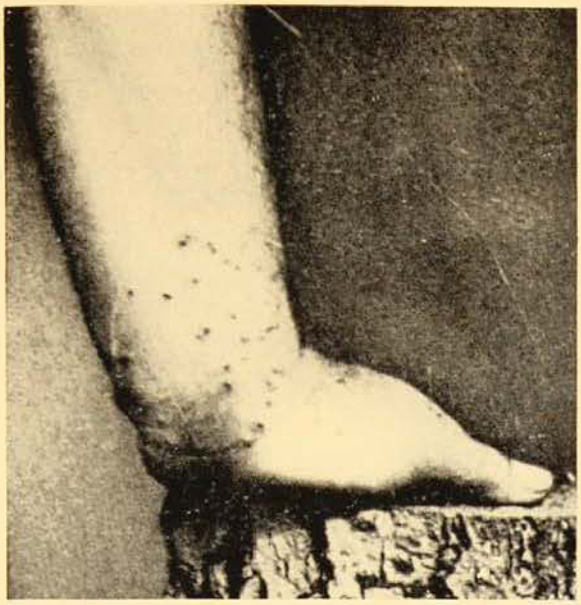
After J. A. Miller.

There are many grades of parasitism between the free-living and independent planarians described above and the completely parasitic flatworms which are generally considered of more popular interest. From associations such as that between the Temnocephala and the crayfish, where the host serves merely as a means of transport and is not injured in any way, perhaps the first steps to the completely parasitic existence are taken by invading the mouth or gills of the host for protection as well as transport. In such a situation one can imagine that the flatworm may find its own food is enriched by the secretions of the host. *Gyrodactylus*, a tiny parasite of this type, lives on the gills of fish. When present in sufficient numbers, this species causes such an increase in the secretion of mucus by the irritated gill tissues that the host fish may actually be suffocated. Infections by this parasite can thus occasion heavy mortality among fish.

A fluke in which the life history is spent partly as a parasite of man and of snails and partly as a free-living creature (albeit only for a short time in certain of the larval stages) is the *Schistosoma*[1] fluke which infects the blood vessels of man. Other adult flukes of different kinds live in the internal organs of sheep, cattle, and other vertebrates, which act as "final" hosts. But, in order that these parasites may multiply and pass from one final host to another, one, or sometimes two, "intermediate" hosts are required and the first of these intermediates (if more than one is involved) is always a snail. Subsequent intermediate hosts may be crustaceans or even fish, as for instance in the case of the lung fluke *Paragonimus* or the Chinese Liver Fluke, *Clonorchis*. In an account such as this it is not possible to detail the life histories of flukes, but a general idea of some of the more interesting phases may be given, if only to indicate their complexity. The eggs laid by the adult pass out of the final host with the droppings or urine or in the sputum. If by chance the egg falls into freshwater the life history can go on. Each egg gives rise to a larva which seeks out the appropriate snail (intermediate host) and, entering the snail's tissue, settles down and produces a daughter-generation of larvae which are often of a very different type from their parent. These daughter larvae may in their turn given rise to more generations in the tissues of the snails, till finally a generation of larvae known as cercariae is produced. These cercariae leave the snails and, where the life history is simple, they are capable of encystment on waterside herbage until eaten by the final host when their life cycle is completed. In the more complex type of life history, the cercariae invade the second of the intermediate hosts. It is not until this secondary host is eaten (raw or undercooked) by the final host species that the adult stage of the life history may be re-established. In the case of Schistosomes, however, the cercaria larvae have the unusual ability to bore through the skin of the host, even of man, in order to reach the blood vessels and so complete their life cycle.

Schistosomiasis, the disease resulting from infestations of these flukes, is common in many parts of the world, particularly in Africa and Asia where agriculture depends on irrigation and the natives work barefooted in the fields and where methods of sewage disposal are primitive. The parasites are also commonly picked up when swimming or wading in fresh waters where they occur. The rash caused by penetration of the parasites is often called "swimmer's itch." During the invasion of the Philippines in the last war, some Australian troops camped near the mouth of the Bislig River. Some of the men bathed in its waters; others liked sea bathing but crossed the sands to wash the salt water off in the river. Soon symptoms of Schistosomiasis were manifest in a third of the bathers. The species responsible was *Schistosoma japonicum* to which man can act as host as well as domestic animals such as dogs, cats and water buffaloes. Other Schistosomes of mammals and of water birds can also cause "swimmer's itch". A similar rash occurring in persons wading in the Murray

[1]Some members of the 1st A.I.F. in Egypt may remember the name "Bilharzia" which was given to the disease caused by infection with *Schistosoma haematobium* flukes.



The pustular lesions of "swimmer's itch" forty-eight hours after infection.

Swamps of South Australia has been studied by Professor T. Harvey Johnston, who suggests that the Schistosomes of ducks and black swans may be responsible.

Another most interesting group of parasitic flatworms are the aptly-named "tapeworms". They are particularly well known for they are common in farm and domestic animals and even man himself. They live as parasites in the gut, especially in the vertebrates. At the thin end of the worm there is a tiny head with suckers or hooks for securing the worm to the wall of the gut. Behind the head there is a chain of segments, often many thousands of them, linked together, although the lower ones can and do break free. Each segment may almost be regarded as a separate individual as it has a complete set of sexual organs and attends to its own nutrition. As distinct from the flukes, there is no digestive system in the tapeworms, food being absorbed through the general surface of the body. Tapeworms have their own type of life histories but are completely dependent on passive transfer from one host to another, even in the larval stages. This is usually accomplished by larval infection of an animal used as food by the final host—earthworms in the case of fowl tapeworms, herbivorous animals in the case of dog tapeworms, and so on.

Taenia saginata is one of the giant tapeworms of man; it may grow to a length of 25 feet. There are perhaps 2,000 separate segments; those near the head are immature but the others, as they approach the free unattached end, become packed with more and more eggs. One or several segments break off and pass out with the faeces. Here they soon disintegrate and, if the stool is deposited on the ground, the eggs may contaminate the pasture and be eaten by cattle. Inside each egg is a larva and if the egg is swallowed by an intermediate host, this larva uses its six knife-like spines to cut through the wall of the gut till it reaches a blood vessel. It is then carried along in the blood stream and finally reaches one of the muscles where it grows to a small bladder-like cysticercus, less than ½ inch across. The bladder is a protective covering for a tapeworm head which lies within it, waiting for a favourable opportunity to continue its development. This happens when the beef is eaten by the final host without its being heated to a temperature sufficient to kill the larvae (120°F for a few minutes.)

Heavy infections occur in communities that like their beef underdone and especially if they have no special arrangements for the safe disposal of human excreta or have faulty meat inspection. A few years ago, light infections were found in cattle on a sewage farm near Melbourne, where crude sewage was used for watering pasture land on which cattle were being fattened for market. The eggs were deposited on the grass from the sewage and it was estimated that only three eggs out of each million were successful in developing to cysticerci. Life seems a lottery indeed for a tapeworm but it still has one trick up its sleeve—that is, the production of enormous numbers of eggs, half-a-million or more each day, so that there is some chance of its survival.

The tapeworm of greatest interest in sheep-raising countries is *Echinococcus granulosus*, a parasite which, as an adult, lives in the intestine of the dog. The larval state is known as the "hydatid" cyst of

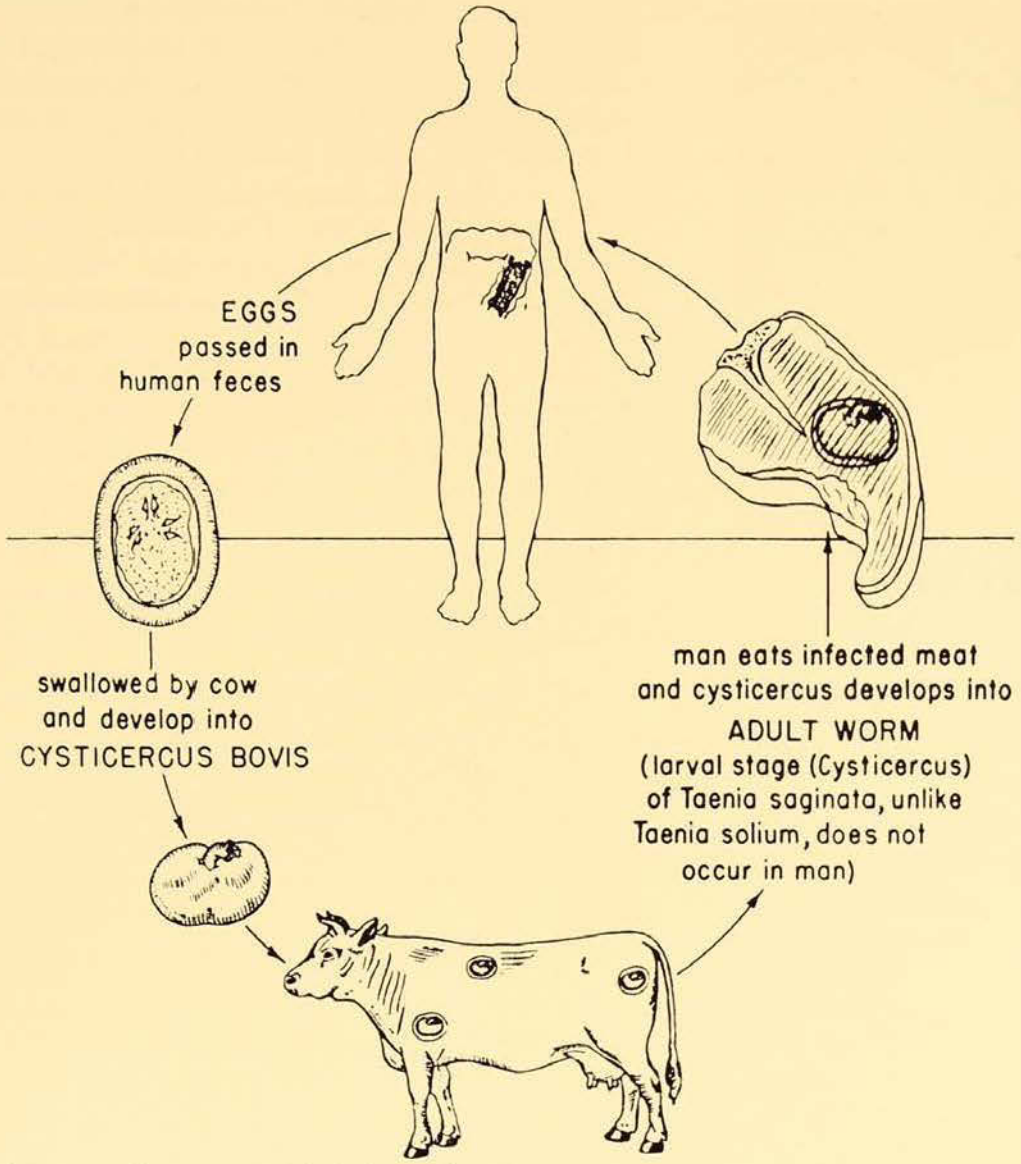


Diagram showing life cycle of *Taenia Saginata*.

sheep and man (which in this case act as intermediate hosts). Those parasites with larval stages which develop in the organs or tissues of the body are always unpleasant and even dangerous to the intermediate host. We do not get so concerned over infections such as *Taenia saginata* (mentioned above) which live as adults in our intestine and use some other animal as a nursery for their young. Sheep get their hydatid infections from eggs scattered over the pastures in the dog's excrement and dogs get their tapeworms originally by eating infected livers or other organs of sheep and even of kangaroos.

