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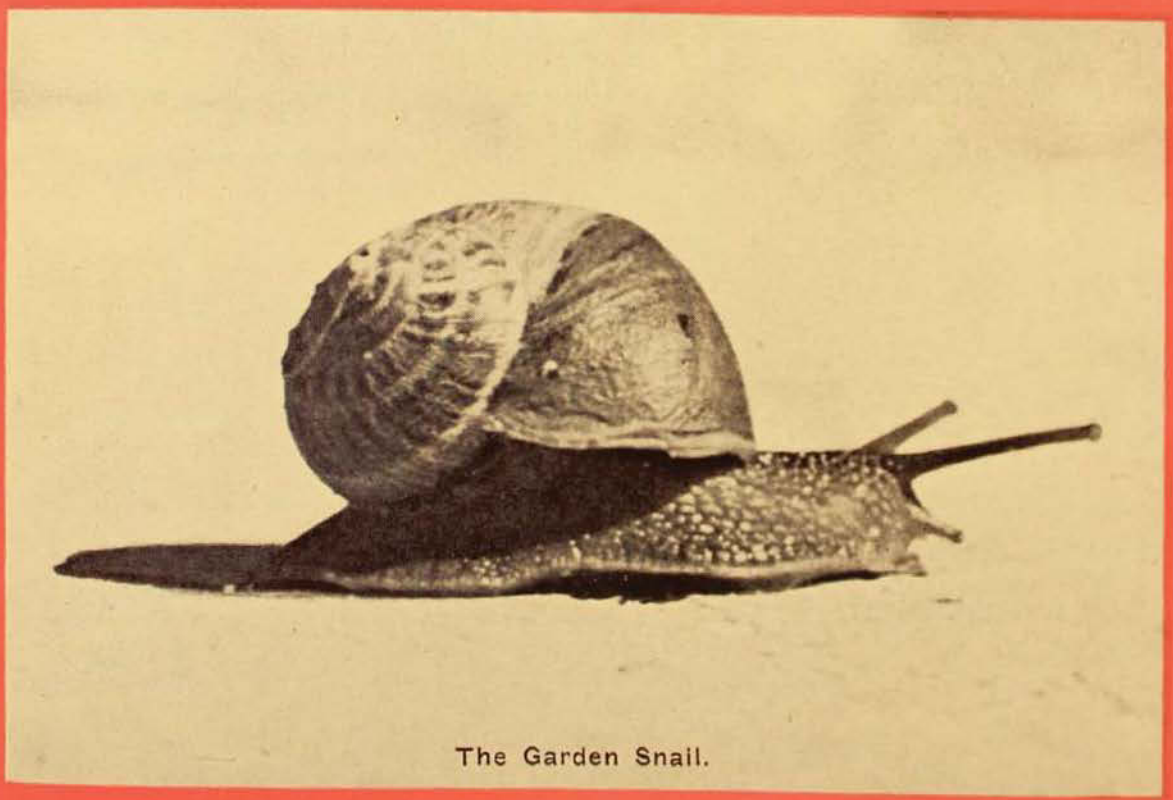

The Garden Snail.

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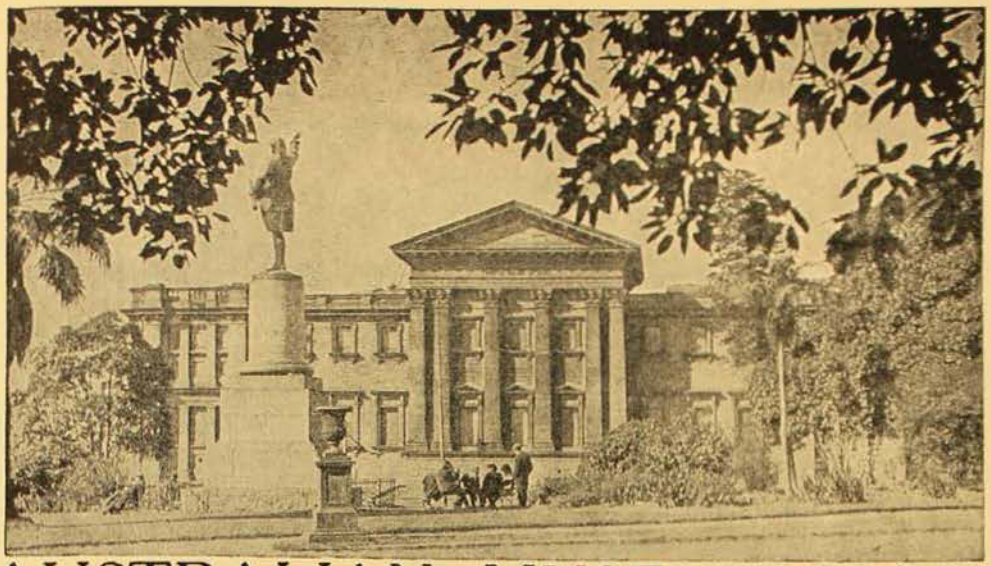

THE AUSTRALIAN MUSEUM MAGAZINE

• OUR FRONT COVER. The Garden Snail (*Helix aspersa*), introduced into Australia in the early days of settlement, has become a formidable foe in cultivated gardens.

The slime track left by the snail as it crawls about, especially on concrete paths, is not continuous, but consists of a series of mucus patches at close and regular intervals. Secretions of mucus from glands in the foot are expelled through an opening between the foot and the mouth, serving to lubricate the path to be taken by the snail. This mucus hardens very quickly on exposure to air or water, forming the familiar iridescent silvery track associated with snails.

As a snail crawls, a series of successive and distinctly perceptible waves of contraction and expansion flows over the foot from behind forward, only the creeping surface and not the whole body participating in the action. The foot is continuously adherent to the surface upon which it is crawling, and not alternately loosened and re-applied.

The gliding motion of a moving snail can be seen perfectly as it crawls up a piece of transparent glass.

Photo.—Howard Hughes.

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A Buddha obtained at Lucknow about 1824. It was brought to Sydney in 1825 by Sir James Brisbane, R.N., on H.M.S. "Warspite", and presented by him to Captain John Piper. Subsequently it was bequeathed by the late Miss Jane Piper to the Australian Museum. The figure is carved in calcite, and the robes and base are coloured in gold over a reddened surface. This interesting exhibit is two feet in height.

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VOL. VIII, No. 8. JUNE–AUGUST, 1944.

Museums and Adult Education

IN the many public discussions on the future development of adult education, especially during the immediate post-war period, little reference has been made to the contribution which museums have already made, both directly and indirectly, or to the possible extension of museum participation in this field. Museum staffs have made many indirect contributions through the Press, popular science lectures, broadcasts, and by dispensing the knowledge gained in their researches to a wide field of inquirers from the ranks of all classes of the community.

In any general scheme of adult education it is certain that visual education must be of considerable importance, and in this respect modern museum displays of educational value have a place. In this direction we have shown, frequently, in these pages, by word and by picture, what this Museum has accomplished.

Most people take an interest in their immediate surroundings and, wherever one lives, there is always something in the fauna and flora to attract attention—mammals, birds, snakes and lizards, insects, shells, trees, shrubs, and a host of other things. The natural history museums can encourage such interests, not only by their displays in the public exhibition galleries, but also by having additional collections readily available for study, accompanied by the necessary library facilities. The staffs have always shown a readiness to give any assistance within their power to those seeking information or opportunity to study. The technological museums provide a similar service in regard to the many applications of science to machinery, industry, and the applied arts.

For museums to make an appreciable contribution to a wide programme of adult education it would be necessary that provision be made for a great extension of museum service. Facilities would need to be provided for museums to be available to the public out of ordinary working hours; additional accommodation would be needed so that collections could be studied in comfort; more staff would be required to guide and to assist students; and, above all, there should be museums, with competent scientific officers, in a greatly increased number of the larger centres.

The various army education services have provided a solid foundation for greatly increased adult education and every effort should be made to ensure that adequate facilities are available to satisfy requirements in normal civilian life resulting from the activities during war time of these services.

Museums are making every effort to fulfil their part in adult education. What we termed the "new leisure" in pre-war days will return in the post-war period, though perhaps not immediately. An American museum authority has said, "among

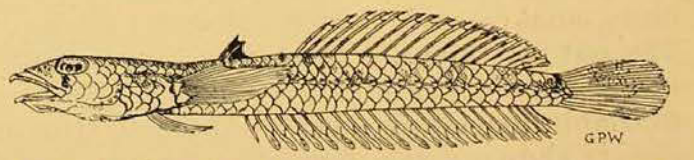
uneager thinkers there is a skepticism as to whether the leisure is real, but educators have not had very much to say about *empty* time. Rather they have talked and written enviously of the hours filled already by organized amusements and disorganized states of mind, and they are hoping to seize upon some of this time by competitive methods". Museums may rightly claim that their activities and services are doing much to fill *empty* time. Popular lectures, and cinema films in the evenings, always well attended, carefully arranged exhibits which unfold a story, are a feature of museum work. Behind the scenes much labour and time is spent in their preparation; further back is the painstaking research without which such things, and many matters affecting our daily well-being, would be unaccomplished.

Rare Fishes

By G. P. WHITLEY

SEVERAL rare and interesting fishes have been given to the Australian Museum in the last eighteen months. A Sucker Fish (*Echeneis neucrates*), which featured in the Sydney press after it was caught in Middle Harbour during March, was presented by Mr. C. Slater. Another fish outside its usual range was a Harlequin Angler Fish (*Pterophrynoides histrio*), a species found usually amongst Sargasso weed in the open sea; this one, however, was obtained by Mr. A. C. Lumley at Lansdowne Bridge, Prospect Creek, well inland, on 23 April, 1942. Mr. T. Payten, of Lord Howe Island, sent us a gaily coloured Painted Flutemouth (*Aulostomus chinensis waitei*), and we also received a small Black Marlin Swordfish (*Istiompax australis*), the first known from Lord Howe Island. After the war, no doubt, our big-game anglers will wish to try their skill after swordfish in those delightful waters.

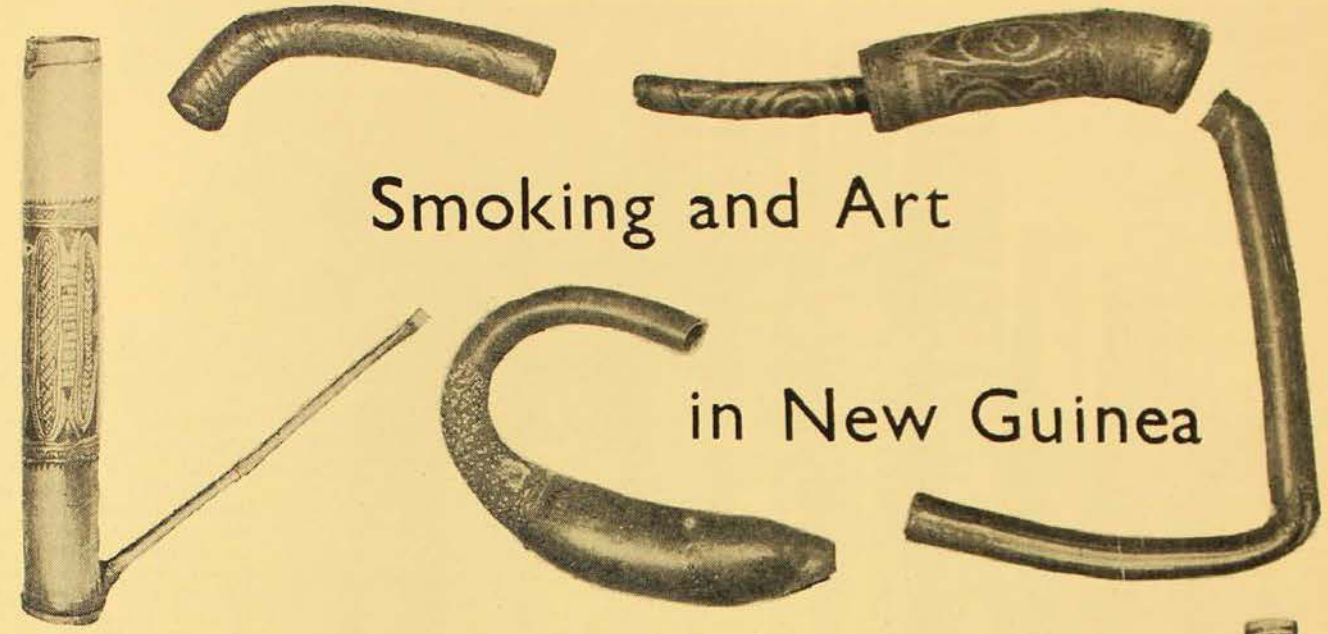
The third known specimen of the very rare Reduced Grubfish (*Enigmapercis reducta*) was found in the stomach of a flathead at Port Hacking and presented by Mr. Keith Sheard. The first specimen, then new to science, was dredged off Long



Reduced Grubfish (Enigmapercis reducta), Long Reef, New South Wales. Natural size.

Reef some years ago by the Laserons, the second was trawled by the *Warreen*, and the species is now illustrated for the first time. A curious feature of this fish is the first dorsal fin, which is reduced to only two spines and some black membrane. An allied genus has since been discovered (from the Philippine Islands) and named *Roxasella*.

Smoking and Art in New Guinea

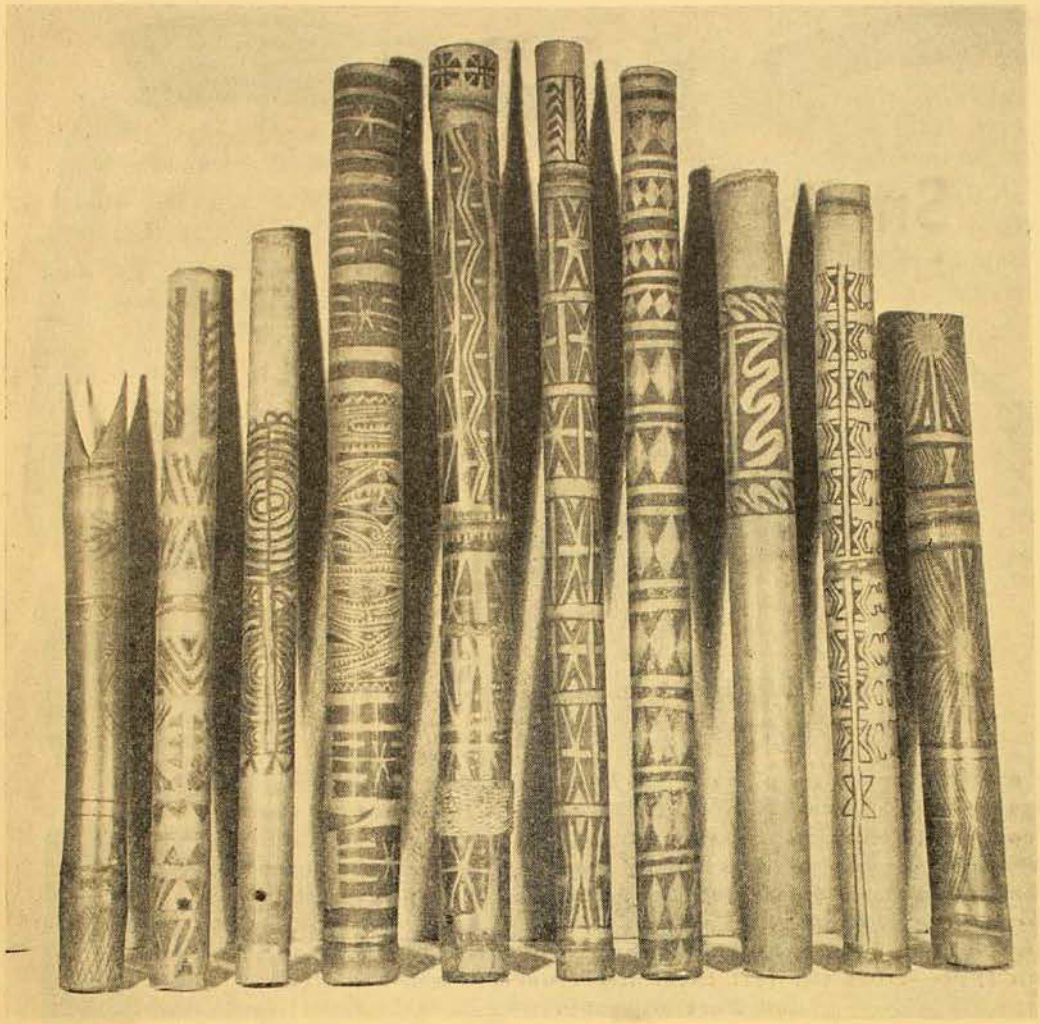


By FREDERICK D. McCARTHY

Some unusual types of pipes from New Guinea. Of the forms illustrated above, from the H. D. Eve collection, that in the left corner is carried in the girdle of its owner by the off-shoot; in the centre is one made from a gourd; on the right is a bent variety from which the smoke is drawn through a slit in the angle, as by the Tapiros; the small figure beneath is a cigar-holder. Beneath this group are three pipes of the baubau type—from the left these are from Tumari, Fly River and Port Moresby.

