

# The AUSTRALIAN MUSEUM MAGAZINE

Vol. VI, No. 6.

APRIL-JUNE, 1937.

Price—ONE SHILLING



Fairy or Blue Wren.



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# THE AUSTRALIAN MUSEUM MAGAZINE

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

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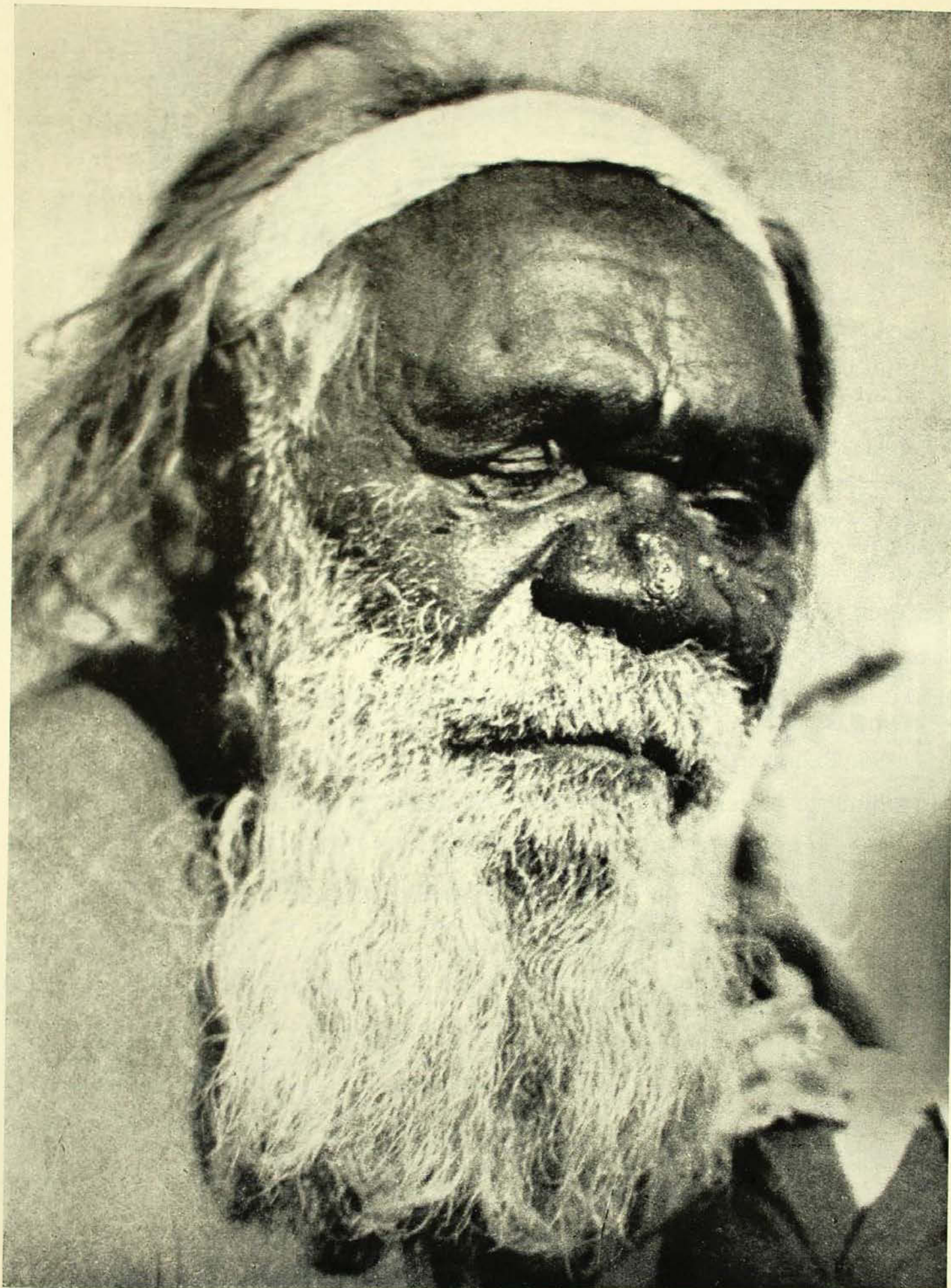
● OUR FRONT COVER. The Fairy or Blue Wren (*Malurus cyaneus*), is by Lilian Medland. It is one of a series of postcards issued by the Australian Museum.