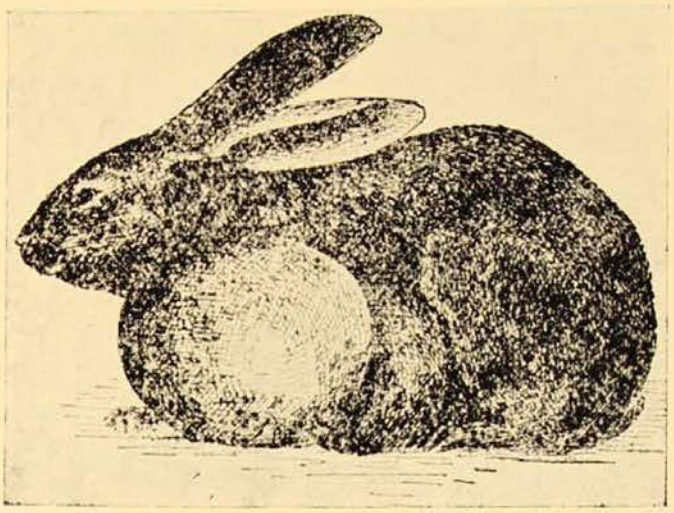
Man is really an intruder in this cycle of development and is of little use to the parasite as he is, as it were, a dead-end and not likely to be devoured after death by any carnivorous animal, at least not in Australia. There are several ways in which man can be infected with hydatids; the most likely is by patting dogs, getting eggs on the hands and failing to cleanse them before eating or before rolling cigarettes. The egg passes thus to the mouth and thence to the intestine where the usual six-spined embryo cuts its way out and reaches the blood stream. Then it is usually caught in the lungs or the liver but may travel to other parts of the body. The larval stage may develop to an enormous size in humans—one abdominal infection has been recorded which contained 11 gallons of cysts and hydatid fluid. Inside the cyst there may be thousands of tapeworm heads as this parasite multiplies in the larval stage.

Rabbits often have cysts, erroneously referred to by members of the public as "hydatids". These also form more than one head in the larval stage; they are the

young stages of another dog tapeworm, *Taenia serialis;* and are usually found just under the skin. If the cyst be opened these heads can be seen on the inside wall like grains of rice. Other small cysticerci are found in the liver and abodmen—these are the larval stages of *Taenia pisiformis* of the dog and have only one head in each cyst. In neither case are these rabbit worms infective for man.

The commonest tapeworm of dogs and cats is *Dipylidium caninum*. Segments of this worm have a characteristic elongate-oval shape, resembling cucumber seeds. When ripe they are voided and the eggs are swallowed by larvae of fleas or by biting lice. By the time the larva of the flea has developed to an adult, the tapeworm has grown to an infective larva in its body cavity. The continuous battle between a dog and its fleas is not without interest to the tapeworm for only when the flea, or louse, is swallowed can the tapeworm complete its development. Infections sometimes occur in children closely associated with domestic pets, probably by accidental swallowing of infected fleas.

The word "parasite" is often used as a derogatory term but may we not be too harsh in our judgment of the parasitic way of life? The free living planarian must eat to live and so must capture and devour as prey slower and weaker animals. It cannot afford any finer feelings of fair play and of regard for the welfare of its fellow creatures to interfere in this ruthless procedure. How different is the attitude of a confirmed parasite like *Taenia saginata* (the giant tapeworm) which has lived through as many generations with man, as has his domesticated dog. The welfare of its host is of supreme importance to it, for if the host dies then food, shelter and all hope of future generations go too. So the tapeworm lies quietly in the gut, bathed in warmed and predigested food and causes as little inconvenience as possible to its harbourer. Only in the case of a multiple infection would the host experience more annoyance than an occasional pang of hunger.



Rabbit showing large cysts caused by subcutaneous bladder worm in the region of the shoulder.

After Moussu.

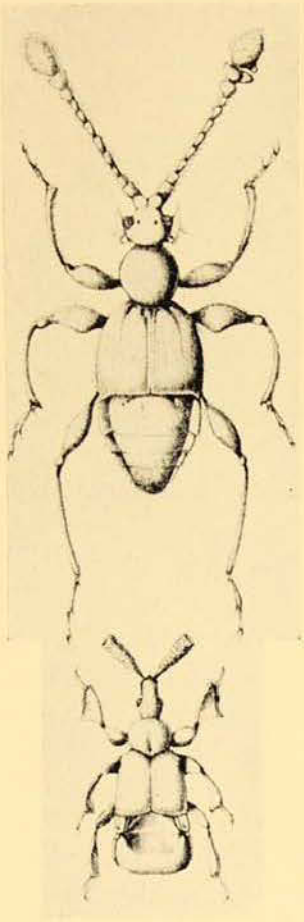
Australian Insects, XLIII

COLEOPTERA, 20.—PSELAPHIDAE AND TRICHOPTERYGIDAE.

By KEITH C. McKEOWN.

TWO families of very small beetles complete the great Superfamily Staphylinoidea; these are the Pselaphidae and Trichopterygidae. The former compensates in number of species for the minute size of the individual insects: almost five hundred species have been described from Australia alone. Of the Trichopterygidae, fifty-one Australian species are known, and most of these have been described within recent years, seven only being known in 1926. It is possible, however, that many more await description since, owing to their minute size, they seldom attract the attention of the general collector; their study has in consequence been the province of a few specialists.

Like the Staphylinidae, or Rove Beetles, dealt with in the previous article of this series, the wing-covers of the Pselaphidae are short, and do not cover the last five or six segments of the abdomen. The antennae present a bewildering variety of form, and, although these are said to be

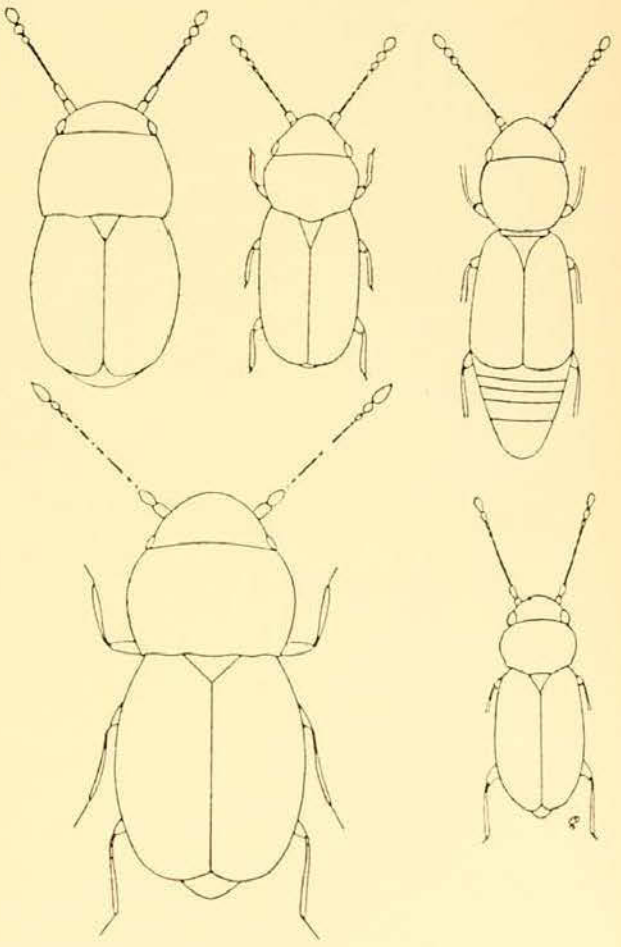


Australian Pselaphidae. *Leanymus palpalis* (above), *Articerus cultripes* (below).

After Raffray.

typically 11-jointed, the number is frequently reduced, and may even consist of a single segment. The palpi in some genera are remarkably developed—but, in those which live in close association with ants, they may be greatly reduced or rudimentary. As A. D. Imms says, they "are evidently no longer needed in species which are fed by their hosts." The feet, or tarsi, are equally variable, and in the genus *Articerus* these are unsegmented. It will be seen that the characters usually of value in classification are notable for their exceptions, rather than their consistency.

The Pselaphids are dull in colour, although occasional species may be yellow or red. They are of very small size and, although our Australian "giant," included in the genus *Palimbolus*, measures 4 mm. in length, *Daveyia mira* Lea attains to only 1 mm. Despite their small size, the insects of this family form an extremely interesting study—an almost unworked field for the patient investigator. The insects are usually to be found in leaf-mould, moss, grass-tussocks, and under bark, but the most interesting forms live in the nests of ants, where they are welcome "guests." The basis of this intimate association between the Pselaphids and the ants lies in the fact that at the base of the beetle's abdomen there is a cavity surrounded by tufts of hairs—often of a golden-yellow colour—which secrete an attractive substance sought after by their hosts. In return, the ants feed their "lodgers" with regurgitated food, just as though they were members of their own race. Some species of Pselaphids, it may be mentioned, are remarkably ant-like in appearance; whether this resemblance has any significance is not known. Detailed observations on the lives of our species, which should be kept in artificial nests with their hosts, are greatly to be desired. Little seems to be known concerning the larvae



Australian Trichopterygidae. *Ptilium parallelum*, *P. rennelensis*, *P. brevipenne* (above); *P. wilsoni*, and *P. simsoni* (below).

After Deane.

of these beetles, except that it is recorded that that of *Chennium* "resembles the Staphylinid type".

Discussing the varied forms of insects associated with ants, W. M. Wheeler wrote: "The existence of a great number of myrmecophiles [ant-lovers] can be accounted for only on the supposition that ant-nests have a strong attraction for terrestrial arthropods. It is not difficult to understand how this can be the case since, in the first place, the nests are usually permanent abodes inhabited for months or years by successive broods of ants. Second, these nests have at all seasons a slightly higher temperature than the surrounding soil. Third, there is usually more or less refuse food or offal, pupal exuviae and dead ants, at least in the superficial chambers. Fourth, the living larvae and pupae represent an abundant and highly nutritious food supply for any insects that can elude the watchfulness of the ants. Fifth, the ants in protecting themselves from larger animals, necessarily protect any small organisms living in their nests. Sixth, the philoprogenitive instincts of the ants are capable of being deceived and exploited, for these insects are so fond of nursing that they are always ready to lavish their affections on any organisms that resemble ant larvae. Since the dwellings of termites, social wasps and bees offer many of the attractions here enumerated, it is not surprising to find that these insects, too, have their nest-mates and parasites."

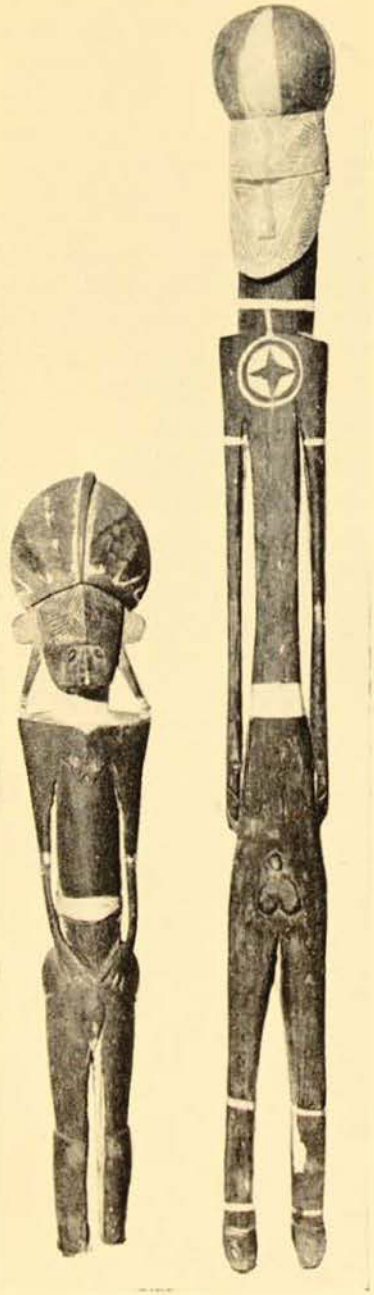
The species coming nearest to the typical belong to the genera *Pselaphus*, *Eupines*, *Euplectus*, and *Sagola* in which the antennae are normal, and may be clubbed or moniliform (like a string of beads). *Pselaphus lineatus* King, one of the few brightly coloured of these beetles, is red. Ant-nest species are found in the genera *Daveyia*, *Leanymus*, *Tmesiphorus*, *Euplectops*, *Tyromorphus*, and others. The subfamily Clavigerinae contains the genus *Articerus*, in which the antennae are exceedingly reduced and the tarsi, or feet, unsegmented: *A. foveicollis* Raff. is a common species.

The family Trichopterygidae contains some of the smallest insects known, and they may measure as little as 0.2 mm. in length; the largest may be, perhaps, 2 mm. long. To the unaided eye, they appear as minute living specks. Under the microscope definite characters are revealed, and we find that the wing-covers almost or completely cover the body, the antennae bear a three-jointed club, and the joints of the tarsi or feet are 3-3-3. The hind or flying wings are astonishingly beautiful objects when greatly enlarged, for they are very narrow and fringed with exceptionally long hairs along the margin. No reason for this development has been suggested. The adult insects are found plentifully in decaying vegetable matter: the genera *Leaduadicus* and *Epibaptus* in rotting leaves; *Philagarica* in moulds and larger fungi; *Achosia* under bark; *Ptilium* under bark; *Cnemadoxia* and *Rodwayia* are inhabitants of ant-nests; and *Hydroscapha* occurs in water. When we turn for information regarding the life-history of these insect midgets, the search is in vain—nothing appears to have been recorded either in Australia or overseas to throw light on the problem. The field for the investigator lies untouched by the plough of knowledge.