AMONG the natives of New Guinea smoking is enjoyed by both men and women, while even children are to be seen puffing away at a cigarette. In the Oceanic region tobacco was first cultivated on Amboina Island, in the Moluccas, in the sixteenth century by the Portuguese, who brought it from America. From Amboina the custom of smoking spread rapidly to neighbouring islands and to south-east Asia; as part of this diffusion it was introduced into New Guinea by traders, possibly before the beginning of the seventeenth century. The only species known to be cultivated in New Guinea is *Nicotiana tabacum*, Linn.[1] This plant and the methods of its use were apparently introduced at various points along the

[1] Gilmour, J. R. L.: Territory of Papua, Anthropology, Report No. 11, 1931.



Pipes of the baubau type from Papua, on which are shown a series of characteristic decorative designs. Nos. 1-4, 8 and 10 from the left are from the Papuan Gulf and Fly River districts, Nos. 7 and 9 from Cloudy Bay, and Nos. 5-6 from Port Moresby.

northern and western coasts, both from the Philippines and from the Dutch East Indies, over a long period of time. In this connection it might be mentioned that the inhabitants of many villages admit that they learnt all about growing and smoking tobacco from a distant or a near-by community, or from the Malay or European traders, and by these means the habit has spread over the greater part of the island within a few hundred years. Smoking is still not practised along part of the northern coast and in southern Dutch New Guinea.

Tobacco is often mixed with areca, betel, and lime, and it is interesting to note that smoking is absent in some areas where "betel" chewing prevails. Tobacco, too, has become an important ingredient in many magical potions.

The tobacco-plant is not a difficult one to grow. The seed is planted in a sheltered spot, a favoured situation being the floor of an old house from which the wall-coverings have been removed and the roof left in place, or under a pile-house, while palm-leaves are used to cover exposed seed-beds. The young plants are thus protected from the fierce rays of the tropic sun until strong enough to be transplanted to open gardens.

The matured leaves are harvested and dried either in the sun or over a fire. They are then made up into rolls from two to six feet long, strung in bundles, or several plaited together. In such a form tobacco is traded extensively, especially from the bush and mountain people, who grow the best quality leaf, to the coastal villages.

The types of pipes and methods of smoking vary considerably. The "baubau" is the best known form. It consists of one or more internodes of bamboo from nine inches to four feet long and from one to three inches in diameter. On some of

Man of Eroro village, Oro Bay, smoking a bamboo pipe. The smoker is decorated with a shell fillet and feather headdress, feathers of the cassowary predominating. Suspended from his neck is a pendant of shell sections terminating in a melo shell plate. Rings of Conus and coconut shells encircle his upper arm, and a shell nose pin is placed in the septum. The effect of the large quantity of smoke imbibed must be exhilarating. The natives relish smoking at every opportunity, and whenever they are in a group a pipe is passed around.

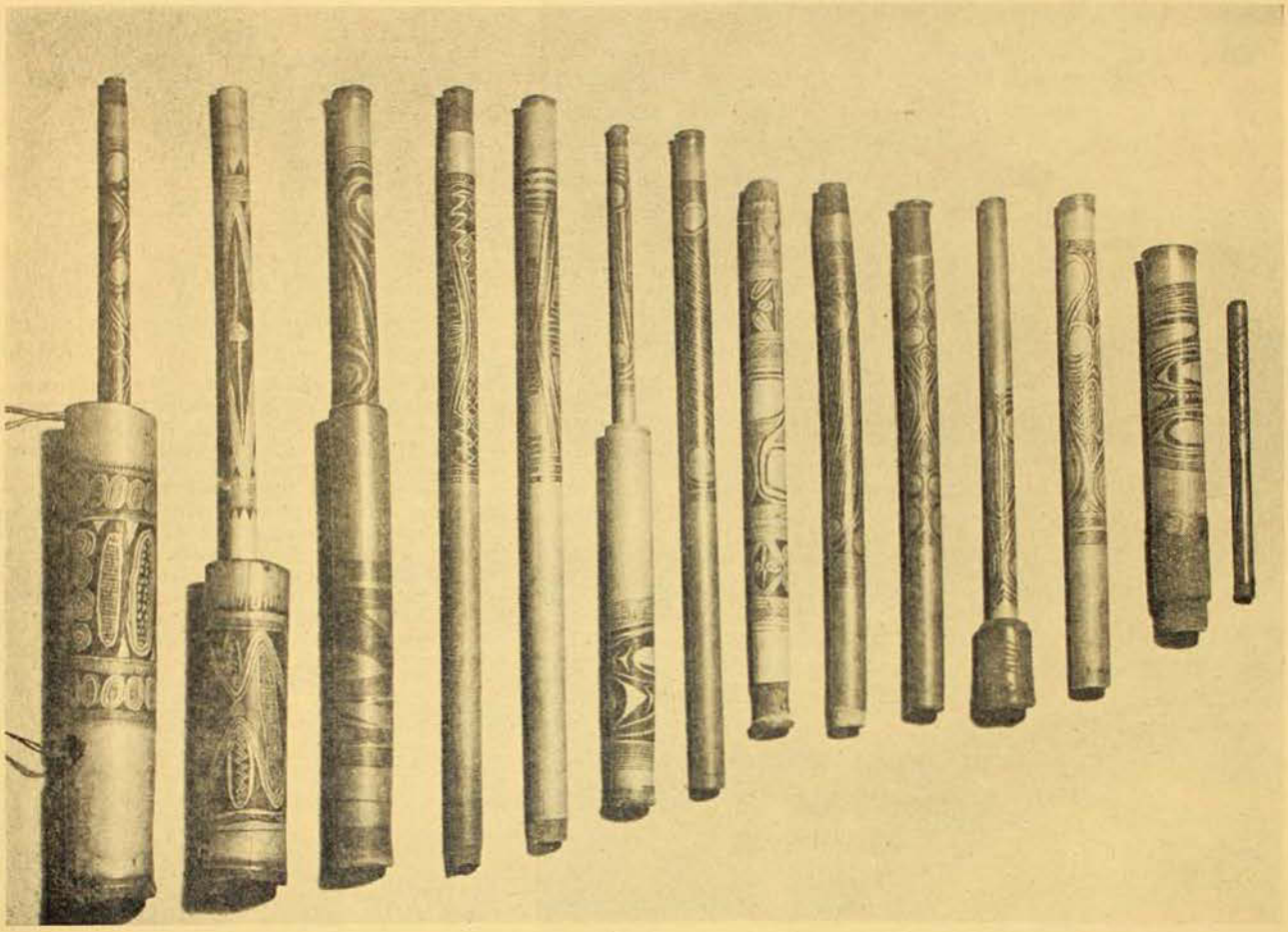
Photo.—Captain Frank Hurley.

the "baubau" a slender twig is left on the stem to serve as a hook for carrying or for hanging in the house. The internodal partition at one end is perforated, and another hole is made a few inches from the other end. The pipe is usually prepared for use by one of the wives of the men present. A cigarette is made by rolling some crumpled tobacco in a leaf or bark wrapping, and its narrow end is then inserted into the lateral hole of the pipe. In many places a tobacco-holder in the form of a slender tube of wood or bamboo takes the place of the cigarette. The tobacco is lighted with a brand from the fire, and then follows the important operation of filling the cavity of the pipe with smoke. This is done either by sucking the smoke in from the perforated end, or by blowing it through the cigarette or tube. When the pipe is full the smoker removes the cigarette or tube, blocks the perforated end with his hand, and takes a few draws through the lateral hole. On some pipes a coconut-shell mouthpiece is fitted. The pipe is refilled with smoke when required, and it may be smoked from the perforated end.

The Tapiro pygmies and other mountain people use a slender bamboo pipe only a few inches long. A plug of tobacco is pushed halfway down the inside and the smoke is drawn either from one end or through a hole below the plug. Sometimes a sago-leaf filter is inserted.

The finest series of pipes in the collection of the Australian Museum consists of more than five hundred specimens from about fifty villages in the Sepik River district[2] of New Guinea. The series was collected between 1930 and 1938 by the late Mr. H. D. Eve and presented to the Museum. The major type represented consists of a wide basal portion up to nine

[2] These villages are scattered throughout the area bounded by the Sepik River in the south, the border of Dutch New Guinea in the west, and the Bewani, Torricelli and Prince Alexander Mountains in the north.



A representative series of pipes from the Sepik district, northern New Guinea, from the H. D. Eve collection, showing the wide range of decorative designs. The single tubes are cigarette or tobacco holders and are placed in a larger tube for use, as shown on the left. On the extreme right is a pipe from the upper Fly River, presented by Mr. Stuart-Campbell.

inches long, into which fits a slender cigarette or tobacco-holder up to fifteen inches long, and each part bears a different art design. Many of the cigarette holders are curved. This type of pipe is smoked through a hole in the broad end. One variety is bent in the middle or near one end and the smoke is inhaled through a slit cut on the outside of the bend. Another unusual form of pipe is made from a long gourd perforated at each end and there are several short cigar holders shaped at one end for the mouth of the smoker. On a number of the pipes a piece of lizard or snake skin is gummed over the end at which the pipe is smoked.

An interesting method of smoking has been observed by Zimmer[3] in the Fly River district. The lighted end of a bamboo tobacco holder is placed in the mouth of the smoker, and the other end in a cane arm-guard. The narrow end of the latter is closed with the left hand. The smoke is blown into the arm guard until its interior is full, when the tube is removed and the end blocked with the right hand. This method is usually employed by the men when they are away from their village.

In the Arfak Mountains of Dutch New Guinea the pipe is cut out of a block of brown wood. It consists of a bowl with a short stem and a handle formed by a knob or a fretwork panel. Clay pipes were introduced into New Guinea by European traders.

The cigarette often serves for a casual smoke by men when they are out hunting or fishing or by the women when gardening. The tobacco is carried in a netted or plaited wallet. The Tapiro pygmies of Dutch New Guinea draw the smoke from

[3] *Man*, 1930, 110, pl. 4.

between the edges of the wrapper until the cigarette is half smoked and finish it in the normal way. In the mountains of the Waria River system the smoke is drawn through a bamboo tube inserted in a hole in one side of a cigar.

The crude methods of preparation produce a very strong tobacco, that of the interior being milder than that of the coast, where it is also hot and somewhat unpleasant.

Being an artistic people, the natives of New Guinea have taken full advantage of the splendid medium for decorative art provided by the bamboo pipes. The designs, which are of great variety, are similar to those applied to weapons, utensils, and sacred objects within the limits of well defined areas in which a distinctive style of art exists. Pipes may, therefore, be localized according to these designs. The most widespread technique is that of poker-work. The surface of the bamboo is burnt or charred in such a way that black patches of various geometrical shapes form a strongly contrasting background for the natural light-yellow parts of the design. A good craftsman scratches in the outlines prior to the charring. In northern and western New Guinea portions are cut out to reveal a pleasing mid-brown surface, which may also be reddened or blackened, and against such a background the glossy lighter parts in low relief stand out sharply.

The designs on pipes constitute an excellent cross-section of Melanesian decorative art. In northern New Guinea the pipes are ornamented with attractive patterns in which curved lines, scrolls and concentric circles are dominant. On those, for example, in the H. D. Eve collection from the Sepik River district, the above motives are combined with chevrons, zig-zags, triangles, lozenges, crosses, cross-hatching, stippled and serrated lines, U-shaped and hour-glass figures. Cigarette holders from the upper Fly River, adjoining the Dutch border, are decorated with neatly engraved line mazes in which chevrons are prominent. The designs from the lower Fly River and neighbouring areas offer a strong contrast to the northern patterns, because they have, as the central motive, portrayals in low relief of an animal such as a crocodile, turtle, lizard, frog or fish, the cassowary or other birds, or a shell ornament, often surrrounded by geometrical figures. In the Papuan Gulf the central motive is a human face, an animal or a star, the lines are serrated, and one end is shaped to represent a crocodile's mouth, so that the pipes from this area are a most distinctive type. Some rather well-drawn animals and fish, lightly incised and combined with serrated lines, are to be seen on the pipes from the Torres Strait Islands, and those from Port Moresby and nearby villages are notable for tattoo designs.

The merit of the work varies according to the skill of the craftsman. In some areas, such as the Papuan Gulf, a design complete in itself is applied to one end of the pipe, but in other localities the whole surface is decorated with a carefully planned and executed pattern. The pipes of Cloudy Bay in Papua are a good example of how the lateral hole is used as a starting point for a symmetrical design divided into a series of divided panels. The designs on the pipes in the H. D. Eve collection from the Sepik River district form an encircling band, each end of which is neatly finished with a border. Some pipes are decorated with a number of quite different and apparently unrelated motives, and on poorly made pipes from the mountain people such as the Mafulu of Central Papua, only aimless and irregular lines are traced. In northern Dutch New Guinea some of the Indonesian motives, including flowers, have crept into the designs.

Smoking, in addition to being a pastime enjoyed by everybody, is an excellent example of how the culture of the New Guinea natives has been enriched by their contact with neighbouring peoples. The tobacco plant not only extends their agricultural activities and produces a valuable article of trade, but the pipes are an excellent medium for craftsmanship and aesthetic skill. It is an illustration of the important process of the diffusion of culture from Asia and Indonesia to the Pacific Islands.

Interesting Sharks' Eggs

By G. P. WHITLEY

MISS K. DENNING presented to The Australian Museum a most interesting egg which she found on Collaroy Beach, near Sydney, in November, 1942. When I wrote an account of the Eggs of Australian Sharks and Rays in an earlier number of this Magazine (AUSTRALIAN MUSEUM MAGAZINE, Vol. vii, No. 11, July-Sept., 1938, pp. 372-382, figs. 1-28), I was unable to say for sure whether one type of egg from Victoria was that of a shark or a ray. This type I dubiously ascribed to the Round Ray (*Irolita*?); it was illustrated as Fig. 25 in my article. Since then I have collected many similar empty egg-cases on beaches in Victoria, Western Australia, and Tasmania. The Museum authorities in Launceston kindly co-operated and enlisted the aid of school children, who supplied hundreds of eggs, found amongst seaweed washed ashore on north Tasmanian beaches. After many disappointments, Miss Van Gooch, of the Queen Victoria Museum, found that one egg had a four-inch embryo inside, and informed me that it was a shark and not a ray. I sketched the specimen, which was a Rusty Catshark (*Parascyllium ferrugineum*), a species new to the Tasmanian fauna,* and so a minor mystery was solved. One kind of *Parascyllium* (*P. collare*) lives in New South Wales, but no similar eggs had been found here during years of beach-combing. Miss Denning's Collaroy specimen now supplies this missing link, and extends by hundreds of miles the known range of this kind of egg.