This wren is always a joy to look upon, but his chief charm is his familiarity. Birds with gorgeous plumage are usually shy and retiring, but this little fellow loves open spaces, and is quite at home in our parks and gardens. His mate is an exquisite little creature, despite the plainness of her colouring.

Besides adorning our gardens, Blue Wrens are useful on account of the number of insects they destroy. They are especially fond of aphids, and may often be seen working carefully over rose bushes which are infested. The song is a gush of hurried notes, not very enchanting, but delivered with all the airs of a prima donna. In gardens the nest may be placed in a creeper covering a wall, or in a hedge. In the field a thicket of some kind is usually chosen, the introduced blackberry being a favourite resort. The nest is similar to that of Redbacked Wren, and three or four pinkish white eggs, lightly freckled with reddish brown, are laid. The Lesser Bronze Cuckoo generally chooses the Blue Wren's nest in which to deposit its speckled egg.

The Blue Wren ranges from South Australia to Tasmania and southern Queensland. Other beautiful species are found all over Australia, to which the group of Fairy Wrens is confined.





*A Tribal Elder.*

*He wears a forehead band made of twisted strands of opossum fur. South-west Queensland. Bands similar to this may be seen in the ethnological halls of the Australian Museum.*

Photo.—Francis Birtles.





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## Insect Musicians

By KEITH C. McKEOWN

### PART I.

VERY many insects, members of a number of different orders, possess the power of producing sounds. In the subject-matter of this article I refer to these sounds as music, and to their makers as musicians. There may be some people who will deny that any insect is musical, but it is possibly a matter of the personal opinion of the hearer; some may find only a discord or merely meaningless sounds; others may find them, or some of them, melodious and full of associations and memories of clear spring evenings and hot drowsy summer days. It may, perhaps, be considered that one of the highest functions of music is the stirring of the wells of memory. Whatever man may think of insect music, there is not the slightest doubt that in those species, at least, in which the males alone are musical, their voiceless mates, the females, find it stirring or filled with fascination and charm, and they are quite obviously entranced by these passionate love-chants.

No insect possesses a true voice: no insects can sing as do the birds, and all

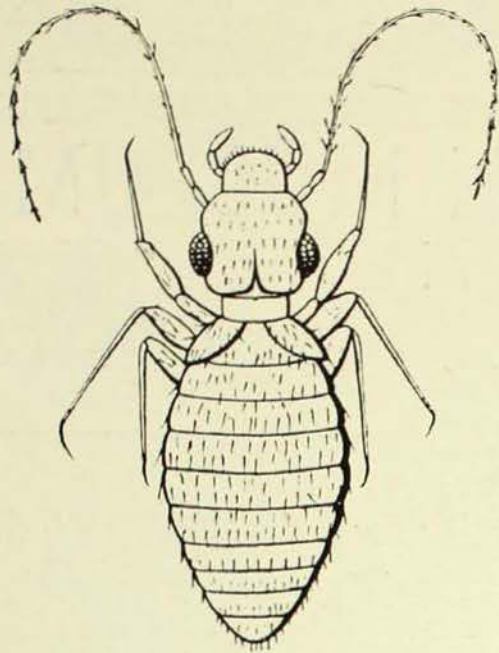
the sounds produced by them are made by mechanical—or instrumental—means. It is well to understand this quite clearly, for many writers refer to “insect singers”, and to “insect song”, and it is more than possible that I will speak of ‘song’, for few terms will convey one’s meaning quite so well as the “song of the cricket” or the “song of the cicada”.

#### SOUND-PRODUCING METHODS.

Before discussing the musicians themselves it will be well to look at the methods by which their sounds are produced.

Like human music, that of the insects seems to have evolved from the very simplest methods, passing on to ways which are more and more complex. First come the “drummers”, those who produce sound by tapping upon some external object—a method similar to that of the primitive African who beats upon the hollowed trunk of a tree in accompaniment to his savage dances, or for transmitting messages over long distances by a rudimentary system of wireless telegraphy.