The Human Sculptures of the Solomon Islands—II

By FREDERICK D. McCARTHY.

THREE of the main styles in our collection of Solomon Islands sculptures are stylized forms in which traditional types of figures have been preserved and perpetuated over a long period of time. In them the craftsmen have been content to imitate the work of their predecessors, but occasionally a sculptor of outstanding ability has, by the sheer brilliance of his work, produced a figure remarkable for its workmanship, pose, and original variation of the local style.



Typical figures from Buka Island. Note the generally elongate style of these figures with a large head as a dominant feature of the style.

BUKA TYPE.

The carving specialists of Buka Island, and the neighbouring portion of Bougainville Island, in the northern Solomons, have evolved a sculpture of the human figure which is essentially a composition of straight lines and curved or rounded surfaces. The Australian Museum possesses seven specimens, ranging from one foot six inches to three feet six inches high. There are two varieties of the type. One has a slim elongate figure in which the flat or rounded body and arms, parallel to one another, are terminated by the well-marked shoulder and hip lines; the legs are also straight, and the body in some figures is much longer than the legs. In the other variety the body and arms are well rounded and the hips large and prominent. In all of the female figures the breasts are subdued to form part of the design, and they are either flat or very small. The arms form a neat curve from the shoulders to the hands which rest on the hips or are outspread at the base of the stomach. The neck is short and thick and supports a large head on which the distinctive face, in the form of a triangular block, consists of two flat sides extending from the ears to a vertical ridge in the middle. On the lower half of the face the small eyes, nose and mouth are carved in relief. The ears extend across to the shoulders. An elaborate cicatrice pattern of concentric diamonds and parallel lines is either painted in white and red or incised on the face.

Above the face is a large dome representing the hair. It is divided by broad red lines into halves, quarters, segments and bands, according to the clan to which

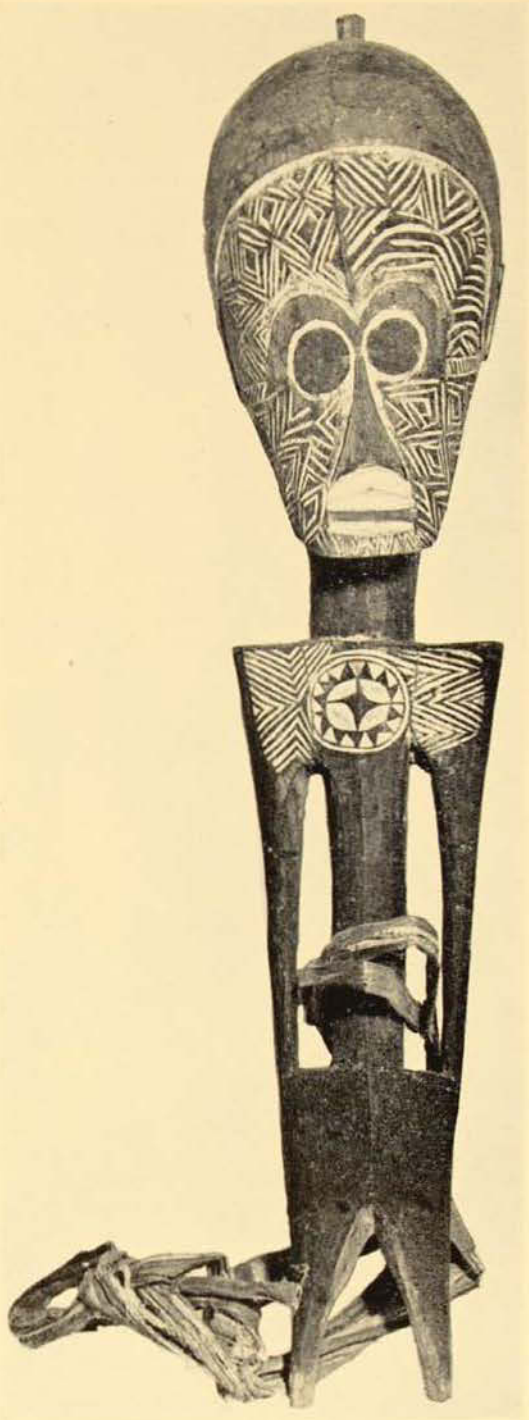
the figure belongs. The ears, breasts and hands may also be painted red. One of the figures is joined to a fish of the species which forms the host of the dead man's spirit.

The finest example we possess of the Buka type is two feet high. Its slim, flat and straight body is decorated with a filigree turtle-shell ornament design between two rhomboid line figures in black and white grooves. The long, thick neck supports an enormous head, from the red-domed top of which the face stretches downwards to a straight, narrow and sharp chin. Colour has been used as an integral part of the design, with black eyes, red nose and eyebrows, and the elaborate cicatrice pattern in black and white grooves. The curved eyebrows and large eyes give this face a dismal owl-like expression, to which the large head adds a suggestion of great wisdom.

GUADALCANAL TYPE.

From a technical and sculptural point of view a round-headed type of human carving from Guadalcanal and Malaita is the most interesting in our collection from the Solomons. The seven examples, of which five are men and two are women, are from one foot four inches to two feet ten inches high. They are carved in both soft and hard wood. The workmanship on the rounded contours of these carvings is somewhat crude and lacks the smooth finish of other types. Here again, the head is large in proportion to the body and is bare excepting on one carrying a bowl. The oval face bears a widely rounded chin with relatively small features, the thin mouth being straight or slightly upcurved, and the inlaid pearl-shell eyes either form a concavity or are set under a straight and well-marked eyebrow ridge. The ears are large and prominent. A horizontal groove marks the hair-line, and the cicatrice pattern consists of concentric circles, zigzags and angled lines. The expression is grim, quizzical and submissive.

Correct proportions are not of much importance in these sculptures because the lengths of the body and flexed legs may be the same or the one may be longer than the other. The arms are carved in relief and the hands are spread out on the belly or on the hips. A deep groove represents the backbone and the buttocks are well shown.



A fine example of Buka Island sculpture.

Two of the male figures are each carrying a baby. On one the father is holding the child against his body, with his large hands outspread over its belly; the child's hands are clasped under its chin and its feet rest on its father's thighs. The other

Above—Carved figures from Guadacanal.
At right—Figure of a man from the southern Solomons, related in style to the Uji type.

figure incorporates an ingenious device to surmount the problem of placing the father's head; here the child is sitting astride its father's shoulders and he is holding its feet against his chest—the child's body forms the father's neck upon which the latter's face is carved in relief so that both faces are in the same vertical plane. The ears are large and perforated. In both carvings the expressions of father and child are the same.

UJI TYPE.

A strongly stylized type of human sculpture, carved in softwood, is produced on Uji Island in the southern Solomons. It bears a resemblance to the elongate Buka type. The twelve examples in our series are from one foot seven inches to two feet seven inches high. A human face is carved in relief on two opposite sides of one of the bases. A head ornament of a different kind surmounts the large head of each specimen. It is marked off from the face by the horizontal rim of the hair paralleled by the straight eyebrows and chin which, together with the prominent ears, frame the face. The nose and flat, straight mouth are carved on a narrow facet, and the sides of the face are almost flat. The broad lower jaw protrudes strongly on a face that varies from square to rectangular in shape, and which bears an expression of defiance and determination strengthened by the simplicity of the facial design and features. The body is stiff and formal, with straight arms, hands on the sides of the hips, thick flat-sided legs flexed forward, and the toes may or may not be indicated.

One of these sculptures is a combination of a long-beaked fish, probably a shark, and a man. The man's buttocks and feet are joined to the fish's neck, and he is holding a heart-shaped article under his chin. His arms are skilfully integrated into the design. Another fine figure is that of a man in a sitting posture, carrying an inlaid bowl on his head. It is one foot eight inches high, with rounded body and limbs, one hand holds the bowl and the other rests lightly upon his hip. He has no neck, and the face is projected well forward from the body. It is a face dominated by the strong chin, with eyes of pearl-shell, and no unusual features about the nose, mouth or ears. There is power and activity, and the vitality produced by the hands of a skilful carver, in every line of the body, an impression added to by the enlarged head and the absence of a neck. The expression is a sinister smile, almost that of a person who enjoys doing evil things or one who has a mystical power over his fellows. This unlocalized figure is from the southern Solomons and is related in style to the Uji type.

The significance and function of the above types of human figures are unknown. There are, in addition, other types which are, unfortunately, not represented in our collection. In the Shortland Islands a human head was carved on the top of each of the four posts erected at the grave of a chief or person of high rank whose body had been cremated. Large human and other figures were set up around cemeteries on Guadalcanal Island. The natives of various southern islands, including Ulawa, San Cristoval, Uji, and others, carved a human figure, or a shark holding a man in its mouth, at the top of the large posts supporting the ridge-pole of the men's club-houses and canoe-houses; these formed memorials to the great fishermen, warriors, chiefs, and others of the past, but very few museums possess examples of them. On Bougainville small human figures, known as *kaisa*, carved on a long handle, were used in the Upi ceremonies.

Solomon Islands sculptures possess many features in common. Most of them are painted black with a pigment from the Parinarium nut; they are attached to a rounded base cut out of the same piece of wood, the genitals are usually large and prominent, and the head is larger than normal. Life-size figures occur in these islands, but very few appear to have ever been collected. Stylization in traditional styles over-rides in general the original or creative approach to the work, and the figures lack the movement, vitality and craftsmanship of African Negro sculpture in which there is a greater range of originality in individual figures. There are no doubt many singularly outstanding examples of Solomons sculptures in museum collections throughout the world, but the custom of burning the figures used in ceremonies has destroyed many of the masterpieces and made it almost impossible for old pieces to survive except in the club and canoe houses.

THE AUSTRALIAN MUSEUM
POPULAR LECTURE SYLLABUS, 1951.

June 28 ..	"LIFE IN THE OCEAN DEPTHS"	G. P. Whitley, F.R.Z.S.
July 12 ..	"HOW ANIMALS BEHAVE"	L. C. Birch, D.Sc.
July 26 ..	"INTERESTING AUSTRALIAN FOSSILS"	H. O. Fletcher.
Aug. 9 ..	"THE STORY OF PERFUMES"	F. R. Morrison, A.A.C.I., F.C.S.
Aug. 23 ..	"FEATHERED OCEAN WANDERERS"..	J. A. Keast, B.Sc.
Sept. 6 ..	"ROCK ENGRAVINGS OF THE SYDNEY DISTRICT"	F. D. McCarthy, Dip.Anthr.
Sept. 20 ..	"METALS"	F. P. J. Dwyer, D.Sc.
Oct. 4 ..	"EXPLORING BETWEEN TIDEMARKS IN VICTORIA"	Miss E. C. Pope, M.Sc.
Oct. 25 ..	"MINERALS AND MAN"	Prof. C. E. Marshall, Ph.D., D.Sc.

DOORS, 7.30 P.M. ADMISSION FREE. LECTURE, 8 P.M.

The Lectures are usually illustrated by Films or Lantern Slides.

More about Wood-swallows

By J. A. KEAST, B.Sc.

Female White-browed Wood-swallow on nest in tree stump.

SOME time ago[1] I related some personal experiences with the Wood-swallows of Australia and New Guinea, and commented upon their distribution, nesting cycle, and nomadic habits. Space did not then permit me to discuss several intriguing aspects of the behaviour of these birds. This I shall do now.

CLUSTERING.

In 1848 John Gould[2] quoted John Gilbert as writing of the Dusky Wood-swallow:

> "The greatest peculiarity in the habits of this bird is its manner of suspending itself in perfect clusters, like a swarm of bees; a few birds suspending themselves on the under side of a dead branch, while others of the flock attach themselves one to the other, in such numbers that they have been observed nearly of the size of a bushel measure."

In the background of the coloured plate of the species a cluster is figured, but presumably its appearance was conjured up by the artist, for it is much exaggerated with the bulk of the birds suspended, rather like a drop of water, well below an almost horizontal branch.

Since Gould's time numerous references have appeared in ornithological literature to the clustering habit. Almost all of these refer to the Dusky Wood-swallow, but a few refer to the Black-faced species, and even to the unrelated Rainbow-bird. Unfortunately, however, only in very few cases are detailed descriptions of the happening to be found. A. H. Chisholm[3] has given a graphic description of a flock roosting in

[1] Keast, J. A., "The Wood-swallows," AUSTRALIAN MUSEUM MAGAZINE, x, 2, Mar., 1950, p. 55.
[2] Gould, J., "The Birds of Australia," vol. ii.