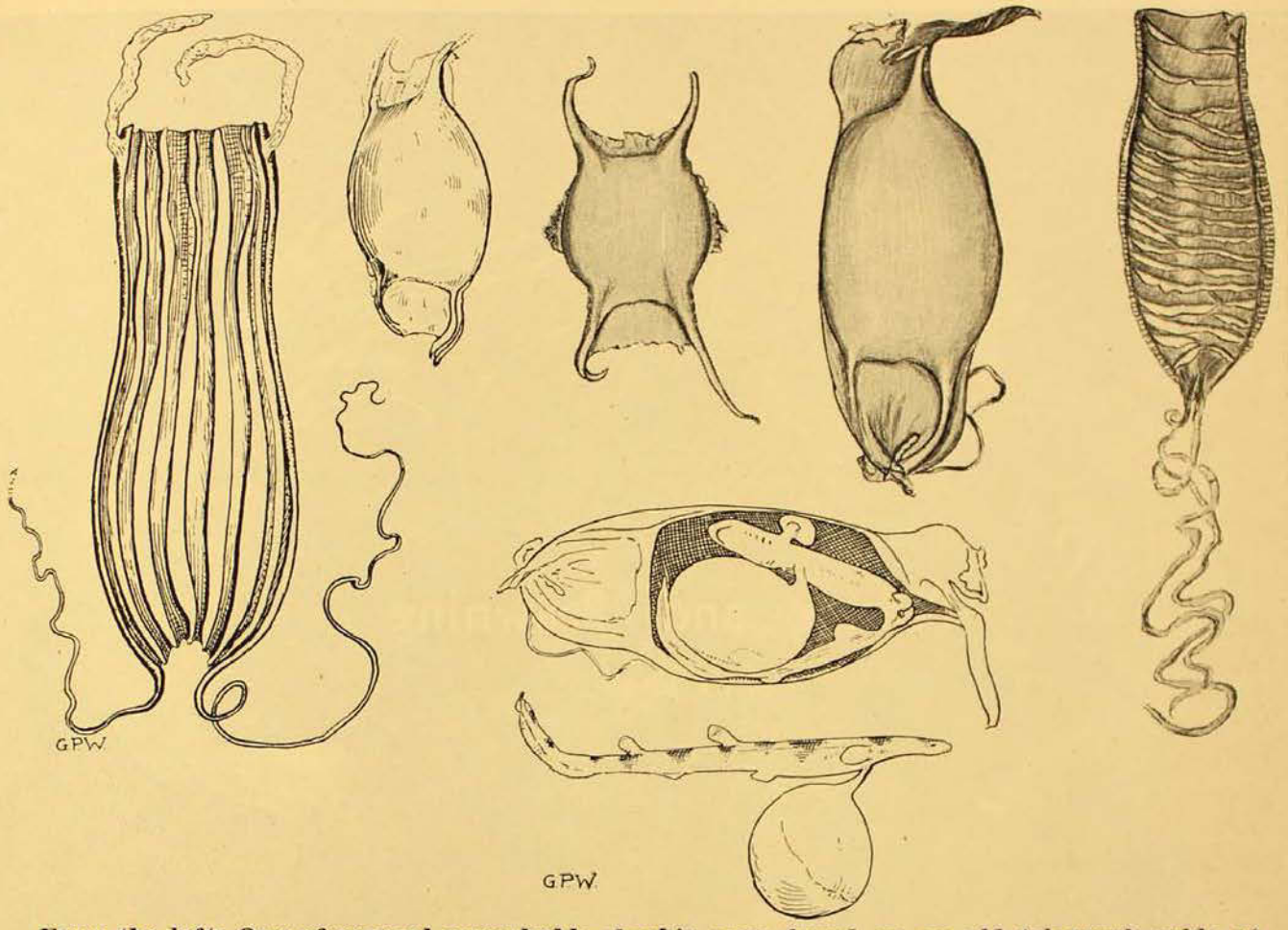
The egg-cases are brown, dark or light honey or golden-coloured, or even black, the colour apparently being of no significance. At Queenscliff, Victoria, they were always washed ashore with shreds of a certain seaplant (*Cymodocea antarctica*). The eggs were of different sizes in different localities, but whether this is due to various species of *Parascyllium* or eggs are laid by sharks at increasing periods of their growth is not known. The body of the Collaroy egg measured 45 mm. in length and 33 mm. in width, or about $1\frac{3}{4}$ by $1\frac{1}{4}$ inches. The normal dimensions of eggs collected by me at Queenscliff, Victoria, in February-March, 1942, were about 50 by 35 mm. In north-western Tasmania, a month later, they were about 57 by 37 mm. At Phillip Island, Victoria, in January, 1935, I obtained several a little larger than this, but the Australian Museum's largest specimens, up to 75 by 35 mm. (nearly 3 by $1\frac{3}{8}$ inches), came from Portland, Victoria.

In my previous Magazine article, I mentioned that two sharks, *Parascyllium* and *Cephaloscyllium* had had their egg-cases confused. I have since found "laminated" eggs from inside the Tasmanian Swell Shark (*Cephaloscyllium*), so that we are still left with two types of eggs associated with *Parascyllium*. It is only by further collecting that these problems can be solved and now that sharks are of commercial interest, their life histories have an added importance. Our readers are again requested to look for the eggs of sharks and rays on the beaches and to let us have specimens.

A final note: in my earlier article I described and illustrated the large "Stringybark" and "Tinder Box" Egg, up to 9 by $4\frac{3}{4}$ inches. This, the largest of the skates' eggs, brown and wood-like, was trawled off southern New South Wales.

"If we can associate this great egg with the largest Australian skate, then it may be that of *Raja scabra* [now *Spiniraja whitleyi*], which grows to $5\frac{1}{2}$ feet in length and is trawled off New South Wales and Victoria, though it has not yet been recorded from Tasmania." (*Loc. cit.*, p. 381, figs. 22, 23 and 24.)

* The Museum at Launceston also had an embryo, $6\frac{3}{8}$ inches long, of this species, which had come from an egg found at Clayton, near Ulverstone, Tasmania, in August, 1939.



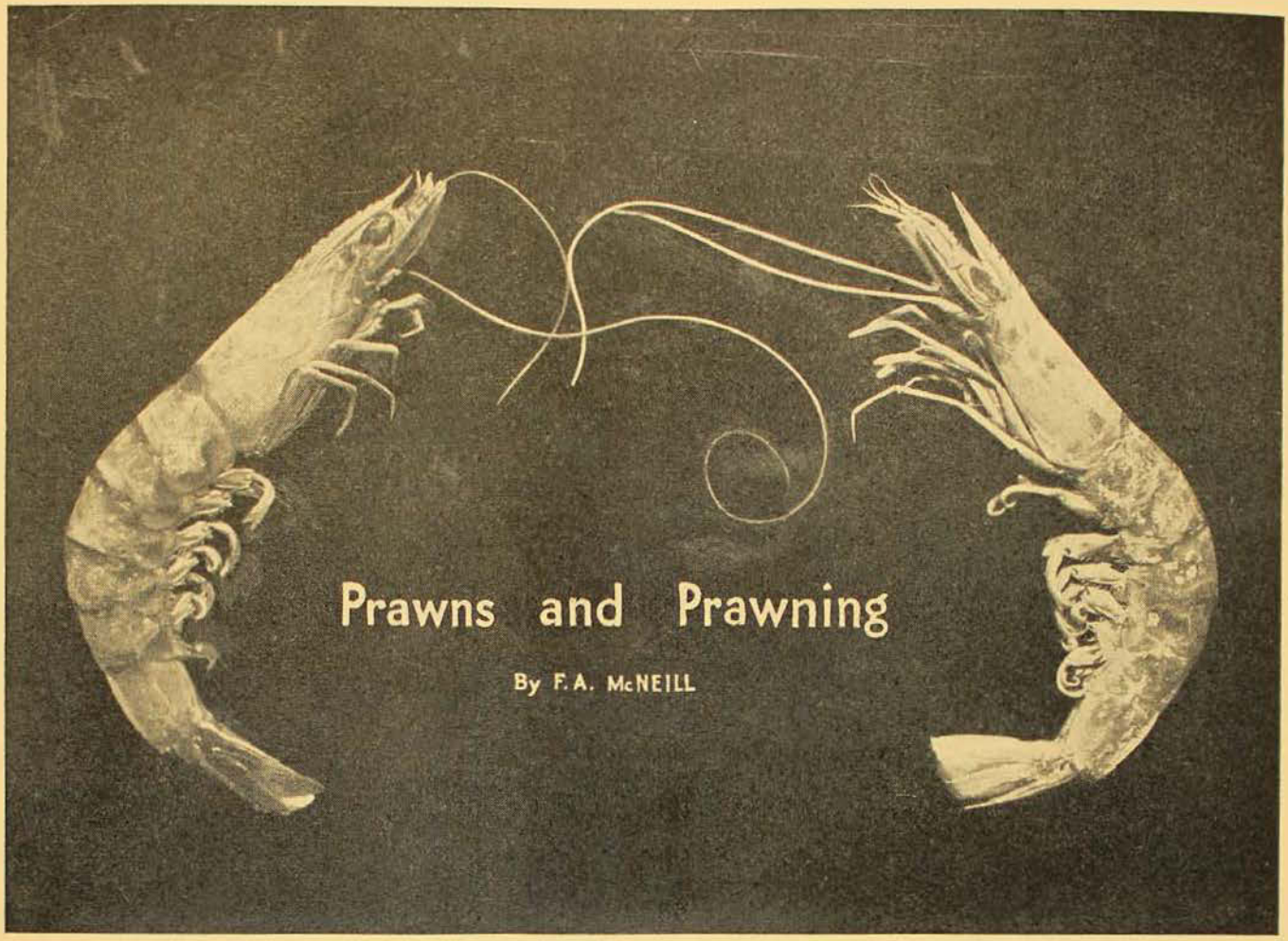
From the left: One of several remarkable shark's eggs found on an old telegraph cable at Darwin, Northern Territory; egg of Catshark (Parascyllium), Collaroy, near Sydney; eggs of a Skate (Raja), a Catshark (Parascyllium) and a Swell Shark (Cephaloscyllium) from northern Tasmania. Below: Egg of Catshark (Parascyllium ferrugineum) laid open to show embryo curled around yolk sac, and embryo removed from the egg, from Ulverstone, Tasmania—specimen in Queen Victoria Museum, Launceston.

Lola van Gooch and G. P. Whitley, del.

My guess was correct, for, when sharking in 8 fathoms off Kettering, D'Entrecasteaux Channel, Tasmania, on 5th July, 1942, my companions and I caught a large female Great Skate inside which were two partially-formed egg-cases of the "Stringybark" type. It is pleasant, not only to confirm the identification, but to have been able to record this ray from Tasmania: it is always pleasant to say, "I told you so".

The Director of the South Australian Museum, Adelaide, recently showed me four eggcases of a kind not hitherto recognized from Australia. They were about 2 inches by $\frac{3}{4}$ inch, but on soaking one overnight in water I found it increased to $2\frac{3}{8}$ by nearly 1 inch. The colour was dark brown, almost black, along the edges and tendrils, with two woolly tufts each side of the exit; there were six ridges right along each side and the top of each ridge was expanded into a light-brown roof. These eggs were found on the old telegraph cable off Palmerston, now Darwin, Northern Territory, in November, 1890, by Paul Foesche, Inspector in charge of N.T. Police, an enthusiastic photographer and collector who is mentioned in Searcy's book, *In Australian Tropics*.

The shark responsible for these eggs is at present unknown, but somewhat similarly fluted eggs have been described from the Northern Hemisphere.



Prawns and Prawning

By F. A. McNEILL

The King Prawn (left) is the best known of our commercial varieties, and in life is mottled with light brown, pink, and blue. Limbs are sturdy and short, and body is compact. Average length about 4½ inches.

In the School Prawn (right) the body is comparatively slender and the limbs long. The head spine (rostrum) has only a few teeth, confined to its upper edge, and is directed upwards at an angle from its base. In life this prawn has a semi-transparent body covered with small reddish-brown pigment spots. Average length about 3½ inches.

PRAWNING holds a fascination for many thousands of holiday-makers, who every summer descend upon one or other of our lakeside resorts. Last season the writer caught this fever and enjoyed some never-to-be-forgotten experiences. To live in surroundings where everyone is talking nets and their patterns, the best spots for prawning, and the quantities caught during this or that outing all adds up to something unusual in the way of vacations. Prawns are a delectable sea food, and to net and cook one's own hauls seems somehow to enhance their appeal.

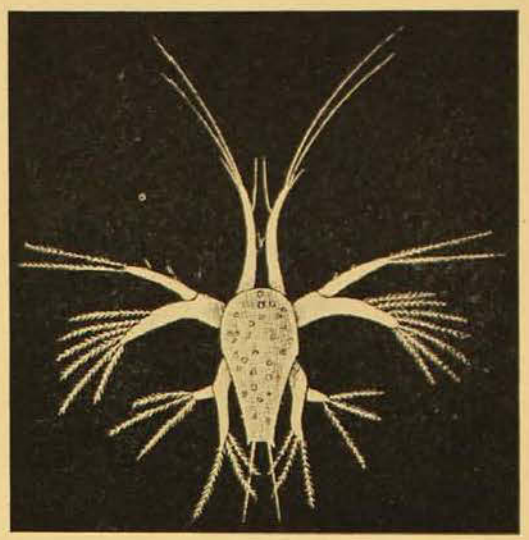
Strangely, only a limited stretch of Australia's eastern seaboard is a favoured breeding and nurturing ground for prawns. There seems no doubt that this is due to a suitable water temperature and the peculiar character of the coast. The swarming places are the numerous shallow inlets and the expansive sand-floored lagoon-like lakes which connect with the sea by narrow channels. Lake Illawarra, Tuggerah Lakes and Lake Macquarie are as famed for their prawn fisheries as for any other reason.

The industry has provided fishermen with a lucrative harvest for more than a hundred years. Year in and year out the rhythmic swarming movement of the prawn hosts has been exploited to its maximum. As with so many other bountiful gifts of nature, little thought was given to any study of the effects of

over-fishing. Certainly laws were made and policed by the authorities, and regulation patterns and mesh of nets insisted upon. Methods of fishing, however, have not been based on any deep study of the habits and breeding of the prawns. No proper significance was given to the fluctuations in the annual yields from the principal fishery areas. And not until very recently was it brought under official notice that a serious diminution in numbers had occurred in the past ten years.

The research which succeeded in throwing light on the breeding habits of our prawns was completed as late as 1938. This was the study by Professor W. J. Dakin, of Sydney, which established for the first time the full life-history of a prawn belonging to the unusual peneid group. The Professor discovered facts about the breeding habits and linked these with the annual swarming phenomenon.