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

Other insects produce sounds by the rapid vibration of their wings, aided by other organs, or by vibrations of uncertain origin. For these we can find no human counterpart.

Then there are those which make their music by the friction of one part of the body against the other, each part specially adapted for the purpose. In some species both the instrument and the sound given forth may be crude, but in its highest forms the instrument is wonderfully perfected and the musician an adept in its use. Among humans they may well be compared with the string instrumentalists—the players upon violin and 'cello.

Finally, there are the cymbal players, who employ a special membrane, vibrated, in their case, by special muscles and provided with amplifiers.

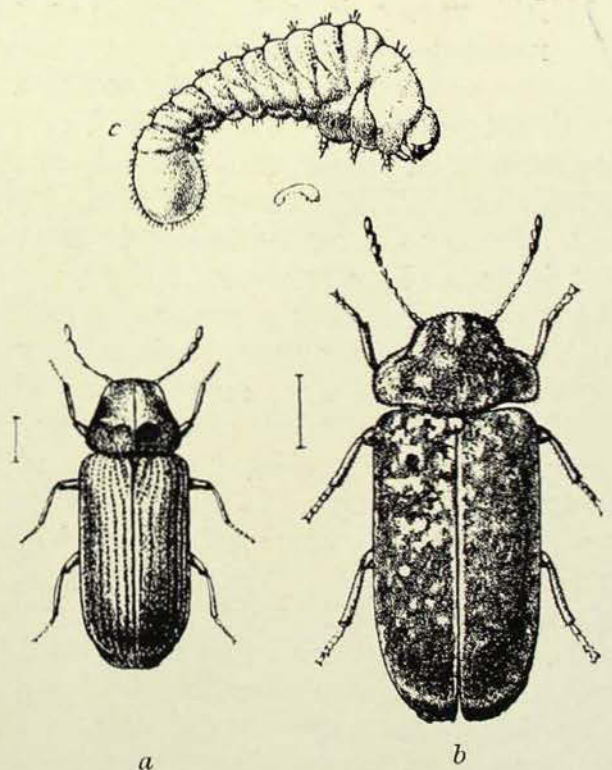
#### DRUMMERS.

The first group, those who beat upon some external object, contains members of widely separated orders, all of which have apparently arrived at the method by parallel evolution. There are the termites, or white ants, the little book-lice, and those rather fascinating insects, the death-watch beetles, which have been objects of so much

superstition in the past—and not only in the past, for it persists even today.

In some species of termites (Order Isoptera), the soldiers strike the floor of the nest with their pointed awl-like heads, or with their long sickle-shaped jaws, producing a clearly audible sound. In the highest stages of this development numbers of soldiers may hammer in rhythmic unison, and it is believed to be a warning signal to the colony, calling attention to the presence of danger. Our own history will provide us with many instances of the assembling of troops and the warning of the inhabitants of a town or city by the prolonged roll of drums—the “beating to arms”.

The little soft-bodied book-lice (*Psocidæ*), which live and feed among old papers, resort to the same method of tapping the head upon a sheet of paper which acts as a resonator; and, considering the small size of these creatures, a really remarkable volume of sound is produced, which is often audible across a large room like the ticking of a watch. With the book-lice this tapping seems to be a means of



The “ticking” of the Death-Watch Beetles (*Anobium punctatum*, a; *Xestobium rufo-villosum*, b) has been an omen of evil to the superstitious for hundreds of years. c, Larva of *Anobium punctatum*.

After Gahan.



communication—a love-call given by both male and female advising their presence to any members of the other sex who may happen to be in the vicinity.