[3] Chisholm, A. H., *Birds and Green Places*, 1929, p. 59.

this manner in southern Queensland. A group of some thirty birds were disturbed from the fire-blackened trunk of a roadside tree at dusk one evening and alighted nearby. Realising that this was an example of the "swarming" habit described by Gilbert, the author drew rein to watch. Then, almost as one, the birds took flight and alighted together on the rough charcoal in a broad depression in the side of the old tree close to the top. "What shuffling there was then! What shrewd manoeuvring for positions! What exclamations and expostulations!" Subdued but animated cheeping accompanied the roosting. Late-comers were observed to push their heads inwards from the bottom of the mass, but several wriggled inwards from the side and one or two from above. The birds were disturbed several times to make them repeat the performance, and on nearly every occasion one bird perched alone on the top of the tree—a sentinel, the observer suggests.

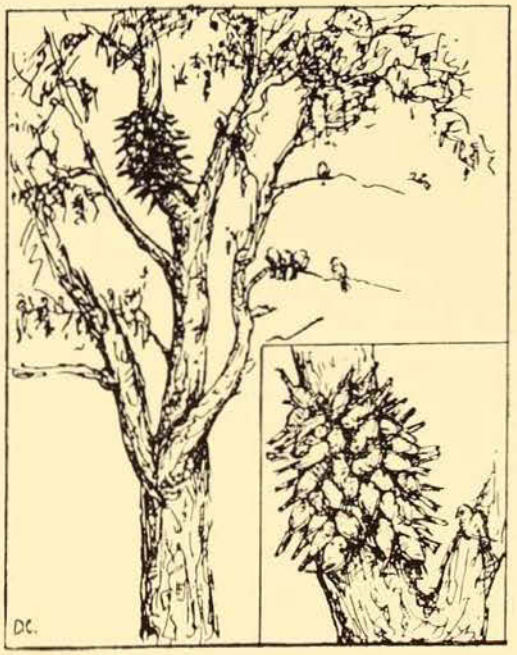
The only naturalist to make a frequent study of "swarming" is Edith Coleman[4], of Blackburn, Victoria. Yearly from 1944 to 1949 she has observed it to commence in the last half of February. She noted that the same tree may not be chosen on successive nights (the choice possibly varies with weather conditions) but that there were favourite trees which were used from year to year. On one occasion the birds perched in a defoliated tree: "the cluster stood out boldly against the evening sky—a great bristly oval mass that should have presented a formidable appearance, even to a bird of prey." This observer describes a "regular routine" prior to clustering: ". . . hawking, play and song among the trees until the sun goes down, then clustering with much chattering."

Clustering has now been recorded from the greater part of southern Australia. It follows the flocking that takes place at the end of the breeding season. There is little doubt that the habit is protective, particularly during heavy rain (the habit has been observed immediately prior to thunderstorms) and during cold weather. It has, however, been observed as early as December and the fact that Mrs. Coleman has observed it so often in February (when the weather is quite warm) suggests that it is a flock habit which does not require adverse conditions for its initiation. At the same time, not all Dusky Woodswallows roost in clusters during autumn and winter, there being many references to twos and threes perching together on a limb in the more orthodox manner of birds. Up to 200 birds have been recorded in a cluster.

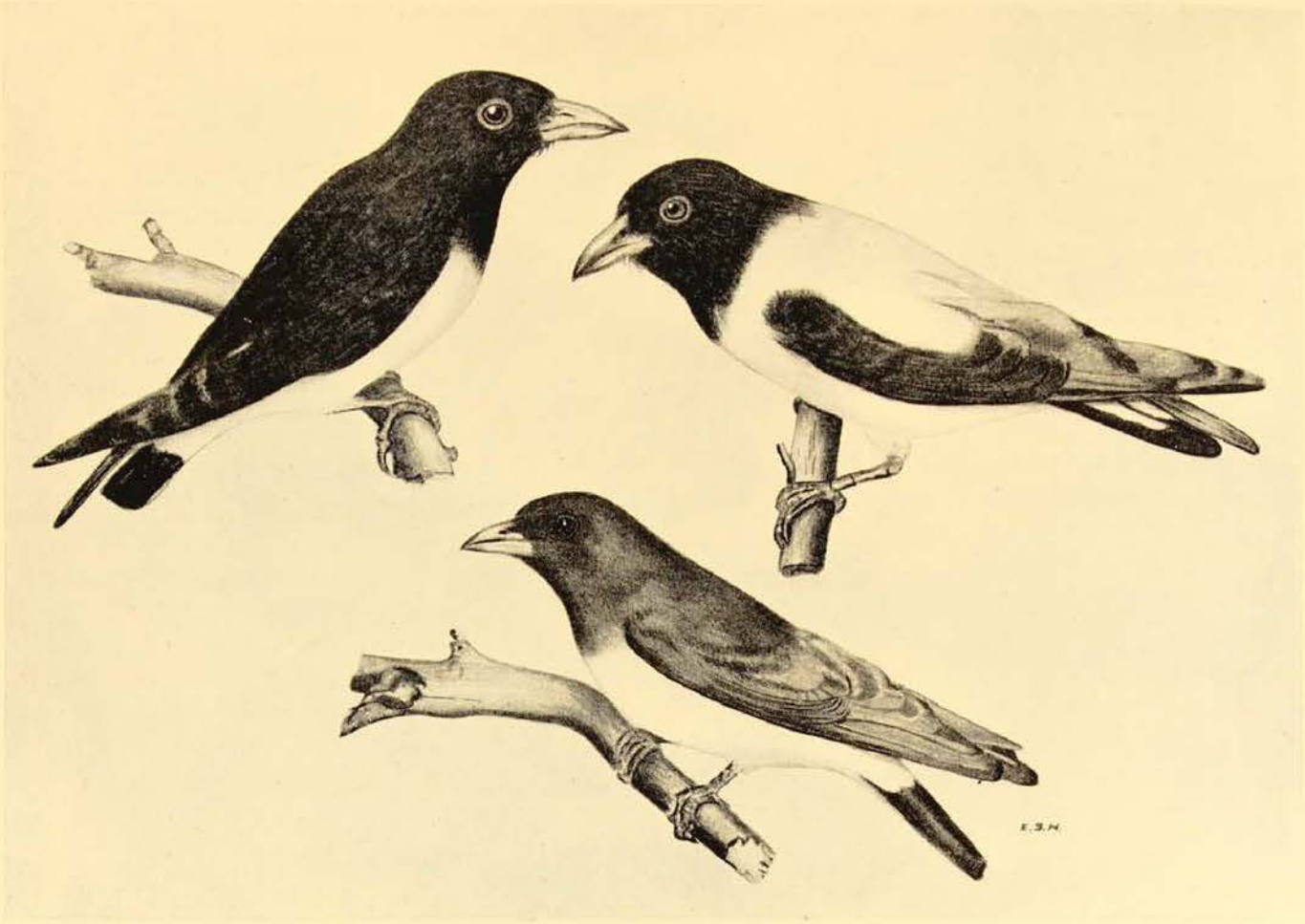
One point requires clarification in regard to the habit of clustering: that is, whether or not the birds ever actually cling to the backs of each other as described by Gilbert. Desirable as this may be from the viewpoint of heat-conservation, I feel that it is unlikely, as over a period considerable damage to the plumage of the flock must surely ensue. Dead birds have been reported following clustering[5] but this could have been due to cold. The matter could be easily solved with field-glasses and a spotlight.

[4] *The Victorian Naturalist*, 1947, p. 28; 1948, p. 230; 1949, p. 57.

[5] Wigan, M. L., *The Emu* (1931), p. 93.



Clustering Dusky Wood-swallows at Blackburn, Victoria.
From E. Coleman, *Victorian Naturalist*, 1948.



Three Pied Wood-swallows. (*See* article of March, 1950.)
Upper: *Artamus maximus* of the New Guinea highlands. *A. insignis* of New Ireland and New Britain.
Lower: *A. leucorhynchus* (White-breasted Wood-swallow) of Australia and New Guinea.
E. S. Hoskin, del.

SONG AND MIMICRY.

The typical call-notes of the Wood-swallows are flock calls, harsh to the ear at close quarters but which merge into melodious twittering when the birds are soaring in the air. Several species, however, are capable of sweet and sustained song. Such a performance is sufficiently unusual, however, to have caused more than one observer to express astonishment at hearing it for the first time. This was my feeling when, on a bleak heathland in early spring, I came upon a solitary Dusky Wood-swallow in full song. It was perched some 10 feet up in a dead shrub and notwithstanding the easterly wind which buffeted its exposed perch it mimicked a variety of heathland birds, particularly the White-cheeked Honeyeater. Despite the weather it was animated, no doubt, by the coming of the spring. My experience parallels that of G. R. Gannon[6], another Sydney ornithologist, who, when strolling in Sydney heathlands one autumn, followed up a "delightful little twittering song," only to find that it emanated from one of a small party of Dusky Wood-swallows.

The White-browed Wood-swallow also, on occasions, mimics other birds (*e.g.*, the Pallid Cuckoo and Brown Tree-creeper).[7]

A VALUABLE ECONOMIC ASSET—THE FOOD OF THE WOOD-SWALLOWS.

The Wood-swallows are primarily insectivorous in diet and examination of stomach contents has shown pentatomid bugs, cutworms, beetles, ants, grasshoppers, moths, dragonflies—in fact almost any

[6] Gannon, G. R., *The Emu* (1933), p. 24.
[7] D'Ombrain, A., *The Emu* (1934), p. 292; Chisholm, A. H., *The Ibis* (1937), p. 703.

insect is likely to fall victim to these efficient little hunters. Evidence is accumulating that they are amongst the greatest enemies of the plague grasshopper, *Calataria terminifera*. For example, a former Government Entomologist, W. W. Froggatt, wrote:

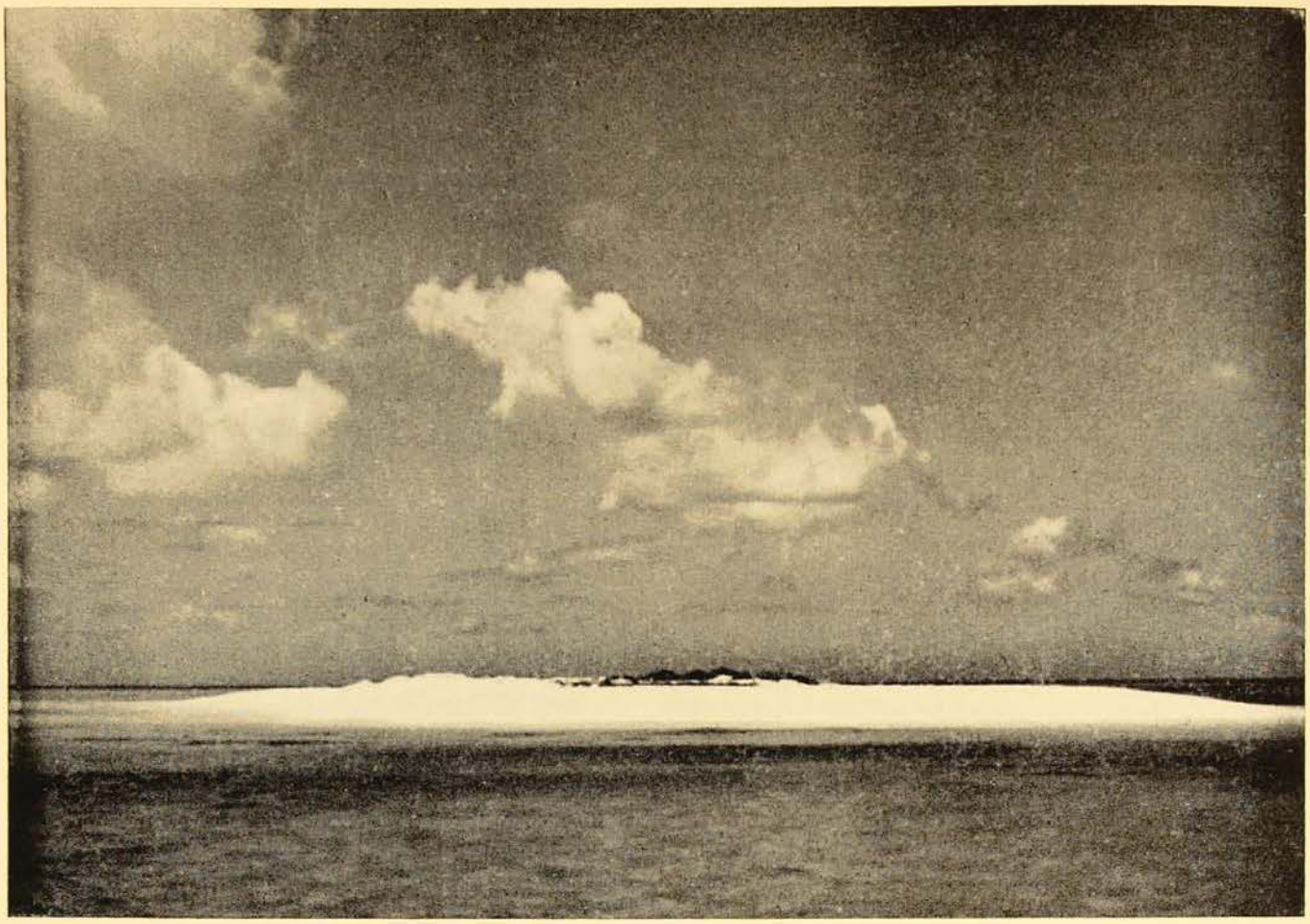
> "In the spring of 1919, in the Hunter River district, numbers of locusts swarmed out in the paddocks, but thousands of Wood-swallows arrived from the north and attacked the locusts while in the hopper stage so vigorously that scarcely an insect escaped to reach the perfect flying state."[8]