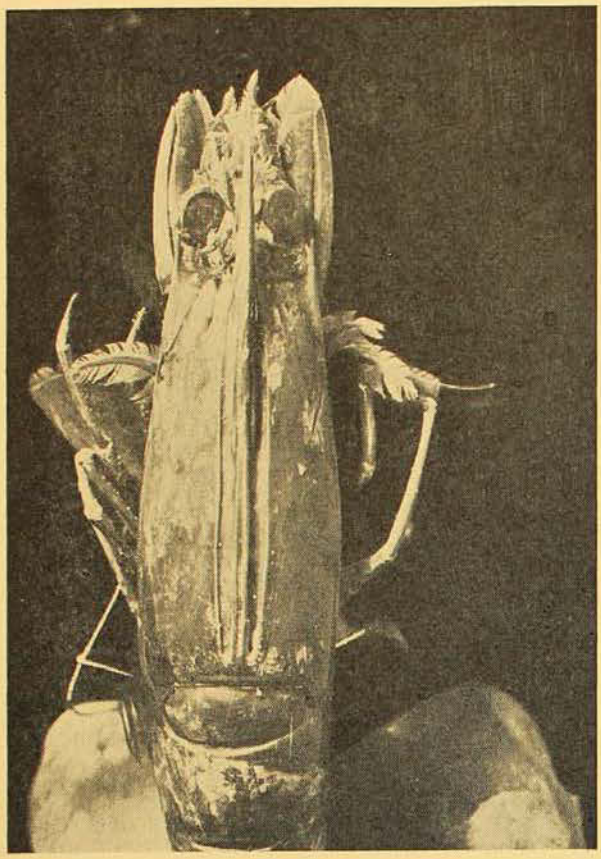
Previously some local specialists had accumulated only scattered data. Among them it was generally accepted that all the commercial marine prawns bred in the open sea, but of this there was no definite proof. Over a long period occasional floating eggs and typical minute early larval stages had been collected off the coast in special fine mesh tow-nets. These larvae, however, could not be identified with specific adult stages. Despite the fact that neither prawn eggs nor prawn larvae were ever tow-netted from inlet waters, the sceptics among the fishermen remained unconvinced. The swarming and then the departure of great numbers of adults from the coastal lakes to the open sea was a common sight to them, but no prawns were ever seen entering the lakes. Therefore, they believed the inside swarming places of the prawns were, without question, also their breeding grounds. Another fact somewhat confusing to the fishermen was the absence in their catches of what they called "berried" prawns—females carrying eggs. It was claimed by some of them that nobody had ever seen egg-bearing females; hence their argument was as good as any other. What they found



The first discovered nauplius larva of a peneid prawn, drawn by Müller in 1863. Greatly enlarged.

hard to believe was that our commercial prawns belong to a family of crustaceans which, in breeding, behave differently from their relatives. Instead of carrying developing eggs in bunches on the underside of the body, the commercial prawns (Peneidae) cast their eggs direct into the water. Subsequently a stage known as a nauplius hatches out, and this is the most primitive form of all crustacean larvae. The members of the barnacle group (Cirripedia) feature a free-swimming nauplius in their early development, but not so any of the crustacean forms more nearly related to the commercial prawns. In them the nauplius stage is suppressed; it is traversed within the egg prior to hatching.

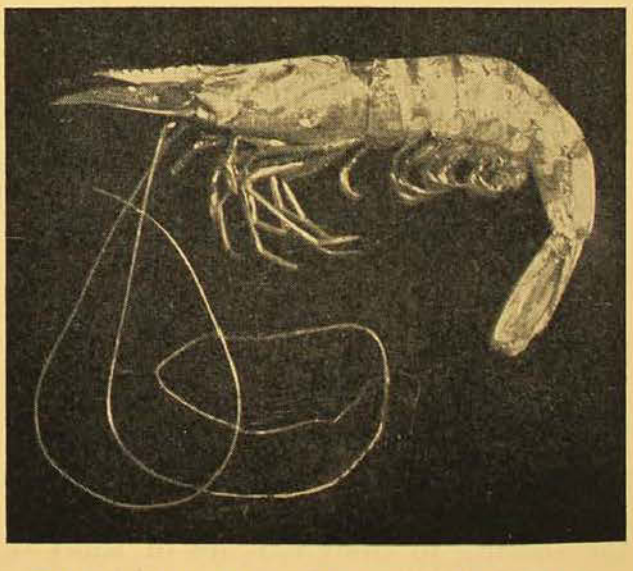
If it were possible to observe the hatching and development of larval changes within the confines of an aquarium, the work of an investigator would be simplified. Think, however, of the difficulties that were encountered in actually tracing through a life-history from the multitude of small creatures captured in tow-net and dredge from the waters of the open sea. Huge batches of often microscopic mites had to be tediously sorted and identified until, link by link and season by season, the various intermediate stages of prawn larvae could be recognized with certainty—



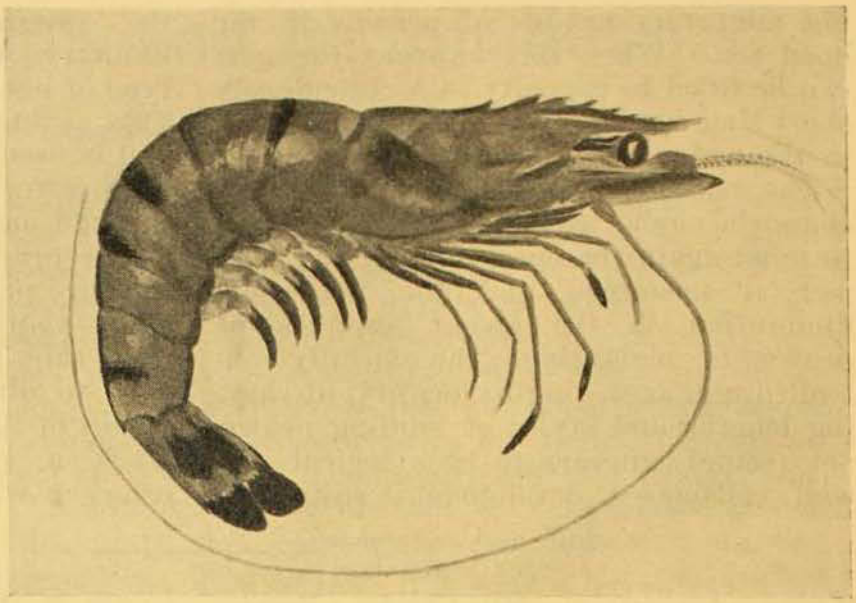
The head spine (rostrum) of the King Prawn merges at its base into a well-defined set of ridges and grooves. This character is the surest clue to identity among local commercial varieties.

recognized and associated with an authenticated species as parent. This last task was by far the greatest obstacle to be overcome in the investigation referred to. The earlier confusion of prawn larvae in the catches was due to the fact that the deep sea is the normal home of the majority of the prawns of the same family as our common commercial kinds, which number a bare three species. Two of these form the mainstay of the industry, and only one of them—the King Prawn (*Peneus plebejus*)—has so far proved to be an oceanic breeder. Its associate, the School Prawn (*Penaeopsis macleayi*), is strongly suspected of behaving in the same way. The third species (*Penaeopsis monoceros*) is called the Greasy Back because of the slippery furry nature of its shell. It is a form only occasionally netted in large numbers, and there is evidence to support a belief that, contrary to usual practice, it has the unique habit of breeding in the inlets. Further, the Greasy Back is not popular among the prawn fishermen. When cooked in bulk it does not possess an attractive appearance, and in a mixed haul its presence is claimed to be responsible for the blackening of the gut of other prawns during the cooking process.

The large King Prawn normally breeds in ocean water well out of the estuaries and lakes where its later young stages may be netted in hundredweights. Collections of larvae have shown that breeding takes place over a long period of the year. This fact explains the occurrence of adults markedly varied in size, which can be netted in any particular week from different parts of the one inlet. It is noteworthy that the same condition of size applies to catches of the equally common School Prawn, likewise a swarmer which has been commonly observed migrating to the open sea. As already indicated, however, all the links of the life-history of the last named have not been recognized with any certainty. With the King Prawn, on the other hand, the changes in form of the normal swimming larvae have been traced through to what is known as a mysis stage. This soon develops the characteristics of the parent form, and while still tiny it



The outstanding feature of the Greasy-back Prawn is the short fur-like growth (tomentum) covering the body. Antennae (feelers) are always long and very slender. Colour in life is a light greenish-brown. Average length about 4 inches.



The Tiger Prawn, probably the giant of its kind, grows to a length of twelve inches. In the past the variety has been abundant in local waters, but few specimens are now netted; tropical Australian waters seem to be its normal home. Special features are the brown stripes extending across the sides, and the short, strong head spine which is raised into a prominent crest near its base. The scientific name of the Prawn is Peneus esculentus.

A. R. McCulloch, del.

becomes a crawler on the sea floor. From here the now juvenile prawn slowly wends its way back unnoticed to the sheltered waters of the bays and inlets. Even in the fully adult state our marine prawns have a liking for hiding in loose yielding sand and silt. It is here that the sparser numbers present during the colder period of the year appear to retreat.

The summer swarming activity referred to is associated with the mild dark nights. On these occasions the opportunities for netting are eagerly availed of by the amateur and the professional alike. When the prawns are particularly abundant, word soon gets around among the holiday-makers at lakeside resorts. From every direction processions of these scantily attired enthusiasts converge on the foreshores. Groups of two to four persons constitute a working unit. Equipment consists of net, hurricane lamp or torch, and a bucket or similar receptacle for storing the catch. The amateurs netting in the channels linking with the sea are restricted to two-foot-wide handnets, mounted on wooden handles. Elsewhere in the lake waters the use of a short length of one-inch-mesh seine net is allowed. This is rigged with a pole and bridle rope at each end and provided with corks and leaden weights. While in operation it is drawn along by two persons in the extensive shallow stretches where the water is no more than two feet in depth. Viewed from the shore the spectacle of a hundred or so shadowy figures wading backwards and forwards in the gloom is both unusual and fascinating. Intent on their occupation, those concerned are quite unconscious of the fairyland effect produced by the criss-crossing of the lights from their lamps, the silvery reflections on the water and the random beams of torchlight stabbing the darkness. Short halts are called while nets are lifted from the water and the captive prawns removed. In the narrow channels closer to the sea the twinkling lights are more concentrated. They are found there in regular rows, indicating the places where the netters are standing knee to waist deep in water either parallel with or at right angles to the shores. Here in the channels the lights serve a double purpose in that they also attract the prawns to the surface and make their capture easier with the smaller nets. Normally the amateur system of netting in the wider lake waters is the most productive. Quite commonly four to five pounds of prawns can be captured by a couple of operators in less than two hours—an amount sufficient for the immediate domestic needs. In the channels, however, there is always the chance that the netters may anticipate a

big migratory exodus of prawns to the open sea. When this happens the nets can be filled to capacity in a ridiculously short time merely by holding them steady in the water.

The mass exodus of prawns through channels connected with the sea brings to mind again the operations of the commercial fishermen and the noticeable diminution in the recent supplies of prawns for marketing. The officially controlled use, according to locality, of varying lengths and styles of hauling prawn net (seine), appears to be a logical and well considered development suited to the progressive requirements of the industry. Unfortunately, however, a new type of net can now be lawfully operated. This is known as the "set pocket net", and is used most effectively for capturing the prawns making their way out to sea through narrow channels. A continuance of the practice might well spell disaster to our prawn fishing industry before many years have passed. Let us trust that this fine marine industry, second only to similar fisheries in the United States of America, will not be allowed to reach a stage of deterioration where recovery will be virtually impossible.

MOSTLY AUSTRALIAN. By Charles Fenner. (Georgian House, Melbourne.) 1944. Med. 8vo. Pp. 181. Price 12s. 6d.

IN a brief foreword to his delightful volume, *Mostly Australian*, Dr. Charles Fenner affirms his opinion that "upon an interest in our hills and valleys, plants and animals, is based the most enduring love of our own country". Every chapter of his book gives proof of the depth of his own love for Australia and things Australian, for even when he is writing of other places he glances ever and anon at his own land.

It is in its variety of subject matter and in its pleasantly discursive style that the main charm of this volume of essays lies. It is a friendly book, one to be taken up at odd moments and consulted again and again. Mostly Australian it is indeed, and it reveals Australia through the eyes of a scientist whose interests range widely over many branches of science and whose quick perception sees a fascinating story where another might find only a monotonous landscape. Chapter headings range from "Our Black Brothers", which contains an interesting section on the migration of the now extinct Tasmanian aborigines, to "Across the Pacific", "Rocks and Minerals", and "Wogs and Whirligigs", concluding neatly with miscellaneous "Odds and Ends".

Travelling over Australia, and indeed over the world, with a mind well-stocked with scientific lore and alive to the historical background of his surroundings, Dr. Fenner recorded passing impressions that delight us by their unexpectedness. Of our own country, we are told that "Australia, smallest of the continents, is also the lowest, the flattest, and the driest of all the greater lands of the world", factors that have helped to make Australia and Australians what they are. At Innsbruck the author pauses to explain that prosperity and artistic development were a result of the warm winds that brought comfort and a pleasant climate to the Tyroleans. We learn that the amazing upward growth of New York, its tremendous concentration of buildings and people on a small area of land, was made possible by the strong and enduring foundations of schist and granite that underlie the city.

It is evident that Dr. Fenner's own special subject, geography, is a fertile source of many ideas new to the general reader, who is fascinated by the series of pictures of past, present and future that the author conjures up. He takes us back far into the past when he describes the delight of hunting fossil fishes, and some distance into the future when he mentions a hope that a time will come when Australians and New Zealanders will visit Antarctica on holiday trips.

This last suggestion brings out an important point Dr. Fenner makes: that Antarctica is about the same distance from Australia to the south as Asia is to the north. Belatedly and painfully we have become aware that Asia, from whose peoples we are so remote in thought, is in fact our near neighbour, and that as distance in effect contracts with the advance of technology, nations must learn to live with their neighbours or perish. We may well, therefore, take timely thought for the development of our neighbour to the south.

The new light cast by Dr. Fenner on so many scenes and subjects is not all sunshine. How completely he shatters the illusion of those who had cherished visions of Elysian "meads of asphodel" frequented by the spirits of the blessed. We are brought rudely to earth by reading that in Australia the classical asphodel is commonly known as "wild onion" and, worse still, has been declared officially a noxious weed!

A review of *Mostly Australian* must not close without mention of John C. Goodchild's pencil drawings, which add greatly to the charm of the book. They are well reproduced, and on the whole—overlooking an occasional misprint—the publishers are to be congratulated on the volume. M.W.

A Water Supply and Its Inhabitants

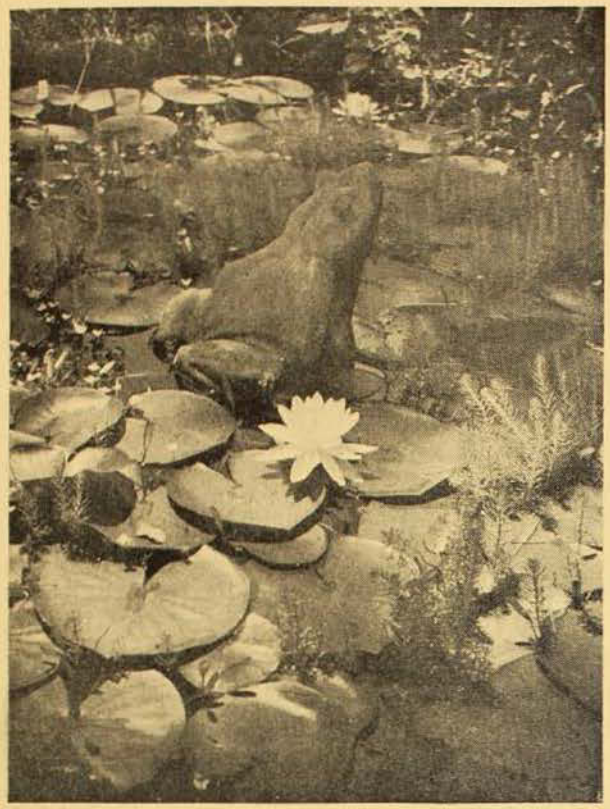
By ELIZABETH C. POPE, M.Sc.

IF a whole menagerie of aquatic creatures poured out before our startled gaze whenever we turned on our kitchen or bathroom taps, we would feel we had the right to complain. Perhaps we would even be goaded into writing to the papers to point out the inefficiency of the authorities. Nowadays there would certainly by a scandal if such a thing happened. Health authorities would step in at once and put matters right. But water supplies have not always been as pure as they are today, and, in the old days, the appearance of stray animals in the household supply was taken as a matter of course. In fact, in 1827 one public-spirited doctor complained about the quality of the water supplied to his home in London by the Grand Junction Water Supply in the following terms: "Scarcely a week passes that I am not presented with a leech, a shrimp-like skipping creature nearly an inch in length, a small red delicate worm, . . . or some other animalcula, and the water is most opaline, muddy and otherwise impure."

Imagine such a thing happening today! And yet the water from which our supply is drawn is just as full of organisms as the River Thames was in 1827, when that doctor made his complaint. Today, however, we are not as a rule conscious of their presence in our dams and streams, because the science of the purification of water has made great advances. Nowadays we are rarely confronted with any sizeable living creature in the water we draw for home use. The fact still remains that the dams, reservoirs and piping systems of a modern water supply form an ideal home for millions and millions of plants and animals.

The inhabitants of any water supply are really only the regular animals and plants that live in freshwater ponds and

Some of the small fry found in freshwater.
All stages of the life history of the mosquito can be collected from pools and dams. Physa, the freshwater Snail, appears here, along with tadpoles, water scorpions, water beetles, and the large Water Tiger, which is a larva of another kind of beetle, the Dytiscid. Water-Striders skate over the surface.
N. B. Adams, del.



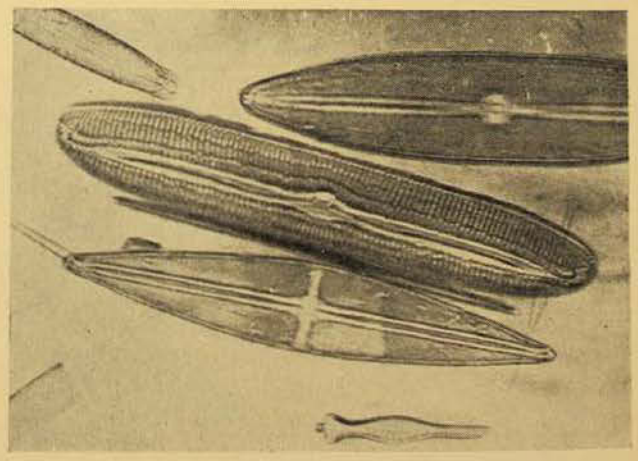
Large freshwater plants running riot in a garden pond. In water supplies, only a narrow band round the edges of the dams would be occupied by plants such as these.
Photo.—E. C. Pope.

rivers of the neighbourhood, but, instead of leading a precarious existence, battling with all the vicissitudes that normally plague freshwater dwellers, they find security and good conditions in the deep, placid waters of the dams. They never have to guard against complete drying up of their watery home as do the organisms of ponds and streams which, today, have plenty of water in them and tomorrow have none.

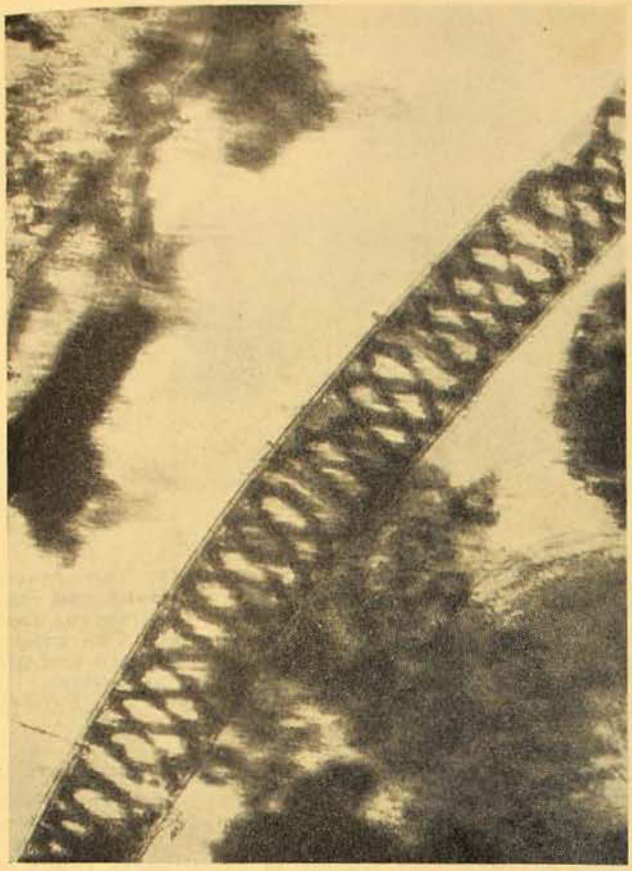
Since conditions in the dams and water supplies are so favourable and constant, it follows that life there is abundant. But it must not be thought that the presence of a flourishing community in the water is detrimental to its properties as a source of drinking water. Rather it is beneficial, since a well balanced community ensures that the water will have in it the ingredients most necessary for health. Only occasionally does some particular organism multiply to such an extent that it becomes a nuisance, either by clogging up the supply pipes and filters or else "tasting" the water by releasing chemical substances (by-products of the living processes) into it. Under normal conditions, however, there is a regular cycle of events keeping things in a balanced state.

Nutritive, fertilizing salts are brought to the dams and reservoirs in the water which runs off the soil of the catchment area, and these salts are utilized by the plants for their growth. The other ingredients necessary for the making of plant foods are dissolved in the water and ready to hand. Among the freshwater plants we find not only large visible forms such as reeds, duck-weed, water hyacinths and water-lilies, but also the far more important microscopic floating kinds—diatoms, bacteria and the thread-like forms which occasionally make the water look green and slimy. However unattractive these latter may seem to the naked eye, when viewed under the microscope they are seen to be delicate and beautiful in structure. Countless millions of these tiny plants form the basic food supply for all the animals in the freshwater community. They are the primary producers. The animals are the consumers and are entirely dependent on them in the long run for their food supply.

Some of the animals eat the plant material directly. They are the herbi-



These diatoms of the Naviculoid group are so tiny that they cannot be seen with the unaided eye, yet they are so numerous that they form the basis of most of the food chains in this community. Magnified 400 times.
Photo.—R. G. Palmer.



Under the microscope the green, slimy threads are seen to have a complicated structure. The criss-cross markings are green and add greatly to the beauty of these plants. Magnified 400 times.
Photo.—R. G. Palmer.

vores of the community. Others get the plant material second or third hand, as it were, when they prey on their fellow creatures. Large kinds of animals feed on the smaller ones, and these smaller ones on still smaller kinds—each having its own definite bill of fare. So we go down, link by link, in each "food chain" till we come to the initial link which always proves to be plant, very often minute types, like the diatoms or desmids.

In time, death comes to each kind of animal living in the water supply, despite the splendid living conditions. The accumulation of dead bodies and also the waste products poured out by the living inhabitants would soon foul the water, were it not for the work of various kinds of scavengers. In particular the work of certain types of bacteria must be mentioned. By their very living processes, they break down and release the chemical matter from the animals' bodies, bringing important raw materials, especially nitrogenous substances, once more into circulation and making them available to plants for their growth. This balanced working of the freshwater community, as mentioned above, improves its health-giving qualities.

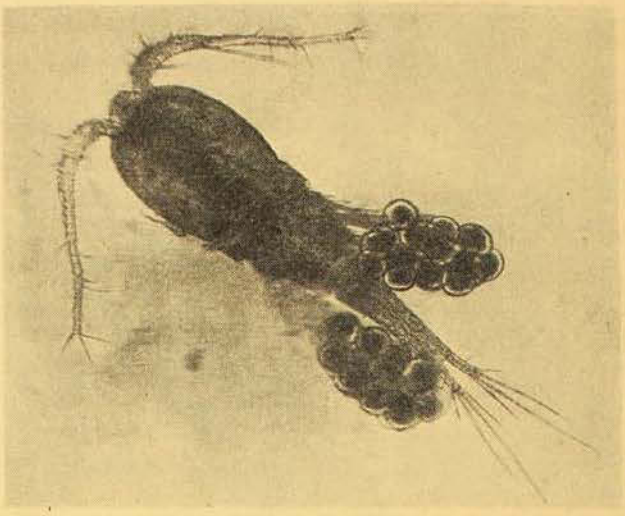
Broadly speaking, there are two types of animals living in the water works—those living firmly attached to some kind of substratum, as for example to the sides of the reservoirs and pipes or even attached to the larger water weeds, and those which move about freely by swimming, drifting or crawling.

To the former group, the sedentary forms, belong such animals as freshwater sponges, polyzoans, colonial rotifers and certain kinds of bivalve shellfish of the mussel type. As a rule, sponges and the like pass unnoticed by the casual observer, who regards them as so much "slime" on the sides of the dams. Only the microscope can reveal their delicate structures, and yet they play an important role in the community because of their unusual method of feeding. Instead of going out, hunting for food, they sit still and create water currents. From these currents they suck in or strain off the tiny organisms which go to make up their bill of fare. Their watery surroundings are to them a kind of "dilute soup" and by straining out the desirable particles they find plenty to eat and their sedentary habits are no disadvantage.

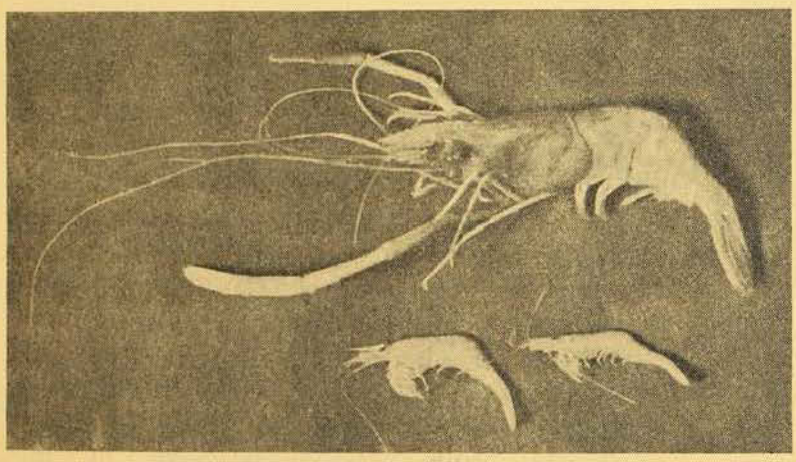
The constant toll exacted by the fixed animals on the numbers of free-floating and swimming organisms helps to cut down the numbers that have to be removed from the water before it goes to the consumer. Occasionally, however, young spore-like stages or early larval forms of these sedentary animals elude the filters and "set up house" in the piping systems. If they then multiply rapidly, they can block the pipes and becomes a nuisance by preventing the flow of water. It is evident, therefore, that the presence of fixed organisms in the water supply is rather a mixed bless-

ing and a constant watch has to be kept on their growth.

The free-swimming and floating animals of fresh water are generally more pleasing to the naturalist than the fixed forms, for among their numbers we find those fascinating small crustaceans, the Water Fleas or Daphnids, and the dainty copepod, *Cyclops*. In addition, there are the larger freshwater prawns and the well-known crayfish, reputed to cause damage to the earthen sides of dams by its burrowing habits. Then there are fishes of various types, tadpoles of frogs and myriads of aquatic insects. Even the reptiles are represented, by the



Above.—Cyclops, a tiny, oar-footed copepod, occurring in millions and constituting an important link in the food chains of higher animals. The grape-like appendages at the hinder end are egg sacs. Magnified 100 times.
Photo.—R. G. Palmer.



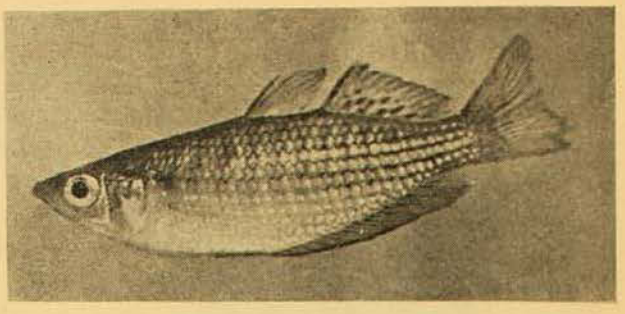
Left.—The two types of prawns met with in our water supplies. Top: Long-armed Freshwater Prawn, Palaemon australis. Below: Paratya australiensis which is frequently found in Sydney's water supply.

Long-necked Tortoise (*Chelodina longicollis*) which frequently finds its way into the dams and reservoirs and may be collected at almost any time at the filtering centres. Living in the mud or crawling about on the debris of the bottom are numerous small worms, shellfish, larvae of insects such as the Caddis larva or the "Blood Worm" stage of the Chironomid Midge, and even large eels which like to lie buried and feel the mud pressing all round them.

Large water weeds of the reed or water-lily type also have their share of free-moving inhabitants. Crawling about on them we notice numerous water snails, leeches and Dragon Fly nymphs, and these are only some of the more obvious reed-dwellers. A microscope reveals many more, both among the reed-dwellers and the freely floating forms. They are so minute as to escape notice, but are numerous enough to constitute the chief problem of the man in charge of filtering processes, for they tend to clog the filters very rapidly. Large freely-moving creatures like fishes are easily excluded from the piping systems by coarse strainers, but any strainer fine enough to keep out all the microscopic forms so slows up the passage of water as to be useless from the point of view of the supply engineer. Bacteria especially are hard to remove—far harder than the other microscopic plants like the Desmids and the filamentous "slime" algae, because they are so tiny. There is, in consequence, a never-ending battle between the bacteria and the biologist who has to control them.

A full list of the inhabitants of a water supply cannot be given within the com-

pass of a short article, but from this description of the more prominent forms it should be evident that biological problems are certainly not the least of the worries of a water supply engineer. One of the most important aspects of his work is the devising of methods of filtration and purification of the water at the pipe head to exclude the fauna and flora. It is hoped in a later article to deal with this fascinating and important aspect of the biology of water works.



Small freshwater fish, Amneris rubrostriata, belonging to a well-known family of Australian native fishes, the largest of which grows to a length of about five inches.

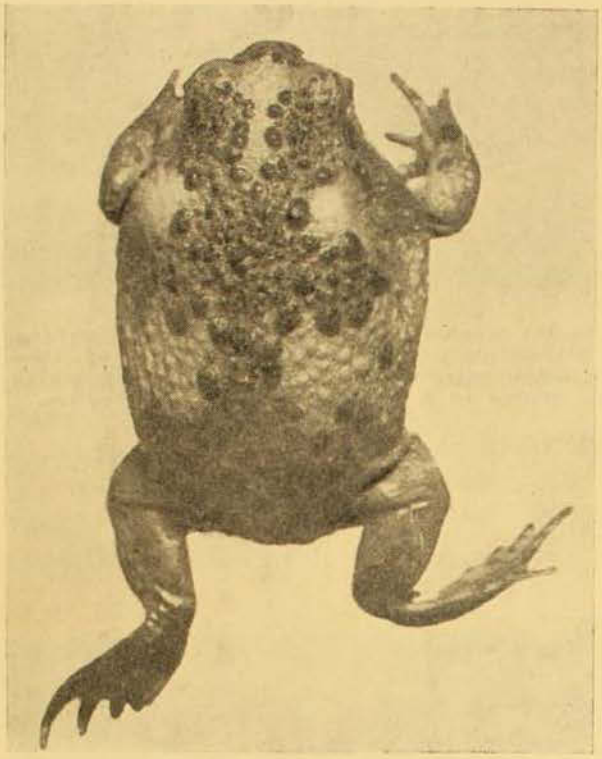
Frogs and Toads

By J. R. KINGHORN

NO doubt most of us have gone frog hunting at one time or another, and we have collected tadpoles and kept them in bottles and tins hoping to see their tails drop off, and we have wondered what exactly are the main differences between frogs and toads. The only true frog of the genus *Rana* in Australia is one known to scientists as *Rana papua*, an inhabitant of New Guinea and North Queensland.