K. C. McKeown, who for some years was entomologist to the Irrigation Commission in the Riverina, informs me that in the Wagga and Leeton districts swarms of newly-hatched 'hoppers can frequently be detected by the mass of Wood-swallows over them. He has seen these birds (chiefly the White-browed and Dusky species) form a swirling, fluttering cloud, which "tumbled" over the paddocks as the birds from the rear fluttered to the front. It is in the first weeks after the hatching of the grasshopper eggs that the Wood-swallows are most effective; apparently once the 'hoppers reach the flying stage they are rather too large for these birds. No estimates appear to have been made of the numbers eaten by any one bird in a day—however, a White-breasted Wood-swallow shot by a Museum party in the Riverina some years ago was crammed full with the partially digested remains of grasshoppers. Although the birds' value in destroying grasshoppers is great, in districts where domestic bees are numerous they will eat these insects and thus may become pests to apiarists.

The Wood-swallows have, strangely enough, evolved the nectar-eating habit and may, at certain times, be seen competing with honeyeaters and lorikeets amongst the blossoming trees. When this was first recorded it was assumed that they were merely in the trees after insects attracted by the flowers. Birds have been shot and their stomachs proved to contain nectar and, all in all, there are now too many records to allow of any other hypothesis than that they eat nectar when the opportunity offers.

Some years ago, in the Tamworth district, I watched some thirty Dusky Wood-swallows fluttering about the outer foliage of a flowering White Box (*Eucalyptus alba*). Closer approach showed them to be clambering amongst the blossoms, sometimes hanging upside down as they buried their bills in the calyces of the blossoms, and they exhibited all the dexterity of lorikeets! The blossoms contained nectar but very few insects. The birds have also been recorded as feeding on the nectar of such trees as the Silky Oak and the Ironbark, and on the sweet secretion on the branchlets of White Cypress Pine and juices of the cultivated fig. The "sweet tooth" of the Wood-swallows undoubtedly provides them with a useful accessory food, and may well be a factor in the evolutionary success of some of the Australian species.

[8] *Some Useful Australian Birds*, p. 33.



Upolu Bank, near Green Island, off Cairns, Queensland. A typical small mound (cay) resting atop a large coral bank. Except for the sparse vegetation, the composition is carbonate of lime—gravels and fine sand.

Photo.—H. Chargois, F.R.P.S.

Wealth in Coral Gravels

By FRANK McNEILL.

THE extent of our dependence on the world's inorganic products is something which often escapes general notice. We, of course, know of the commonplace metals such as iron, copper and lead mined from the earth and used in manufacture. Most are even aware that gypsum is the source of plaster of paris and that the ochre used in so many of our paints is secured at shallow depths. Vast wealth has been won by converting such resources to the ever-demanding needs of mankind.

While great advances have already been made in the exploitation of nature's bounteous crude materials, there are always surprising new discoveries cropping up. One recent find of far-reaching effect has an intimate link with things organic, and thus accounts for the writer's present deviation from subjects normally zoological in character.

The story is one about calcium carbonate, a product without which this world of ours could not carry on. Not that the material in its several forms is anything but common; it has been used for centuries in building and manufacturing. A high-grade quality in the raw state, however, has always been particularly scarce. This is in great demand for certain specialized purposes, and specialist millers have been

alert for years for new sources of supply. One such is the Great Barrier Reef of Australia. Tests of a number of samples from there have proved boundless commercial possibilities and great potential national wealth. The vast deposits awaiting collection are scattered for twelve hundred miles along the north-eastern coast of the continent—the fine gravels as well as sands which are the wastage or debris (detritus) of the coral banks. In hundreds of places they comprise the low mounds heaped above or near to the surface by the action of the waves and the wind. Many are tree-decked coral isles, while others carry either little or no vegetation whatsoever.

Details of the approach to this big discovery of the value of the coral gravels are worth recording. In 1937 a Mr. F. Hodges of Sydney called at the Australian Museum and asked for some fragments of bleached coral skeleton for the purpose of experimental milling and processing. Later he brought in some powdered calcium hydroxide derivative of several grades. At that early stage this manufacturer sensed great commercial development of the products of the Great Barrier Reef. These early results, however, did not meet with the expected standards required, and further investigation was postponed until a personal visit could be made to the actual source of supply. It was not until 1947 that Mr. Hodges was able to make a trip in company with the writer and to gain an intimate knowledge of the resources of the area. Our camping excursion was to the Capricorn Group of coral islands, east of Gladstone, Queensland. There an extensive survey of detritus material in many situations was made, and selected samples of various grades collected for later milling and testing. All the samples have since been found to be equally valuable for processing, and the results proved little short of astounding.

A revealing fact is that, in Australian industries at least, the purest calcium products used are derived from white marble, an altered form of limestone. The production is costly, largely by reason of the great care needed in the selection of suitable material from widely scattered localities. Further, the milled derivatives always contain the impurity magnesium, in deleterious quantities; up to 2 per cent. is present in some batches of the raw material. This makes most of the calcium hydroxide derived from white marble unsuitable for many chemical processes. On the other hand the coral detritus is virtually pure calcium carbonate, free from magnesium of any consequence, and its calcium hydroxide derivative is eminently suitable for use in specialized manufacture. Salt (sodium chloride) is absent from a great amount of the raw material, and when present it can easily be removed by a simple washing process. The source of supply is limitless, easy of access, economically approachable and needs no selection. It is decidedly softer than white marble and the virtually broken-down state of the deposits makes for far easier milling.

There is such a tremendous demand for processed high grade calcium carbonate that the commercial possibilities of the Great Barrier Reef in this direction are almost unlimited. The initial experiments by Mr. Hodges have disclosed that a minimum of 240 tons of various grades can be absorbed every week by only a limited number of local manufacturers. First the raw material is changed into calcium oxide (quick lime) by heating. It is then ground into various grades and hydrated to become calcium hydroxide.

Some of the lesser known uses for high grade calcium hydroxide are as a flux for glaze on metal refrigerators, baths and sinks, and for pottery, wall tiles, etc. It is also extensively used in the manufacture of sugar, gelatine and leather.

In Brisbane there is a milling firm which processes coral material dredged from a dead reef on the silted floor of Moreton Bay. This calcium carbonate is commercially valuable, despite the extensive cleansing and crushing involved in processing. The calcium hydroxide derivative, however, is not nearly the quality of that from the Great Barrier Reef deposits, as shown by Mr. Hodges' experiments. Of the last-named he claims "peculiar physical properties which other carbonates do

not possess." To those familiar with the raw material this finding points to the presence in the detritus of substances other than coral remains. Associated with the growing coral are other organisms which secrete calcium carbonate from the sea water and contribute a large percentage of dead remains to the deposits. First there are the primitive marine plants called coralline algae (*Lithothamnion*), easily detected in life by their low encrusting growth and pinkish to mauve coloration. Next are the disintegrated skeletons of Foraminifera, the giants of the Protozoa or single-celled animals, so abundant in tropical parts. The largest kinds are round, flat disks, often with fluted edges, and may measure half an inch across.

The vast accumulations of detritus along the Great Barrier Reef have lain dormant and unnoticed for centuries. They can be processed into highly valuable commodities for half the present cost. It will be interesting to see how long a time will elapse before this source of national wealth is turned to account.

The Eagle stands Accused

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

THE eagle has once again swooped from the clouds into the limelight and quite a controversy is raging between graziers and ornithologists as to its economic status.

It is a "bird of prey", one that is defined by the dictionary as a bird that feeds on the flesh of other animals, a term applied rather too largely to all eagles, hawks and owls but not including such flesh-eating birds as crows, ravens, butcher birds, currawongs or kookaburras.

It is an unfortunate term. The more I think about it the less I like it, because the mere mention of "bird of prey" inspires one to conjure up visions of a ruthless killer; whereas, like every other creature in the realm of nature, it only kills to live. There would be nothing wrong with that if the eagle restricted its diet to rabbits and the native fauna, but when it attacks sheep, lambs and poultry, it becomes a marked bird and most people are too anxious to "frame" it because of the acts of a few.

The present controversy arose during a recent conference of ornithologists, following which the Tasmanian authorities placed the eagle on the totally protected list. The ornithologists then requested that other Australian States do likewise.

The matter came before the New South Wales Fauna Protection Panel for consideration, where it was decided that not enough scientific data was available, and information is now sought from pastures protection boards, farmers and settlers' associations, and individual graziers.

It is true that an eagle is a magnificent and noble bird, ranking as one of the largest in the world. In the air, soaring amidst the clouds, it is an inspiring sight, but in most parts of Australia it is accused of being a killer of sheep and lambs, and a menace to the pastoralist.

There is no doubt that the eagle, known in the sheep country as "The Hawk", occasionally kills lambs, hunts and disturbs lambing ewes, and will devour dead lambs, but the evidence against it is often more circumstantial than real. It also kills many rabbits in the course of a year but that alone does not prove it to be of any great economic value. There are two sides to the question but to date there is not sufficient evidence, either to convict the eagle as a rogue, or to protect it as a friend.

Early in this century, when I lived in the country, the very cry "hawk" was the cue for everyone to rush for guns, but to-day, as a result of better education in

regard to the value of bird life, the cry "hawk" seldom attracts much attention. In the year 1900, had you sought the opinions of graziers, almost 100 per cent. of them would have declared the eagle a pest and a menace but to-day the general opinion is much divided.

Following a recent broadcast appeal for information, I received a very large mail from all over Australia and, on sorting out the letters, I found that 57 per cent. were definitely against protection for the eagle, 30 per cent. favoured protection, and 13 per cent. were open minded, were not worried about the loss of some few lambs, and stated that neither the good nor bad points of the eagle constituted any great economic problem.

For your information, here are a few of the comments taken from lengthy and informative letters:—

Caroda: "The eagle is definitely a curse to the man who breeds sheep, as it accounts for quite a number of lambs, and can come from such great distances in such a short space of time . . . as regard its destruction of rabbits, I am of the opinion that the eagle is absolutely useless."

Western Australia: "My experience goes back forty-five years. I have known eagles to take live lambs on rare occasions, but they mostly feed on dead lambs . . . I consider the bounty paid on the heads of eagles quite wrong . . . The eagles eat young rabbits, parrots and other vermin, and in my opinion should be protected."

Queensland: "They do most certainly kill sheep and lambs; as for devouring carcases, they are no match for the pig and the fox, but one never hears of protecting these.

"I have a great admiration for the eagle in the air, gliding and diving among the clouds, but as soon as he descends my admiration ceases."

South Australia: "On my property they have taken lambs and turkeys, but they do not, as far as my experience goes, do much harm except in drought years."

Far N.W. Queensland: "I have lived here for years; eagles are very troublesome at lambing time, possibly because we had no rabbits or other small mammals . . . nests were full of bones of lambs."

Wellington, N.S.W.: "I think the Australian Eagle Hawk should be protected, and the sooner the better. I say this as a breeder of sheep for many years . . . The good points of this bird far outweigh the evil ones."