The true toads belong to the family Bufonidae and there are only a few small representatives in this country, but we have many species which might be classed as "near" toads, and "near" true frogs, and it is because of the external appearance of these creatures that we speak in general terms of frogs and toads. The technical differences are mainly skeletal, and concern to a large extent the development of the shoulder girdle, breast bone, and the presence or absence of teeth in the upper jaw.

The popular belief is that frogs have a smooth moist skin, and toads a warty dry skin, but conditions approaching these are found in both, so we will have to look for other differences. Broadly speaking, the tongue of a frog or a toad is fixed in front and free along the hinder edge, and this free edge is notched in frogs and rounded in toads. Frogs generally have well developed, slender, long hind legs, whilst toads have powerful, short legs. Frogs have teeth in the upper jaw and toads have none. For our purposes, we will include among our Australian frogs all those that have teeth in the upper jaw; and we find that there are the green tree frogs, grey tree frogs, brown river frogs, mottled swamp frogs, golden tree frogs and burrowing frogs—the latter often being referred to as toads because of their rough skin. We can restrict the name toad to such members of the *Bufonidae* as the Cross-bearing Toad and Crowned Toadlets.



Cross-bearing toad, Notaden bennetti. In colour this is a brilliant green covered with black nodules in the form of a cross. Natural size.

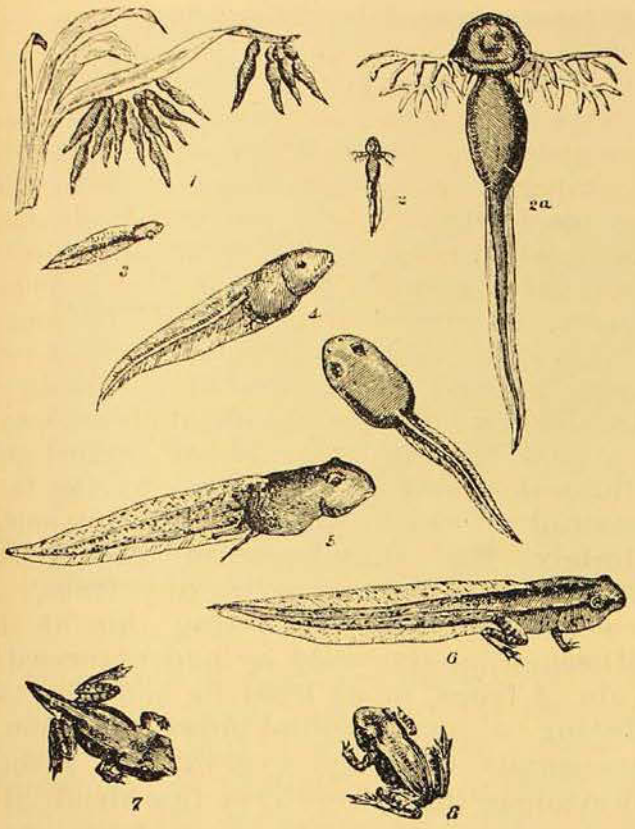
COLD-BLOODED ANIMALS?

Frogs and toads are called cold-blooded animals because of a variable body heat, depending on and changing with the temperature of the water or air in which they live; and because of this they can endure certain extremes of heat and cold. There is, of course, a limit to this, and death may occur in water of 104° F., though a frog can sit in the sun when the temperature reaches 120° F., the reason being that the evaporation of moisture on its skin keeps its temperature within endurable bounds, as it is with mankind. At this high temperature there may be some of the drier skinned frogs that would perish, whilst toads would have to hide away under stones and logs, or burrow into the soft earth. With decreasing temperatures the respiration and blood circulation slackens, and eventually the frog or toad becomes more or less torpid, and crawls away to some secluded spot to hibernate. Because of this condition, known as suspended animation, respiration sinks to a primitive state, sufficient air to sustain life is taken through the skin by means of the reticulations of the blood system, and food is not required.

When springtime brings warmer days, there is a rise in the body temperature of the frog, resulting in increased physiological activity, and eventually the creature emerges from its comatose state and takes up life where it left off on the approach of winter.

THE EGGS AND BREEDING HABITS.

The eggs of frogs are minute, jelly-like, and resemble boiled tapioca. They are laid in masses, numbering from fifty to thousands, depending on the species, and from a distance appear as froth attached to the stems of water plants. The egg batches of toads differ from those of frogs in that they are deposited in a string and are laid not only in water but under stones and damp moss. After about ten days, providing temperature and general conditions are suitable, the eggs hatch, and tiny wriggling tadpoles emerge. At this stage they are mouthless, limbless and blind, but are covered with microscopic cilia which collect the air necessary to sustain life. A tadpole soon passes this stage and develops external branching gills by which it takes air from the water in much the same manner as does a fish. A few days later these gills give way to lungs, and a sucker-like mouth through which the tadpole gulps air during its frequent visits to the surface of the water. If food and other conditions continue to be favourable, development is speeded up; the hind legs break from under the skin, and these soon are followed by the arms, so that the tadpole begins to look more frog-like. At this period it is often termed a bully frog, and is collected by children and placed in a tin or jar in the hope that the tail might be observed dropping off, but this does not happen. If a tadpole had been placed in a suitable aquarium, the final stages of development might easily have been observed. The eyes become elevated, and movable lids develop. The horny parts of the sucker-like mouth are dropped, and the mouth increases in size, becoming more like that of a frog. At this time the tadpole cannot get all the



The development of a frog from the tadpole stage. (1) The newly-hatched tadpoles clinging to the undersides of water-weeds. (2) The external branching gills develop (2a is a magnified view). (3) The gills gradually disappear, and are replaced by lungs. (4) The air-breathing tadpoles. (5-6) The hind- and then the fore-limbs appear. (7) The tail is gradually absorbed. (8) The developed froglet.

food it requires, but nature has made provision for this, and it exists on fats stored up in its body, and by the absorption of its tail, which diminishes in size until only a mere stump remains and a complete but tiny frog jumps onto the rock or grass at the edge of the pond. Its metamorphosis is complete, and it commences life as a frog.

Most toads go through the same process of development, but once having reached to adult stage, they leave the water or marshy area and take up a life on the land, only returning to the water year by year to lay their eggs. Some toads, that habitually live in drier areas, do not lay their eggs in water, but select some damp place under moss or stones, and the tadpoles undergo complete metamorphosis within the egg mass.

BREATHING.

A frog has no true ribs, these being replaced by short processes from the vertebrae sufficient only to give some protection against injury. Because of this, there is no expansion and contraction of the ribs and diaphragm in breathing as there is in higher animals, the breathing mechanism as we know it being absent, so a frog has to get air into its lungs by other means. It does this by means of a pumping action of the throat. The whole process might be likened to pumping through bellows. The mouth acts as an air reservoir, corresponding to the bag part of a bellows. The palpitating of the throat, so commonly observed in frogs, is actually the pumping action during breathing. Air is drawn into the mouth through the nostrils and pumped direct to the lungs. If you were to puncture the bag portion of a bellows, you could not pump air, and so if a frog's mouth were kept in an open position, it could not pump air into its lungs, and, extraordinary as it may sound, the frog would suffocate.

THE VOICE.

All kinds of frogs and toads have voices, but this is restricted mainly to the male, a few females being able to emit only a growling sound. Some males have special sacs entering the larynx and when these are filled with air they extend like bladders at the corners of the mouth; in others the throat is blown up into an air reservoir. This reservoir, in both types, acts as a resonator, and greatly increases the volume of sound produced. So it is not always the largest frog or toad that has the loudest voice.

The sounds emitted vary considerably, from the rather sweet whistling of some tiny Hylas and the croaking of tree frogs and swamp frogs to the loud barking of a South American species called the Barking Toad, the voice of which somewhat resembles the bark of a small house dog. The Fire-bellied Toad of Uruguay is the most accomplished vocalist, and its voice is said to resemble that of an English finch.

One of the most peculiar voices is that of our little crowned toadlet, which resembles the scratching of a nail on a wax match box. Choruses of frogs are only too well known, and their sudden cessation at the approach of man and the almost equally sudden resumption on his departure is always a source of wonderment.

THE SKIN AND COLOUR CHANGE.

At certain times during the summer months frogs and toads cast their skin, either in large flakes or whole except for that covering the fingers and toes. This cast outer layer is very thin and transparent, and generally is eaten, especially by toads.

The surface of the skin of frogs and toads is covered with glands which, particularly in toads, are wart-like excrescences. It is from these glands that a secretion is exuded, and this may be in the form of a powerful irritant, or even a poison, and is used by some native races to poison the tips of their arrows or spears. It is the irritant effect of this poison that causes a cat or dog to drop a frog when it takes it in its mouth.

Frogs and toads can change colour to a limited degree, depending more on temperature, light and darkness, than on the colour of their environment.

This colour changing, which in effect may be regarded as a form of camouflage, is brought about by black and coloured pigments in the skin in addition to the presence of certain reflecting substances and surfaces. Actually, there is no green pigment, the green of the frog being produced by light rays which pass through a yellow screen and are then reflected back through interference cells, which by a prismatic effect, cause a green coloration of the surface.

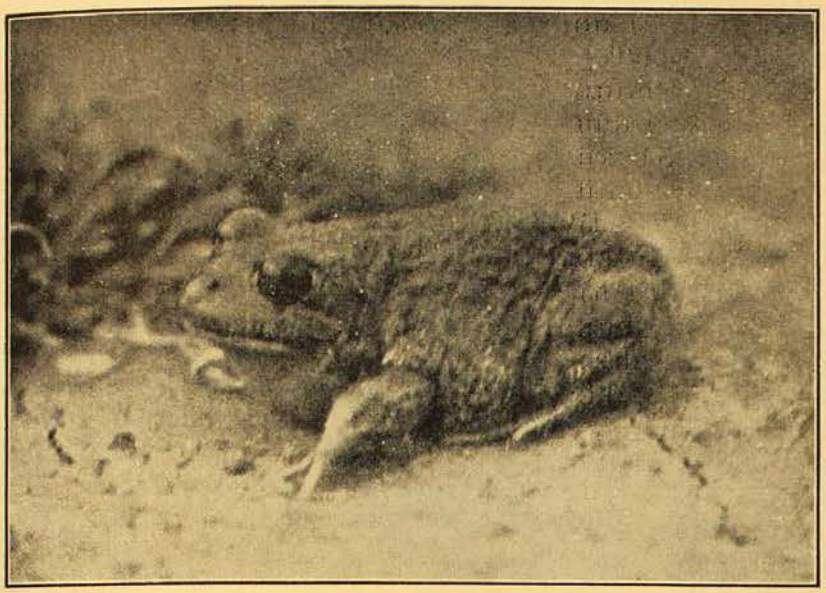
When all is not in harmony with the surroundings, a stimulus is given to the nerve centres controlling the pigments and light-reflecting cells in the skin, and a change of colour is gradually effected. This is "automatic" and is not in any way controlled by the frog, it is an emotional or physiological action. The effect generally is to render the frog or toad more or less inconspicuous, so that it is better concealed from its enemy.

RAINS OF FROGS.

One often hears of "rains of frogs", but we also hear it stated that "it rained cats and dogs", the former being as impossible as the latter; yet the story persists, and incidents quoted from time to time appear authentic enough to prove the phenomenon. Of course it is possible for small frogs, and fish, to be lifted with the water from a pond or section of a lake by a tornado and deposited some distance away on land, but the creatures so carried and dumped would all be killed by the fall, instead of which, we are told, that immediately the thunderstorm broke, the ground was "alive" with tiny frogs. A visitor who was discussing this at the Museum one day said he had witnessed a rain of frogs, or at least he had gone out during a heavy cloud-burst and found thousands of frogs everywhere, though previously there were very few about. His theory was that the tiny frogs were carried into the clouds by tornados and carried about until it rained. On further questioning he admitted that he could not explain what would happen to those frogs had the clouds dispersed, as they often do, without raining. Perhaps the most feasible explanation may be found in following the story of froglets after emerging from the tadpole stage. These tiny creatures often commence an immediate nocturnal migration to other ponds or streams. By day they hide in crevices and cracks in the soil, or under tufts of grass or stone. Whilst in hiding there may be a sudden downpour and naturally the frogs come out in their thousands and continue their journey; such facts have been recorded over and over again, and by this reasoning we have produced the "rain of frogs". It should be maintained that nobody has ever actually seen the frogs falling through the air, so it appears obvious to the thoughtful person that they had been in hiding.

FROGS IN SOLID ROCK.

Another story concerns the finding of living frogs in solid rock, and it is almost



Australia's largest native frog, Limnodynastes dorsalis, a burrower from the inland areas of southern New South Wales.
Photo.—K. C. McKeown.

impossible to convince the narrators that they have been misled by circumstantial evidence, and that a frog could not possibly be found alive in solid rock. Firstly, the rock in which the frog was supposedly found was formed millions of years before frogs lived on the earth, and secondly the frog "discovered" is a recent and not a prehistoric type.

The only explanation is that at one time there had been an opening leading to the rock pocket in which the frog was found, through which the growing frog had squeezed its way in—this may have been months, or even two years, earlier. Later, either the crack closed up through natural earth movements, or silt washed in and closed the entrance, but air and moisture sufficient to maintain life reached the frog, where it huddled in a comatose state. Then comes the day when the rock is blasted or smashed open with modern machinery, and behold a frog, fitting tightly in a pocket, and all trace of the original entrance blasted away, so the quarryman can hardly be blamed for thinking that the frog was actually in solid rock.

Frogs are not restricted to the wetter coastal areas, but are found in the drier areas of Central Australia. Here they may be found in the lakes and lagoons, not only when there is plenty of water, but even after the water has disappeared, leaving a hard-baked surface of mud—a clay pan. Where, then, is this frog? What kind is it? It is known as the Water-holding Frog—*Phractops platycephalus*, and its peculiar mode of life is well known to the scientific world, and to the aborigines. Before the lake dries up, these frogs fill themselves with water until they look as if they would burst and burrow deep down in the soft mud. When the lake is dry, they lie torpid in a pocket of clay well away from the scorching rays of the sun. They remain below until the next good rains, which may not be for a year or two, and, as the lake fills, they scramble to the surface to enjoy another short spell of freedom. The aborigines can tell whether frogs are below by a glance at the footprints in the clay pan, and many a traveller would have died of thirst were it not for knowing where to dig for water-holding frogs.

In comparison to some other countries Australia has very few toads, and they are restricted to three genera. In the inland areas there is one species that is known as the Cross-bearing Toad, *Notaden bennetti*, which in the young stage is golden, and in the adult green, both young and old having black nodules or warts on the back in the form of a cross. It is the only Australian toad with webbed feet. An occasional young specimen may be found with tiny scarlet warts between the

larger black ones; the little creature resembling a piece of gaudy jewellery. *Notaden*, though fairly widely distributed throughout the inland districts, is by no means common, and the occasional specimens found are always very welcome to scientific collections.

Our smallest member of the family is the Crowned Toadlet, *Pseudophryne australis*, which is less than one inch from snout to tail. It is marbled black and white underneath, and purplish black above, with a reddish or yellow triangle on its head, a red stripe over the tail, and red spots at the armpits and thighs. One is tempted here to compare the size of this three-quarter-inch-long toadlet with the world's largest species, the Goliath Frog of South Africa, which has a body length of twelve inches.

There is perhaps no group of living vertebrates that receive so little attention from field naturalists as the Amphibia, and much remains to be added to our scant knowledge of the spawning and every-day life of frogs and toads. If one has not the time to observe them in their natural surroundings, it might be possible to include one or two species in the home aquarium or lily pond. There are many kinds to choose from; some, such as the green tree frogs, prefer the fern house to the fish pond, for they spend most of their time out of water. In addition to these green species there are grey and brown tree frogs, found near streams or swamps, but by day mostly under the loose bark of trees. These tree frogs, *Hyla caerulea* the green kind, and *Hyla peronii* and others of the grey coloured

Toadlet, Pseudophryne australis. This species is commonly found in damp grassy places bordering swamps and on the banks of streams. The illustration is about twice natural size.

species, have large disks on their toes to aid in climbing, but a close relative, with smaller disks, the golden swamp frog *Hyla aurea*, prefers an aquatic life. This frog actually is green, but has golden stripes on its sides and back; it is by far the commonest frog found in the eastern part of Australia, but is not so often seen because of its watchfulness, diving below the surface of the water before an intruder can get within yards of its resting place. Yes, there remains much field work to be done before we really know our frogs and toads, and there is a great opportunity for the naturalist to do really good original work on these peculiar animals.

The Kangaroo Family

Tree Wallabies

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

IN continuation of the series on the kangaroo family, which began with this volume of the MAGAZINE,[1] we now deal with some very remarkable members of this surprisingly varied group of hopping marsupials. The Tree-Wallabies are unique amongst kangaroos in having undergone an unusual twist or reversal in evolution which has coincided with their re-adaptation for a tree-haunting existence. Having evolved, like other kangaroos, from primitive tree-dwelling ancestors, their adoption of the hopping mode of progression must have resulted in a striking extension of the hind-limbs, and the disappearance of the prehensile possum-like great toes; the tail was also transformed from a grasping to a balancing appendage. After ages of the terrestrial hopping existence, which moulded their kangaroo-like structure, these wallabies gradually reverted to the trees for foraging and security, with a corresponding reversion of general structure towards the original tree-haunting kind of furred animal.

The fact that the clinging structure of the foot and tail has not been re-acquired clearly illustrates an irreversible law in evolution that any structures atrophied by disuse cannot be regenerated. The tree-wallabies, however, have undergone a process of natural re-adaptation which is reflected in the strangely composite character of their form and dentition. Their general build presents a striking contrast to the rest of the family in the more equal proportions of the fore- and hind-limbs, due to the fact that the jerboa-like extension of the hind-quarters is no longer required for hopping along at great speed. But the secondary phase of their evolution is most emphasized by the reacquired shortness and breadth of their pliant feet, the cushion-like pads of which have been "re-soled" with roughened skin to avoid slipping, while some of the nails are sharply curved. The hands are very large and powerfully nailed for grasping branches, and the long whip-like tail serves as a climbing-prop and guiding rudder for leaping amongst the the trees, rather than as a counterpoise for hopping along the ground.

Goodfellow's Tree-Wallaby, one of the most brilliantly coloured of the five New Guinea species, if not of all marsupials. It inhabits the higher zones of the Owen Stanley Range in Papua, and mountainous regions in the Mandated Territory. (After Rothschild and Dollman.)

[1] Troughton.—THE AUSTRALIAN MUSEUM MAGAZINE, Vol. viii, No. 1, June-August, 1942, p. 17.

Tree-Wallabies are no longer so dependent on hearing to sense the movement of ground-dwelling creatures; therefore their short rounded ears provide another indication of the return to arboreal life, in that they are not deer-like and movable in various directions like the ears of terrestrial kangaroos. Another evidence of re-adaptation for tree-life is that their natural attitude has become hunched or possum-like, so that their posture is more horizontal, though of varying degree in different species. Such variation is shown on the back by the position of the crown or whorl at the reversal point of the thick fur, which provides a natural water-shedding device adjusted to the carriage of the body. The position of these "crowns" has been used as a distinctive specific character with the idea that animals having the hair reversed on the shoulders would naturally be more erect than those with the reversal on the middle of the back.

The dental characteristics differ from the majority of the kangaroo group in the retention of the ancestral low-crowned molars adapted for the pulping of a leafy diet, while the long blade-like premolars—known as "secators"—are adapted for the shearing of foliage, rather than the nipping of grasses or the cutting of flesh. The tree-wallabies are therefore not very intimately related to the present-day wallabies and kangaroos, but apparently represent an individual branch of the common ancestral stock.

As previously pointed out, there are no basic anatomical differences between wallabies and kangaroos, so that size, as conveniently expressed by the foot-length from heel to longest toe, minus the nail, offers the simplest means of distinguishing the several sections. As the foot-length of the largest wallabies ranges from 6½ to 10 inches, and that of the largest of the "tree kangaroos" does not exceed 6 inches, it appears obvious that they may be termed, far more appropriately, tree-wallabies. In any event, the unique position of these quaint "climbers" among their fellow kangaroos, is indicated by their genus name *Dendrolagus*, from the Greek, meaning a "tree-hare" in allusion to the more equal limb-proportions, climbing activities, and vegetarian diet.

DISTRIBUTION, HABITS, AND FOOD.

The influence of the jungle or rain-forest habitat upon their development is illustrated by the greater variety and richer coloration of the New Guinea species, while an affinity with the tropical Australian fauna is shown by the occurrence of two species in the Atherton to Cooktown region of north coastal Queensland. Two of the five recognizable New Guinea species have the most brilliant coloration of any living marsupial. One of these (*Dendrolagus goodfellowei*) is named after its well-known collector, who presented the original specimen to the British Museum. It inhabits the 8,000 ft. zone of the Owen Stanley Ranges and the Mandated Territory, and combines a foxy-red back with a bright yellowish face, belly, hands and feet, with yellow lines extending along each side of the spine. An even more spectacular tree-wallaby (*Dendrolagus matschiei*) from the ranges of the Huon Peninsula, in the Mandated Territory, named after a former director of the Berlin Zoological Museum, adds a bright yellow tail to the above rather "sporting" ensemble. The other three species, ranging from Papua to the north-west of Dutch New Guinea, are of a more sombre brown coloration, like the two Australian kinds.

On the mainland, the more brightly coloured species (*Dendrolagus lumholtzi*), with a yellowish face, limbs, and tail, inhabits the mountainous rain-forests of the Herbert River district, the Atherton Tableland, and the Bellenden Ker Range of north-eastern Queensland. This species is known as Lumholtz Tree-Wallaby in honour of the Norwegian naturalist-explorer, Dr. Carl Lumholtz, who succeeded in obtaining six specimens after several months' search in the rugged districts of the Herbert River in 1882. They were obtained upon information by blacks that a tree-climbing kangaroo, which they called "Boongary", existed in the scrubs of that region. Although not

Bennett's Tree-Wallaby, duller-coloured of the two north Queensland species. The shortness of the face and ears, the relatively more powerful forequarters, and grasping ability of the shortened feet, result from re-adaptation of the hopping habit to life in the tree-tops.

uncommon, they were difficult to secure, preferring the highest and densest scrubs where even the blacks have to be careful amongst the rocks.

They seemed to live only in one kind of tree, plentiful on the crests of ranges and growing to a great height though rather slender. The blacks said that frequently several of the wallabies were found sleeping in the same tree, and that they seemed to prefer the shorter trees in rainy weather. The flesh of the Boongary was greatly prized by the natives, who considered a suitably trained dingo necessary for the hunting, as it followed their tracks and stopped at trees which the marsupials had climbed. These the blacks climbed, either causing the marsupials to jump down or seizing them by the long tail with one hand while smashing the head with a stick.

The duller coloured and more northern species (*Dendrolagus bennettianus*), inhabiting the mountainous rain-forest region of the Daintree and Bloomfield Rivers, nearer Cooktown, was named in honour of the distinguished author-naturalist Dr. George Bennett. According to Charles De Vis, who named the species when Director of the Queensland Museum, he yielded to "a desire to dignify it by association with one of our oldest and most respected Australian naturalists" who had insisted on the probability of the genus occurring in Queensland as well as in New Guinea.

The first specimens in the Australian Museum were obtained in 1894 from the Bloomfield River, where the blacks' name for the climbing kangaroo was recorded as "Tcharibeena". The blacks hunted them with dogs and were very fond of

the meat. Inhabiting the tops of trees by day and descending in the evening to feed upon creepers, ferns, and fruit, they were but rarely seen by the white settlers. Occasionally a few were observed on the flatter land, but the natural haunts were on or near the tops of mountain ridges at 1,500 to 2,500 feet. The late Dudley Le Souef, when obtaining specimens for the Melbourne Zoo, found them fairly plentiful in the scrub-covered mountains near Cooktown. He said that they did not eat grass, which was not plentiful in their native scrubs, but fed on the leaves of the White Cedar and other trees. They were also partial to bird's nest ferns, creepers, and almost any of the wild fruits so plentiful about the scrubs.

Very large tree-trunks are usually climbed by the festoons of vines, but the tree-wallabies are amazingly agile amongst the branches. They may travel rapidly from tree to tree, leaping as much as thirty feet downward to an adjoining tree, the roughened foot-soles and prop of the tail preventing them from slipping. They also jump to the ground from remarkable heights without injury, landing cat-like on all fours. One wallaby was observed to jump from a bough to a small rock jutting from a mass of creepers at least forty feet below, while another jumped fully sixty feet and landed on the ground unhurt.

The brushy tail is not prehensile, and is either carried hanging downward or forward between the legs when climbing or sleeping, but is bent over branches while the wallaby reaches down for berries or other food. The tail can also be stiffened and its great length and brush of hairs has apparently evolved as a balancing rudder for directing the extensive leaps. The descent from trees is usually tail first, unlike opossums, while on the ground the tail is arched up like that of an ordinary wallaby, the hopping being by relatively smaller leaps, with the body leaning well forward to counterbalance the long tail.

Blacks hunt the wallabies with dogs in the early morning when the scent is freshest, several natives climbing trees adjacent to the one in which the quarry is located. Another black then climbs for the animal, either catching its tail or forcing it to jump down, when it is caught by other blacks or the dogs. The natives say the wallabies do not descend for drinking as there is such an abundance of moisture in the trees, but they always drink the water supplied in captivity. Although males are very pugnacious, often fighting viciously until the weaker is killed, individual captives soon become tame, feeding upon bread, vegetables, fruit, and various leaves, though not long-lived owing apparently to diet deficiencies.

The confusion of characters resulting from their re-adaptation or "double life", apart from leaving the close family relationship of the tree-wallabies in considerable question, renders their marsupial genus of great scientific interest. Fortunately, the remarkably agile though ungainly creatures, which share responsibility with the largest possum or cuscus for reports of monkeys in northern Queensland and New Guinea, haunt such dense rain-forest regions that their survival, unlike most of the kangaroo family, would seem definitely assured.

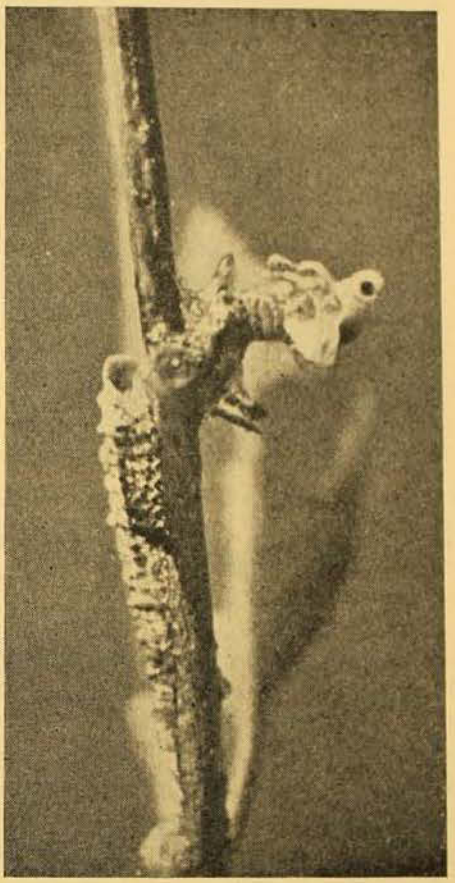
Australian Insects. XXI.

Homoptera 2—Tree- and Leaf-hoppers

By KEITH C. McKEOWN

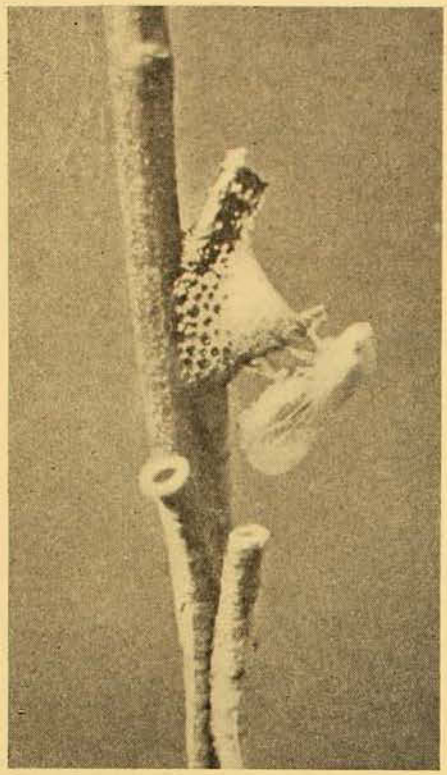
THE majority of the Homoptera—apart from the cicadas—are of comparatively small size. The adult insects of the Tree- and Leaf-hoppers are usually of a typical wedge shape, although this may, in some families, be modified in various ways.

The Cercopidae—the Froghoppers or Cuckoo-spit Insects—are closely allied to the cicadas, but possess two simple eyes, or ocelli, on top of the head instead of three as in that family. The immature forms of those species popularly known as Cuckoo-spit Insects secrete a mass of viscid, frothy fluid in which they hide; this is believed to serve as a protection against enemies or the drying effect of hot winds upon the soft-bodied insects. The occurrence of this 'cuckoo-spit' upon the young shoots of plants has given rise to considerable popular speculation as to its origin, and many strange beliefs are associated with it. As the name implies, it is supposed to be produced in some mysterious way by the bird, and in England it was thought by children that if you rubbed your eyes with the frothy liquid early on a May morning you would see the fairies!



A nymph of Pectinariophyes pectinaria forcing its way out of its tube (enlarged).
Photo.—H. Hacker.

The commonest Australian species belong to the genus *Philagra*; they are brownish insects with the head produced forward into a beak-like extension. The most remarkable members of the family belong to the genera *Pectinariophyes* and *Polychaetophyes*, which construct on the twigs of eucalypts slender trumpet-shaped horny tubes in which they live. Little is known regarding the details of their lives, but Mr. H. Hacker has described the strange manner of the emergence of the adult insect of *Pectinariophyes pectinaria*. He tells how "the first indication that the insect is about to emerge is the appearance of small bubbles at the mouth of the tube. This occurs in early spring, generally in the evening or at night. Viewed through a lens at this stage, the posterior end of the nymph is seen continually moving from side to side; this end protrudes for about a second, evidently to obtain a supply of air, and then retracts, after which fresh bubbles are blown; this renewing of the air supply takes place at intervals. The operation continues for about an hour, by which time a large mass of froth has been pro-



The perfect insect of Pectinariophyes pectinaria, having emerged from the tube, resting in its characteristic position (enlarged).
Photo.—H. Hacker.