In reading through the letters (those quoted being typical examples), I find a great diversity of opinion but it would appear that most of the damage done by eagles is during drought years, and in this regard it may be interesting to read the words of one of our greatest bird observers, the late Dr. W. MacGillivray of Broken Hill, who spent about two months every year touring the west, from Alexandria Downs through western Queensland and New South Wales. He wrote this letter to the *Barrier Mail* some years ago:

"More lambs and sheep have been lost during any one period of drought, or scarcity of water through mismanagement . . . than have been killed by eagles since the settlement of the country. During my first fifteen years' residence in this district I have examined nearly 200 nests of eagles during and after the lambing season, and during the breeding season of the eagle, and in only one of these did I find the remains of a lamb. Under all of the nests were rabbit remains, the skulls showing as many as 200 in some instances."

Despite the divided opinions of graziers, the eagle war goes on and bounties are still paid on every head of a bird produced. Away back in the year 1899, bounty was paid on the heads of 7,865 eagles. In the year 1907 this was reduced to 873 birds, and figures remained round about 1,000 to

1,500 for several years. In 1947 there was renewed activity and 3,573 eagles were destroyed, the greatest numbers coming from Tamworth, 687; Cobar, 683; Hillston, 471; and Wentworth 437; and in the year 1948 another 1930 eagles were destroyed.

In regard to bounties, it may be interesting to note that in the U.S.A., over a period of years, the stomach contents of 70,000 hawks of different species were critically examined and it was found that, with few exceptions, hawks were of value in destroying rats, mice and other vermin. In one well known poultry State, over 100,000 hawks and owls were destroyed in a period of eighteen months, and the bounties paid totalled 90,000 dollars. It was estimated that, on an average, 5,000 chickens valued at 1,250 dollars and fowls at 1,875 dollars were taken by hawks in eighteen months, so that State alone paid 90,000 dollars to save a mere 3,125 dollars' worth of poultry. Taking into account the value of the hawks to the farmer in destroying mice, each mouse doing several cents' worth of damage daily, it was shown to the poultry farmer that each hawk was worth 10 dollars a year to him, and that the State threw away 2,105 dollars for every one dollar saved.

To-day in that State, and throughout America generally there is a very different attitude towards hawks, and the farmer thinks twice before attempting to destroy them. Meanwhile in Australia the war against the eagle continues and, until a searching investigation is made, no definite opinion on its economic status can be expressed.

As this story goes to press, a newspaper cutting from the *Western Stock and Station Journal* has been received and, in that, Mr. Paul F. Korsch, of Sarona Downs, Nyngan district, gives his opinion after forty years' observation. He has seen eagles devouring carcases of lambs, but on only two occasions has he observed them doing the killing. He admits that in his examination of nests, he has found only the remains of rabbits, but concludes his story as follows:

> "An occasional bird will no doubt learn to attack lambs, and can do a lot of damage in a short time during the lambing season. But taken by and large, the wedgetail does far more good by destroying rabbits than affecting the grazier's potential profits."

The editor of that journal, and of this magazine, invite other graziers and readers to forward their views.

Cinema Screenings, 1951

Through the courtesy of a number of film libraries, whose names are shown in the list below, the Australian Museum has been able to arrange a series of half hour cinema screenings in the Museum Lecture Hall, at 1.15 p.m. on the first and third Wednesday of each month, admission free. Further information about the undermentioned and forthcoming programmes may be obtained at the Museum.

June 20: "Marine Animals and Their Food"—N.S.W. Film Council. "Cliff Dwellers"—N.S.W. Film Council.

July 4: "Vegetable Insects" (Colour)—Canadian Government. "Atlantic Salmon"—Canadian Government.

July 18: "The Grand Canyon" (Colour)—United States Government. "Mountain Building"—N.S.W. Film Library.

August 1: "Indian Canoe"—Canadian Government. "How to Build an Igloo"—Canadian Government.

August 15: "Primitive People" (B. & W. Sound)—N.S.W. Film Council.

September 5: "Beginning of History"—U.K. Information Office.

September 19: "Spreading Wings" (Colour)—U.S. Information Service. "Gift of Green" (Colour)—U.S. Information Service.

October 3: "Erosion"—U.S. Information Service. "Rain on the Plains"—U.S. Information Service. "Grain That Built the Hemisphere"—U.S. Information Service.

October 17: "The Use of Chemicals for Shark Repellent" (B. & W. Sound)—U.S. Information Service.

Tracks in the Sand

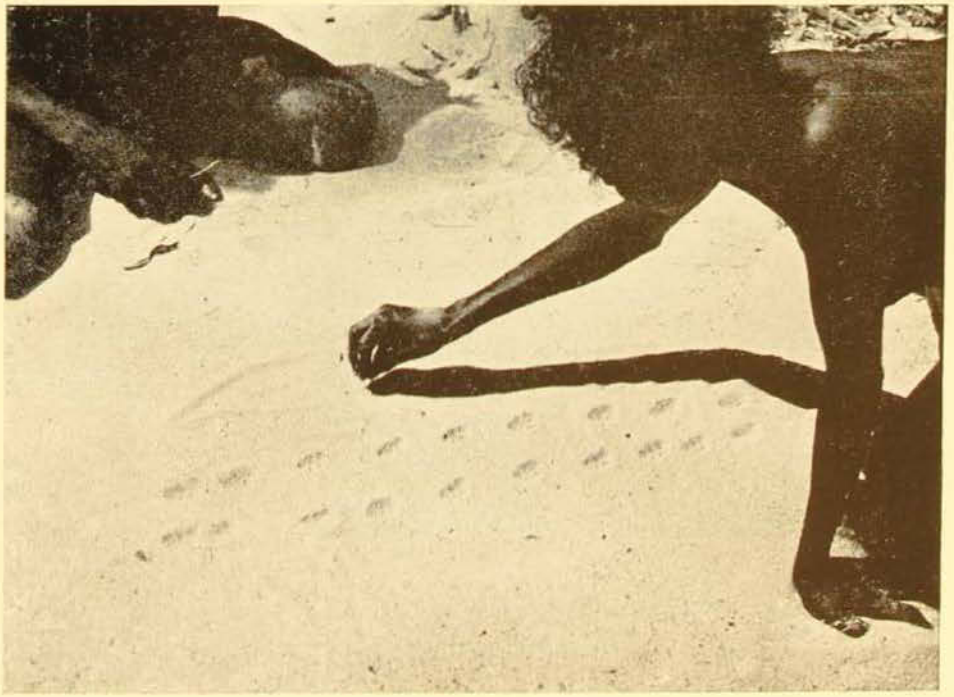
By ELIZABETH C. POPE, M.Sc.

TO the aboriginal who has to hunt and trap for food a knowledge of signs and tracks left by animals must be a regular part of his education. Much time is spent in instructing the aboriginal children in the art of recognizing tracks and reading from them what the animal is doing. Often tracks are drawn in the sand during these lessons to illustrate what is meant and the children frequently play games among themselves by drawing various types of tracks and quizzing one another about them.

While tracking is most important to primitive peoples, it is not without its uses to those of us who consider ourselves civilized. Is not the detective largely someone who has been trained to read tracks and signs? Even the ordinary householder comes to have a limited knowledge of animal tracks—if only to be able to work out whether it was his own dog or next-door's cat which left all those prints in the new concrete path and whether a mouse really has been at the dripping tin.

Personally I find that animal tracks—especially those made on the clean sands of deserted beaches—have a particular fascination. I am never satisfied till I can find out the creator of the tracks and learn how they are made. Everyone should have seen somewhere pictures of turtle tracks on the smooth sands of our tropical beaches. These are made by the female as she toils across the uphill sands to reach the higher parts of the shore to lay her eggs in a specially-dug hole. Many Australians can distinguish the upward track which tells the story of her laborious progress up the slope heaving her body, not built for locomotion on land, a few inches at a time, from the smoother, continuous track downhill, back to the sea.

Birds' footprints often leave pleasing patterns on the damp sand near the water's edge, and it is amusing to try and distinguish the different types and determine what the bird was doing—walking, running or taking off for flight. This is generally an easy matter, for the birds can be seen and the various tracks correlated with the makers and their activities. Not so easy to pin down are some of the delicate tracks which are often to be found



An Arnhem Land native illustrating his remarks by drawing the track of the animal of which he is talking in the sand.

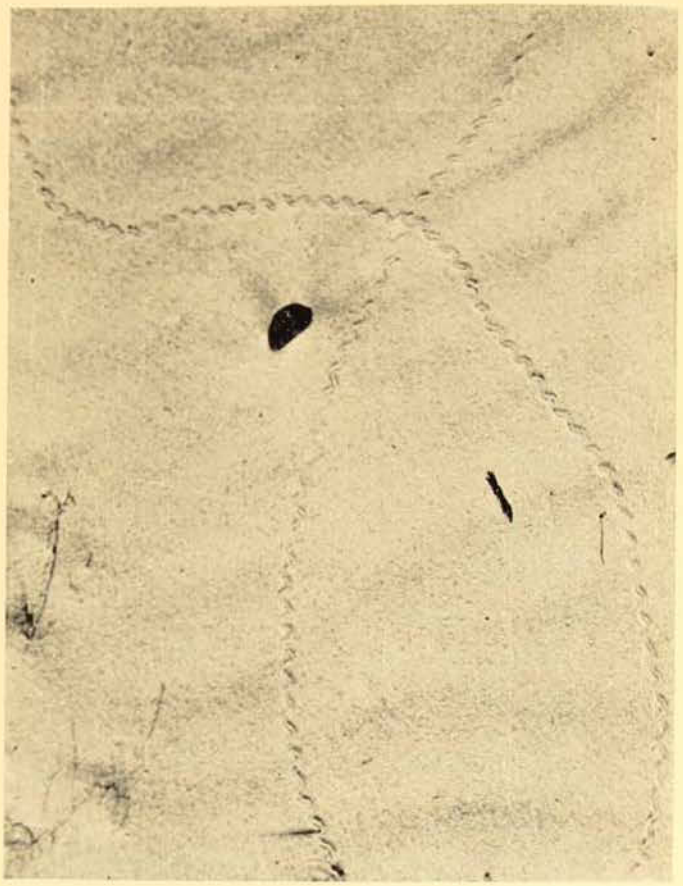
Photo.—F. D. McCarthy.

among the dunes, just behind surf beaches, for these are mostly made by nocturnal animals or by unobtrusive creatures which escape notice unless you are watching for them.

One type of track often seen, provided there has been no wind or rain since the previous night to obliterate it, is the straggling runway of the Ghost Crab, *Ocypode*, leading from the high dunes to the sea. The crab does not, as a rule, emerge till dusk or thereabouts and generally begins his evening's operations by shovelling a pile of sand out of the hole which is the door to his deep, moist burrow. Probably a loose plug of sand is used to reduce the size of the bore of the burrow through the day and thus conserve moisture, and no doubt it is this which is removed as a preliminary to the night's prowling activities. These crabs have become so used to life on land that they actually drown if kept entirely immersed in sea-water for much more than twenty minutes, but they are nevertheless tied irrevocably to the sea, for they have to return to it at intervals through the night's activities to bathe their gills and they have to go back to it when breeding and laying their eggs. The tracks they leave in the sand mark the routes they traverse either on their way to the shallows or on their seavenging expeditions. Being crabs, they run sideways and the marks left by their four pairs of walking legs form a band of confused, straggling impressions like oversized commas in the sand.

Tracks left by the ghost crab, *Ocypode ceratophthalma*, in the sand dunes near Smoky Cape.

Photo.—E. Pope.



The rick-rack braid patterns left by the underground workings of two Therevid larvae whose paths crossed in the high sand dunes near Norah Head.

Photo.—E. Pope.

For some time we were puzzled by a type of track which we used to see in the high sand dunes. It was regularly kinked, first to one side and then the other, like rick-rack braid. The mystery was not solved till we thought of digging in the sand at the ends of the tracks. Then we

Scuttling in and out between the sparse vegetation of the sand dunes, scavenging beetles leave most distinctive tracks in the sand. Other tracks in the photograph not sheltered by the grass have been obliterated by the wind.
Photo.—E. Pope.

found that the rick-rack pattern on the surface of the sand was the result of the tunnelling operations, just below the surface, of an insect larva with a long, worm-like shape. The larva progressed by lashing its body violently from side to side and since its rate of progress is quite quick it is possible to watch the track appearing on the surface as though by magic, for no active agent can be seen. The larva is the young stage of a Therevid Fly.