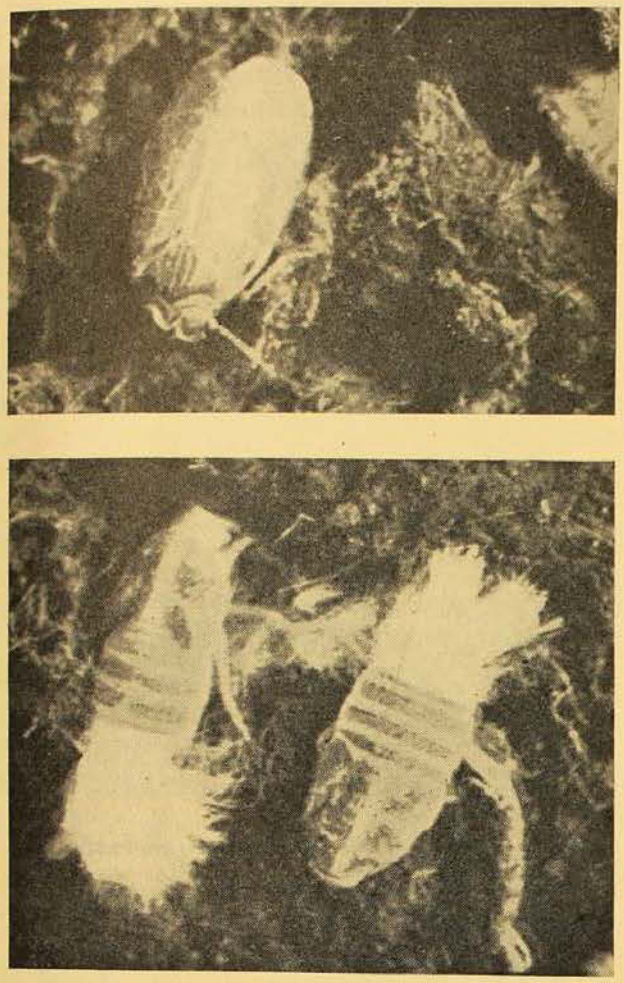
duced, covering the mouth of the tube and hanging over the side. When about to emerge, the nymph forces its way to the top of the tube, protruding its posterior end first until the legs have reached the lip. It then swings itself over and, with the head now upward, it climbs down the outer side of the tube until it is merged into the froth which has accumulated on the lower side. There is constant movement inside the mass of froth, caused by the insect getting out of its nymphal skin. The froth now gradually subsides: all movement has ceased, and the newly emerged insect is seen clinging to the empty nymphal skin, which is in turn clinging to the side of the tube.

"The pale yellow wingless insect remains quite motionless. After a short interval tiny tegmina and wingbuds begin to appear. These expand rapidly, and in half an hour from the time they were first seen are fully developed. While this growth develops, and for some time after, the wings hang down perpendicularly; they are then suddenly flexed once or twice, and closed to their normal roof-like position. At this stage, though rather soft, the insect is able to walk and jump, but if left undisturbed it will remain quietly on the twig until the next day."

The Jassoidea—Leaf-hoppers or Tree-hoppers—are small to medium sized insects with strongly swollen cheeks and of stout wedge-shaped build. The commonest and best known members of the super-family are the insects of the genera *Eurymela* and *Eurymeloides* (family Eurymelidae). They are deep blue or black and marked with white, yellow or red. When approached, these insects have the habit of moving slowly round the tree so as to keep its trunk between them and the observer, a habit that has earned them the popular name of 'sharpshooters' in other lands. In their immature stages these Tree-hoppers are assiduously attended by ants for the sake of the sweet honey-dew they secrete. Very little is known of the details of the lives of these insects.

The Apple Leaf-hopper (*Typhylocyba froggatti*), a member of this super-family, is of economic importance. The young emerge in September and October, from eggs laid under the bark of the apple trees in the previous autumn, and feed on the underside of the leaves, and by their sucking of the sap from the foliage cause it to become blotched and mottled, or even to fall prematurely. There are usually two generations in the season. The adult insect is pale green in colour. Insects of the genera *Ledra* and *Stenocotis* are brownish and curiously flattened in form, and in their immature state are little thicker than stout paper, a development that facilitates their habit of hiding under peeling bark. Unfortunately, little is known of their lives and habits.

The Membracidae — Tree-hoppers — resemble the preceding, but may be readily distinguished by the head being vertical to the body and the cheeks without marked swelling. In many forms the thorax is produced into horns, knobs, and other fantastic adornment of



Perfect insect of Oliarus felis (above) and two nymphs (below) sheltering in crevices in the soil (enlarged).
Photo.—H. Hacker.

unexplained purpose. The commonest and most readily observed species is probably *Sextius virescens*, a pale green insect with the thorax produced into two laterally projecting spines tipped with brown. The insects swarm upon the soft young shoots of wattles in all stages, and are constantly attended by ants in search of the sweets they exude. The eggs are deposited in rows in slits cut in the soft bark by the ovipositor of the female, an operation usually accompanied by considerable exudation of gum from the injured tissue. The adult insects can dodge about the twig or jump with amazing agility when disturbed.

Of the family Cixiidae (super-family Fulgoroidea), only one species seems to have been studied in any detail: this is *Oliarus felis*, whose habits have been described by Mr. H. Hacker, who writes: "The capture of one or two examples at my home first drew my attention to them. Subsequently others were taken by 'sweeping' in the garden where they appeared to be limited to the lower end. This part consists of a black, sticky, alluvial soil, while just beyond is a fringe of mangrove trees and the banks of a tidal creek. The only vegetation in this low-lying strip is the salt-water couch grass, *Spirobolus virginicus* var. *minor* Bail., which forms a dense mat over the area, owing to its being fenced off from stock.

"At the roots of the grass, *Oliarus felis* Kirk. were found in numbers. Blocks of soil were cut out, and were readily broken apart where cracks occurred, displaying a white fibrous substance on both faces. In these cracks, early in April, were various-sized nymphs, and adults of both sexes. The white material consists of the filamentous tufts which are rubbed off the terminal extremity of the nymphs while moving about in the crevices. The attachment of the white tufts is extremely weak; they may be seen becoming detached when colonies are exposed, and the nymphs are pushing among the rootlets, trying to find fresh hiding places. The nymphs are sensitive to light, and when exposed their chief object is to find some small hole or rootlet into which they may push their heads. After attaining this object they will remain quiet, although the rest of their bodies is exposed to strong light.

"Besides their delicate sensitiveness to light, the disparity between the thousands of insects inhabiting each acre of grass roots, and the comparatively small number seen above ground or obtained in the sweep net, indicate that they are truly subterranean in their habits.

"During the spring tides the place is saturated with brackish water, and for short periods is actually submerged for an hour or two daily. Several adults were seen climbing up the grass stems to avoid the water. No nymphs appeared, although they were numerous at the time. After the water receded some

were dug up and were found to be apparently dry. No doubt the waxy secretion which covers their bodies renders them waterproof.

"Another examination of the couch grass was made at the end of April, and many clusters of eggs were present in the crevices, each covered with its small white wad; a few females were seen at this time, but no males. On 12th May about one hundred young nymphs were seen by breaking up two small blocks of turf, but only one egg-mass. Examination at different periods showed that, in November and April, adults of both sexes were plentiful; while at other times only nymphs were present."

The Delphacidae are mostly small, inconspicuous insects, recognizable by the presence of a movable spur on the hind tibiae. The best known of the species, despite its small size, is the Sugar-cane Hopper (*Perkinsiella saccharicida*), which has attained prominence on account of its importance to the sugar industry.

The Derbidae and Fulgoridae contain striking and brightly coloured species. *Rhotana chrysonoe* (family Derbidae) has the wings strikingly marked with yellow. In the Fulgoridae perhaps the most beautiful are insects of the genus *Desudaba*. Nothing appears to be known regarding the life histories of these insects.

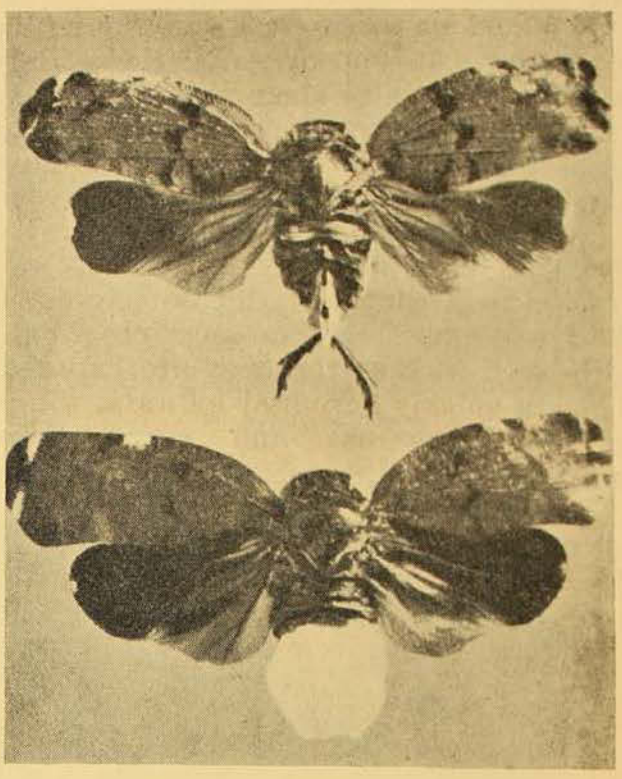
Members of the family Eurybrachidae are generally broad, somewhat flattened insects coloured in tints of brown and orange. The family is confined to Australia. Little detailed observation has been recorded on the insects of this group, but, again, every credit must be given to Mr. H. Hacker for providing, by careful and patient work, what little we know of them in his account of the life history of *Platybrachys leucostigma*. "The egg patches", he writes, "are conspicuous objects on the trunks of Spotted Gums, *Eucalyptus maculatus*, in this district [Brisbane]. During February numerous females were observed ovipositing on the trunks of these trees, generally at a height of three feet to twenty feet

Four females of Platybrachys leucostigma on a tree trunk, one of which has completed an egg-mass (enlarged).
Photo.—H. Hacker.

or more from the ground. The bark of spotted gum comes off in small scales, leaving oval depressions or scars. These are the places selected by *P. leucostigma* for oviposition. They take up a position in the centre of these hollows during the operation, and place the eggs in neat rows, moving gradually upward as the rows are completed. To place the outside eggs in position, the insect inclines its body from side to side without shifting its central position. When each row is completed she rubs the posterior end of her body over the eggs, covering them with white material from a mass which is situated there. This covering is carried half an inch beyond the eggs on each side. . . . The eggs are fastened to the bark rather firmly, with their upper ends inclining away from the tree. In the central part of the depression they are placed two deep, and the covering is finished off flush with the surrounding bark.

"The young nymphs emerge through slits in the outer side of the shells which extend from the stud-like protuberance to the middle, and push their way through the waxy covering, making ragged tears and cracks. They are pale yellow, with black eyes, and remain motionless in a cluster on the white cover. After a few hours they become grey. On the second day the two long tails characteristic of these and other *Platybrachys* nymphs appear. On the third or fourth day the cluster breaks up, and they scatter over the tree, going up into the higher branches.

"The two anal appendages of *Platybrachys* nymphs consist of excremental material. It is forced through two circular plates situated on either side of the last segment. They are divided into many small compartments by fine radiating and concentric lines somewhat resembling the markings on an *Arachnoidiscus* diatom. These circular plates are present in nymphs of all stages. Even



Adult females of Platybrachys leucostigma (enlarged).
Photo.—H. Hacker.

Nymphs of Platybrachys leucostigma showing the long tail filaments (enlarged).
Photo.—H. Hacker.

when newly-hatched they are present, but are, of course, much smaller and contain fewer compartments. After passing through these plates the excrement is drawn out into long bundles of fine glassy filaments, tightly twisted until near the apical ends, which become untwisted and brush-like. The appendages are constantly growing, but the loose ends (being very brittle) are continually being abraded; the average length remains constant in the different instars, reaching a maximum of about 12 mm. in the last. After each moult they are left behind on the discarded skins, but others soon appear and gradually lengthen until the maximum is reached.

"*Platybrachys* are double brooded; from eggs hatching in February the winter months are passed in the nymphal state, the adults emerging in spring. From eggs laid in September, the summer months are passed in the nymphal state, the adults appearing in February. The latter is the main brood.

"Considering the unprotected condition of these insects in all their stages, and

the number of their enemies, both predatory and parasitic, it seems incredible that any can survive, as their only defence seems to be their ability to make quick leaps. It is evident, however, that large numbers do escape, as they are numerous in all our eucalyptus forests. . . . Sometimes the egg patches are so situated that in heavy rain they are exposed to streams of water flowing down the tree trunks. If the covering should be injured so that the eggs are exposed, they are quickly devoured by ants, which cut the eggs out and carry them away. . . ."

The Achilidae have the tegmina folded down flat over the body and not held in the usual roof-like manner. *Achilus flammeus*, a bright red insect, is often found in the nests of termites; the association is obscure, but it would seem that the insect may feed on moulds, since it will develop in rotting timber in the absence of other insect associates.

The Ricaniidae and Flatidae are broadly triangular when viewed from the side. The common Passion-vine Hopper (*Scolypopa australis*), with clear wings broadly margined with black, sits in rows along the stems of passion-vines and sucks the sap. It is a member of the Ricaniidae. Typical members of the Flatidae are included in the genus *Siphanta*. *Siphanta acuta* is wholly green; it drains the sap from the young shoots of eucalypts.

Notes and News

MR. F. D. MCCARTHY, Anthropologist at the Museum, was away for ten days recently, recording further series of aboriginal rock engravings as part of a survey of undescribed groups in the Sydney-Hawkesbury River district. He completed scale charts of two groups at Old Boree, one near Wollombi and one near St. Albans, in the county of Northumberland, and one at Maroota, in the county of Cumberland. He accompanied Mr. D. W. Chapman, of the Surveyor-General's Department, who was working in the above localities.

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MR. TOM IREDALE, who for the past twenty years has been conchologist at this Museum, has entered upon leave prior to retirement. On July 28 he was the guest of the President of the Board of Trustees, Mr. F. S. Mance, at a sherry party. Two days previously, at a staff gathering, he was the recipient of two photographic reproductions of drawings by W. Hodges, and a chromium-plated tray for Mrs. Iredale. Hodges accompanied Cook as an artist on the *Resolution* and *Adventure*, and the original drawings are in the library of the Australian Museum.

THE centenary of the departure of Charles Sturt's exploring expedition to the centre of this continent from Adelaide, in August, 1844, is now being celebrated. Sturt was associated with this Museum as a member of the original committee of superintendence of the Australian Museum and Botanical Garden appointed on 14th June, 1836.

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THE following popular science lectures will be held in the Australian Museum at 8 p.m. on the undernoted dates. These will conclude the 1944 session. Arrangements for the 1945 session will be announced later.

September 14.—"The Work of a Biologist in War-time": I. M. Thomas, M.Sc.

September 28.—"A Visit to the Clarence River": Joyce Allan.

October 12.—"The Fishery Potential of Australia": H. Thompson, D.Sc.

October 26.—"Dry-Rot—White Ants—Borers, and their Control": R. A. Johnson, A.M.I.E. (Aust.).

Doors, 7.30 p.m. Admission free. The lectures are usually illustrated by films or lantern slides.