Another track which frequently appears in the sand dunes is the one illustrated here, made by a beetle of some type which we have not, as yet, been able to determine. The track is a most distinctive one and somewhat reminiscent of the tread of a caterpillar tractor. Perhaps some reader can help to solve the mystery by catching the beetle in the act and forwarding it to us.

Lizard tracks or those of small mammals may sometimes be seen in the sands at the back of beaches, and in these cases there is not only the impression left by the feet but also the occasional swish of a tail which marks the ground. Unfortunately, we have no photographic record of these.

Nearer the water's edge, especially near low-tide mark, many more tracks and signs may be read in the sands and their authors are often creatures such as snails or starfish or even worms. In fact, the more you look, the more kinds of tracks you see and learn to recognize and, after a few years' practice, you can read the riddles of the sands with great accuracy—probably not so well as a black tracker, but adequately enough to impress your friends with your abilities as a natural history detective.

Introduced Fishes—I

By G. P. WHITLEY.

ENGLISHMEN who colonized Australia in the early days sadly missed the trees and flowers, the birds and other animals to which they had been accustomed, and they found the fauna as alien as the surroundings generally. A love of Australia and things Australian for their own sake or because of their unique value had not then been developed. So acclimatization societies were formed: trees, seeds, pets, game and domestic animals, and even fish, were brought from overseas to fill the sentimental gaps. As far as fish are concerned, the kinds introduced into Australia fall into groups, thus:—

(1) Members of the Trout family (Salmonidae) introduced for sporting anglers;

(2) Aquarium fishes, belonging to many species, of ornamental appearance or domesticated as pets;

(3) Eaters of mosquito-larvae; and

(4) Freshwater (and a few marine) species introduced for angling or as food.

THE TROUT FAMILY.

The introduction and acclimatization of Salmonidae was a difficult task in the old sailing ship days, but it was successfully accomplished and has since formed the subject of several books, articles and biological papers, so that it is beyond present scope. The best-known introductions are the Brown Trout (*Salmo eriox*, often called *S. fario*), the Loch Leven Trout (*S. levenensis*) and the Rainbow Trout (*S. gairdnerii*, generally called *S. irideus*, and its variety the Kern River Trout, var. *gilberti*). The foregoing have become established, though in places they have to be replenished from hatcheries. The following species, however, failed to thrive in Australia: Sebago (*Salmo sebago*), Atlantic Salmon (*S. salar*), Quinnat or King Salmon (*Oncorhynchus tschawytscha*), Sockeye Salmon (*O. nerka*) and Brook Char (*Salvelinus fontinalis*).

AQUARIUM FISHES AND MOSQUITO EATERS.

The fishes enjoyed as pets, or bred by fanciers for ornamental varieties, come from nearly every country except northernmost Europe, Asia and America, and the South Sea Islands. They belong to various Orders and Families, particulars of which can be obtained from the extensive literature on aquarium fishes. Species belonging to the following genera of introduced freshwater fishes have been kept in captivity in Australia: *Acanthophthalmus*, *Aequidens*, *Anabas*, *Aphyocharax*, *Badis*, *Barbus*, *Betta*, *Brachydanio*, *Carassius*, *Channa*, *Chela*, *Cichlasoma*, *Clarias*, *Cobitis*, *Colisa*, *Corydoras*, *Ctenobrycon*, *Ctenops*, *Cyprinus*, *Danio*, *Dermogenys*, *Gambusia*, *Haplochromis*, *Helostoma*, *Hemichromis*, *Hemigrammus*, *Hyphessobrycon*, *Lebistes*, *Limia*, *Luciocephalus*, *Macropodus*, *Mastacembelus*, *Mesogonistius*, *Mollienesia*, *Notopterus*, *Ophicephalus*, *Oryzias*, *Osphronemus*, *Osteochilus*, *Panchax*, *Perca*, *Phalloceras*, *Platypoecilus*, *Polyacanthus*, *Pristella*, *Pterophyllum*, *Rasbora*, *Rasborichthys*, *Rhodeus*, *Tanichthys*, *Tilapia*, *Trichogaster*, *Trichopsis* and *Xiphophorus*. The list, though formidable, is easily comprehended by aquarists and is worthy of mention as it is the first of its kind and there is always a likelihood of these fishes becoming introduced into our rivers, though it is hoped that this will not occur. Some damage has already been done: the common Goldfish and Carp and the Redfin or English Perch are already pests in many rivers, spreading in a comparatively short time over an enormous area at the expense of the native fauna.

During World War II the import of foreign aquarium fishes into Australia ceased, but local enthusiasts guarded their breeding stocks with care so that good exhibitions of them could be maintained. Recently, attempts are said to have been made to obtain fishes (and even fish eggs) by air, but the law must be observed and Customs and Fisheries Departments' requirements respected.

Marine fishes require special conditions in aquaria and practically the only foreign ones are on public display rather than in private hands. Live coral fishes were transported to Sydney from Honolulu in January, 1912, by Captain Gibb of the s.s. "Makura", but only one survived in a tank at the zoo. Since Taronga Park Aquarium was established the beautiful fishes of New Guinea and the South Seas have been brought regularly to Sydney for display.

The more important freshwater aquarium fishes (notably the carp and gourami and their allies) will be dealt with in a second article in their zoological order; so too will the mosquito-eaters which are mainly Cyprinodontes (e.g., Millions Fish and *Gambusia*).

Introduced Food Fishes.

French explorers of the early 19th century brought Paradise Fish in their ships to Australia from the East Indies and, in error, they were classified as a new Australian fish, *Platypodus furca*, but they did not liberate them ashore. Other Frenchmen recommended the introduction of our Murray Cod into France for the gourmets of Europe. A few years ago the suggestion was made that Murray Cod be introduced into the fresh waters of Bengal as food for the natives. However, Dr. Sunder Lal Hora, of the Calcutta Museum, rightly advised against this introduction, pointing out that the Murray Cod was a "wolf" fish which would destroy other forms of life in the rivers and so the suggestion was dropped. In the past, Chinese labourers introduced paddyfield eels and certain other Oriental fishes which they kept in ditches for food but the species have not, fortunately, persisted. Probably inspired by the work of Frank Buckland and the International Fisheries Exhibition of 1883, in which Australia had taken a part, local authorities many years ago considered introducing marine fishes of potential economic value, but there were difficulties in the old days of sail. Early in this century, H. Dannevig acclimatized English flatfishes at Gunnamatta Bay, New South Wales, and liberated them in the sea, but nothing more was heard of them. Similarly some American Striped Bass (*Roccus*) which had grown too large for an aquarium were set free in Sydney Harbour about twenty years ago and came to naught.

Altogether, it seems better to encourage the propagation of Australian food-fishes rather than try to upset the balance of nature still further by introducing alien species. Efforts to cultivate native mullet, bream, perch (*Percalates*), palmer, and grunters, and even the lungfish, have met with success in some parts of Australia. The Milk Fish (*Chanos*) might be "farmed" in ponds in tropical Australia, as it is overseas, whilst Golden Perch and Murray Cod are preferable to foreign Gourami or American freshwater fishes as far as Australia is concerned[1]. So far, only a few persons, careless or ignorant of the consequences, have suggested bringing bluegills and other sunfishes and bass from North America into Australia, and their suggestions luckily have been ineffective. The danger of such importations has been stressed by an American colleague, Professor G. S. Myers[2]: even the diverse and mighty fish-fauna of the Amazon, he thought, might be devastated by introducing northern hemisphere fishes.

Untold damage might be done to Australia's fluvifauna especially when floods overflowed pond-cultures in the outback. The modern attitude to acclimatization and pisciculture is that it is unwise to

[1]See A. D. Butcher & G. T. Thompson, *Fish Farming* (Fisheries & Game Dept., Melbourne, Pamphlet No. 3, 1947). Inquiries regarding fish farming should be addressed to one's State Fisheries Department.

[2]G. S. Myers, *The Progressive Fish-Culturist* (Chicago), ix, 4, 1947, p. 177.

liberate foreign or even Australian fish indiscriminately in our waters and that a biological and hydrographical survey should precede any introductions which may be made, and any attempts at introduction can, very rightly, only be made with the sanction of our State Fisheries Departments.

Saville-Kent introduced into Western Australia Carp, Goldfish, freshwater eels, Murray Cod and Perch from the eastern states, but the good Australian food-fishes failed to thrive there whilst the pests persisted and have now been joined by later recruits, *Salmo* and *Gambusia*.

A plan to fertilize certain south-western Australian lakes with nutrient salts (sodium nitrate and superphosphates) to encourage the growth of flounders was mooted after the example of Loch Craiglin in Scotland, but the Scottish experiments, though promising at first, proved disappointing later, and the Australian scheme was abandoned. The importance of avoiding pollution in seas and rivers should be stressed and, inland, it may be necessary to rescue young fishes left stranded in evaporated pools[3]. The artificial fertilization and hatching of fish eggs is applied to the trout family more than to native fishes.

[3]See Anderson, H. K.—*Australian Zoologist*, I, 1918, p. 157.

Aftermath of Rain

By JOYCE ALLAN.

THE past year in Australia will long be remembered as one of unprecedented torrential rains. Water appeared in vast sheets where it had not been seen for years, and the unexpected news came that even Lake Eyre had filled. Following closely in the wake of the numerous widespread floods which left a vast trail of devastation over millions of acres of fertile, heavily stocked country—or simultaneously with it—appeared various animal life which humid and rainy conditions, even in normal times, stir into activity. But under such abnormal circumstances, they appeared in pestilential force. Whilst trying to extricate himself from the state his property has been left in, the man on the land has now to face the additional worry of hordes of snakes lurking in the water, in the man-high after-flood grasses, and in the homestead. He must combat mosquito plagues of phenomenal ferocity, the threat of sheep-flies and sheep worms to his remaining stock. Even the aerial invasion of a sticky white gossamer-web cast over the countryside by myriads of tiny spiders, as related by Anthony Musgrave in a previous number of this magazine[1], would have its nuisance value.

Following similar torrential rains in the metropolitan areas over somewhat the same period, moist conditions and plentiful food supply became extremely favourable for many known and lesser known creatures of past seasons. Thus, lured from their normal haunts and hiding places, they rapidly became conspicuous in their fresh surroundings, and so, over the last months, we have constantly heard of strange spiders, beetles and other "wogs"; of shovel-headed worms and peculiar ribbon-like flat-worms of various colours seen sliding over paths, and of giant size slugs invading suburbia and its outer regions.

Snails and Slugs.

But as far as metropolitan invaders go, it can be said that over the last twelve months, the snails and slugs, especially the slugs, have scooped the pool. We can recollect no previous year in which so many of these molluscan creatures have been forwarded to this museum for identification, or have appeared in so many places. Humid and moist conditions at

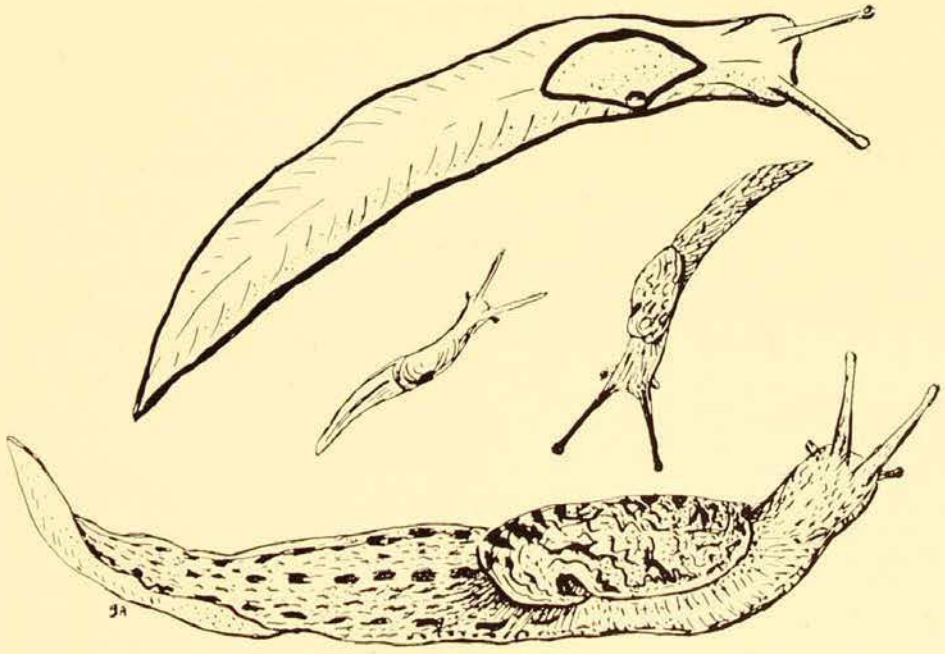
[1] Musgrave, A., Spider Aeronauts and Gossamer Web, AUSTRALIAN MUSEUM MAGAZINE, X, 4, Dec., 1950.

any time will immediately signal the advance of snails and slugs in bush or cultivated garden. But what might, under normal conditions, be a more or less leisured nightly torch hunt to the keen gardener or professional cultivator, has now become a rapid, ceaseless war against relentless enemies, if tender seedlings and succulent plants are to survive.

Many of the snails have been of the native bush type which have wandered away from their haunts into the more cultivated areas, no doubt lured by the lush growth and decaying matter which has persisted for so many months. Or they have been of the small introduced kinds which have been slowly appearing over the years. The common garden snail, *Helix aspersa*, of course, is always with us, and there is no need to mention how rapacious its attacks have been. This introduced European species has established itself just about all over the world, and appears able to withstand most adverse conditions, simply by hiding away, like its brother snails, and slugs, until more favourable conditions, the refreshing shower and moisture, the green vegetation—its staple food—prevail again. Can it altogether be blamed for wishing to move about freely when the welcoming shower falls?

Although we can sympathise with the gardener who treats all snails and slugs with scant respect, dealing out death to every one that comes his way, yet not all these are vegetable feeders! The ravages amongst his plants may be the work of only a few types, and some innocents may have been slaughtered in vain. For instance, one such snail, *Strangesta capillacea*, is the native carnivorous species, which, formerly confined to our native coastal bush, is now well established in some suburban gardens and attacks the garden snail with relish, although feeding also on minute insects and worms. Also there is the tiny introduced *Helicella cellaria* which thrives on slaters.

The same applies to slugs. Now, to most people these are most repulsive with their soft naked bodies exuding copious supplies of mucus, which, however, is necessary to enable them to move freely and safely over the roughest surface. So, nearly always, any seen on sight are stamped out. Granted that some of these (and it is pointed out here that practically all species of slugs found in the garden are the introduced European species) can play disastrous havoc amongst seedlings, plants and fruits, some are not green plant destroyers; a few are carnivorous, whilst others are omnivorous, feeding on decaying animal matter, meal and meat of various kinds, milk, fats, kitchen garbage, and fungi, ignoring foods containing chlorophyll. These



A handsome red-bordered native slug, *Triboniophorus graeffei* (top figure) has a similarly coloured triangular pulmonary area and one pair of tentacles. The introduced slugs have a smaller additional pair of tentacles, as seen in the Great Grey Introduced slug, *Limax maximus* (bottom figure)—a handsome grey, black-splashed slug reaching almost a foot in length. Centre left is the introduced Jet slug, *Milax gogetes*, the small black destructive pest so well known to gardeners; centre right shows the large yellow slug, *Limax flavus*, one of the commonest garden slugs, distinguished by its yellow, pustulous body, long, slender, dark-blue tentacles and its omnivorous habits.

frequently haunt the houses for this type of food and many householders in recent months in this moist weather have been horrified to find a large grey slug sliding over the clean kitchen floor or climbing a wall to reach the shelf where desirable food may be. However, at least one of the omnivorous species, the small pale yellowish to black *Agriolimax agrestis*, a common garden pest, although having a varied diet, is most destructive in gardens, sometimes feeding right through the night on leaves, roots, pods, flowers, young shoots and fruits. Its attacks have been even more virulent during this rainy weather.

The prevalence of two large slugs in particular round bush and garden has caused more commotion than any other molluscan types since the freakish weather commenced. These are the Great Grey Introduced slug (*Limax maximus*), and the almost as large, but more slender, Australian native slug (*Triboniophorus graeffei*). The former slug, although a settler in this country of some years standing, has never been so abundant, and one might say so cheeky, as during the last year. Usually nocturnal like most snails and slugs, it has emerged at all times, in many places, and frequently in extraordinary corners of the home. A handsome slug, slaty grey, streaked and spotted with rich black, it can stretch to almost 12 inches in length, but is normally about 5-6 inches in repose. It has a small slender shell lying under the skin towards the anterior end of the back, near the pulmonary opening. Like all slugs, it burrows lightly below the surface to bury its eggs. Its strong sense of smell enables it to find all sorts of food, it does not like green cultivated plants or seedlings, although often suspected of this when noticed crawling in the garden.

The native slug is distinguished immediately from the introduced ones by having only one pair of head tentacles instead of two pairs, a large and a small one, and its colouring. Varying from yellow to greenish grey, it has a bright water-melon pink border to the body, and a border of the same colour outlining the triangular-shaped pulmonary area on the back. Sometimes the whole animal is the pretty water-melon pink shade, a colour which rubs off easily as the slug moves along or is handled. It has no internal shell like that of the introduced slug, and gives off a copious supply of mucus which continuously runs down the vein-like body grooves on the slug's surface, almost as though it serves some irrigation purpose. The slug inhabits the coastal regions of New South Wales and to about mid-Queensland, but is more and more forsaking the bush for cultivated regions, being frequently found in Sydney gardens. Its abundance during the last year has been remarkable, and it has been extremely common round the Hawkesbury River district. The entirely pink form had until lately only been recognised from Mt. Kaputar, Narrabri, New South Wales, and Bellenden Ker, Queensland, but a few months ago specimens of this type appeared round Gosford and Terrigal. This slug also prefers its natural bush food, refuse and so on, but if no other food is available in a cultivated garden will, of necessity, eat lettuce. It is an extremely pretty slug, capable of assuming the shape and colouring of gum leaves, either in their fresh green state, or dying autumn tints. This slug in particular, should not be destroyed when found, but if possible placed in some native bush, or left in a less orderly part of a garden. It likes to lie away in the daytime amongst rotting, moist plant life, and will soon find these if transported to a bush environment.

Reviews

COMPARATIVE ANIMAL PHYSIOLOGY, by C. Ladd Prosser, Professor of Physiology, University of Illinois; D. W. Bishop, Professor of Physiology, University of Massachusetts; F. A. Brown, Professor of Biology, Northwestern University; T. L. Jahn, Professor of Zoology, University of California at Los Angeles; V. J. Wulff, Asst. Professor of Physiology, University of Illinois. (W. B. Saunders Company, Philadelphia and London, 1950, 888 pp., 312 figs. Price £5 18s. 9d.) Our copy from W. Ramsay (Surgical) Pty. Ltd., 340 Swanston Street, Melbourne, C.1.

COMPARATIVE physiology, like animal ecology, is a modern frontier of zoology attracting an increasing number of workers. Most of them are engaged in the minutiae of investigation adding new facts to an already voluminous literature. When these new facts appear in the many zoological and physiological journals, it is often only the titles which are read by the classical zoologist. The particular gaps which these contributors are seeking to fill, in the understanding of how the animal body works, are largely unknown to him. But the classical zoologist is hardly to blame. Comparative physiology has not had a comprehensive text book in English describing the underlying similarities and differences in the physiology of animal groups. In the numerous text books on "General Physiology" emphasis has been largely on the higher animals. To be truly comparative and to do justice to modern developments, adequate consideration must be given to the vast amount of research in invertebrate physiology as well. The significance of this new book is that it attempts to do this.

The result is 888 pages of closely-written text fully documented with references and lengthy tables. Two initial chapters deal with the role of water and inorganic ions in body fluids, a short chapter on protein specificity is wedged in between these and a series of chapters dealing with the main functions of nutrition, respiration and excretion. (The placing of the chapter on protein specificity is rather odd and without explanation in the text.) The remaining chapters are concerned with a variety of subjects largely bordering on animal behaviour, *e.g.*, chemo-reception, photo-reception, hearing (which the authors call "phonoreception"!), nervous physiology and endocrine mechanisms. There are several other chapters which seem to fit into no particular plan in the book, though they are important contributions in themselves.

Some chapters represent much needed reviews of special fields; others draw heavily on older texts, differing little from them except in the addition of more examples (*e.g.*, chapters on respiration and nutrition). Others are elaborations of reviews previously published by the authors in review journals (*e.g.*, chapters on endocrine mechanisms and nervous physiology). The student and research worker will be glad to have all this material together and brought up to date. The comprehensiveness of the treatment will probably leave the undergraduate and the general reader a little bewildered. The University teacher may, for this reason, hesitate to advocate the use of this book as an undergraduate text book. But it is one which he will insist on having on his own shelves and accessible to students for reference. Few will sit down and read it from cover to cover: it is not that sort of book.

One almost wishes that the highly qualified authors had written something shorter and eminently readable and had left out some of the encyclopaedic detail for the sake of letting a few principles live. This was done for comparative biochemistry by Baldwin's "Introduction to Comparative Biochemistry" and for animal ecology by Elton's "Animal Ecology". Something similar needs to be done for comparative physiology. The place for detailed expositions is then in separate monographs on the various functions.

It is this heavy documentation which makes this book difficult to read. Some of the tables are unnecessarily detailed even for a specialist review (*e.g.*, Tables 9 and 76). Many of the graphs are confused, with too many lines or points running together (e.g., figs. 13, 14, 19, 129). There are, on the other hand, some curious instances in which so little detail is given that the contribution has little value. Fig. 44, for example, pictures four respirometers, without any explanation in the text as to how they work. Similarly the eight line description of Fry's excellent work on acclimatisation in fishes is quite inadequate to give the reader any true conception of the nature of acclimatisation experiments. The reviewer noticed a few mistakes in principles. There is good reason to question the assertion on pages 226 and 342 that the Arrhenius formula is a satisfactory description of the relationship between temperature and physiological rates. And parapodia in polychaete worms are not primarily evolved as gill structures (page 213).

In many respects the most rewarding chapters are left to the end: Brown's chapters on endocrinology and Prosser's chapter on nervous physiology, perhaps because the authors here are writing in their own research fields. It is the research worker and the graduate student who will find most value in the book as a whole. For this reason alone its publication will be welcomed by zoologists.

L. C. BIRCH.

AUSTRALIAN SHELLS, with related animals living in the sea, in fresh water, and on the land. By Joyce Allan, F.R.Z.S., Curator of Shells, Australian Museum, Sydney. (Georgian House Pty. Ltd., 431 Bourke-street, Melbourne, 1950. An Australiana Society Publication.) Pp. XIX and 470, 44 plates and innumerable text figures. Price, £3.

SHELL collectors throughout the world will welcome this popular authentic and only comprehensive account of Australian shells. The simple layout of the book, the plates, and text all point to a careful analysis, by the author, of routine museum inquiries received from the public, for she has supplied in one book the answer to most of them. Good colour plates and simple descriptions should enable even the amateur to identify and name most Australian shells likely to be collected.

Whether it be camouflage in wartime or sea shells in peacetime the author excels as an artist and what is more she has that rare and valuable combination of artistic talent and specialized scientific knowledge. Miss Allan's position as conchologist at the Australian Museum has given her the means to complete a work which probably only she could have done in such an able manner. An extensive collection and a good library containing many rare works on the mollusca, the valuable tuition received from her capable predecessors, Hedley and Iredale, have all contributed to the accuracy of the finished work.

Molluscan nomenclature has changed with the times. Much incorrect and unsuitable Australian nomenclature has been adjusted in numerous, widely scattered scientific works, but stability is gradually being achieved. However, those highly technical accounts are frequently beyond the general collector and may have confused rather than enlightened him. Miss Allan has simplified the problem by giving for each shell mentioned the present accepted generic and specific name and, where necessary, any familiar synonym which may have been discarded.

The wide distribution of many Indo-Pacific species has also been a confusing factor to Australian collectors, for many shells which may have been originally named from some distant part occur in our northern waters. Miss Allan enlightens us by figuring and correctly naming the tropical Australian species while suggesting their Indo-Pacific range.

Separating land, freshwater and marine shells has further simplified the work for they are each a different problem to be tackled from a different angle.

The only criticisms offered concern faults arising, we suspect, from sources beyond the author's control. Cheap paper, poor photographic half-tones and a fair number of printer's errors are the main shortcomings. Considering the precarious times in which we live, power shortages, blackouts, high costs, material shortages, general inconveniences and delays we should still be thankful that the production is no worse.

There will be a big demand for this work both here and overseas and we expect to see a second edition with probably a more embracing index and each plate bearing a number.

With these few minor criticisms we close by assuring the author, the publisher and the printer that "Australian Shells" is welcome and well done.

B. C. COTTON.