Of all the “drummers” the death-watch beetle is the most skilled, and has a sinister, if quite unearned, reputation. Two species (*Anobium punctatum* and *Xestobium rufovillosum*) are included in the name of “death-watch”. Both are wood-borers, tunnelling in old furniture, and, in the old homes of England, they find a happy hunting-ground in the ancient beams and panelling. As with the book-lice, the signal is a love-call to some member of the other sex, a kind of Morse code, tapping out a declaration of affection and making all the necessary arrangements for a tryst. In calling, the beetle jerks itself forward several times in rapid succession, each time striking the lower part of the front of the head against the surface upon which it is resting. The sharp clicking continues rhythmically for several seconds and then ceases suddenly, to begin again as the insect repeats the performance, or to be taken up by another insect as it answers the signal from another part of the room. The beetles will often answer the tapping of a finger-nail upon the table-top. The

sound resembles the ticking of a watch or clock, and, heard in the stillness of night, is undoubtedly eerie. The superstitious for many centuries have endowed the tapping with sinister meaning as predicting the early death of some one of the family in the house in which it was heard.

Dean Swift was among the first who correctly attributed the sounds to an insect, when he wrote of:

. . . . . a wood worm

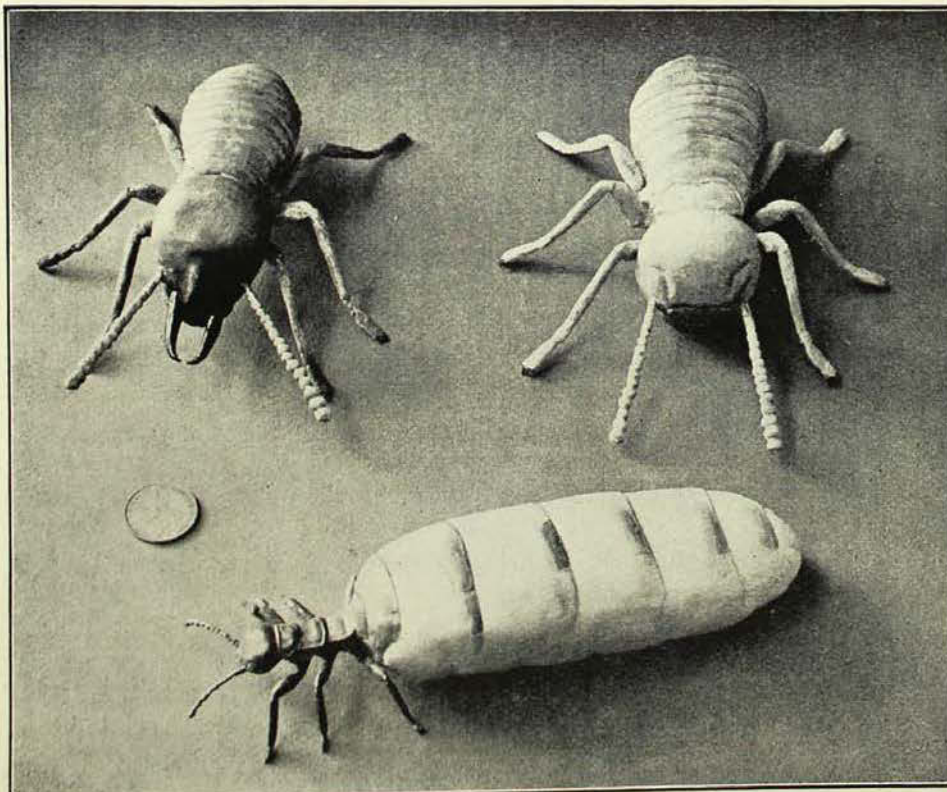
That lies in old wood, like a hare in her form:  
With teeth and with claws it will bite or will  
scratch,  
And chambermaids christen this worm a death-  
watch:  
Because like a watch it always cries click;  
Then woe be to those in the house who are sick!  
For, sure as a gun, they will give up the ghost,  
If the maggot cries click, when it scratches the  
post:  
But a kettle of scalding hot water injected  
Infallibly cures the timber affected:  
The omen is broken, the danger is over,  
The maggot will die, and the sick will recover.

It may be some consolation to the nervous, when next they hear the ticking in the still hours of night, to remember that they are listening to the love serenade of a beetle, and not to some supernatural warning of death.

\* \* \*

This article is the substance of a lecture recently delivered by the author at the Australian Museum. A further section will appear in the next issue of this MAGAZINE.

*Soldier termites (top left) beat a call to arms upon the floor of the nest with their jaws as a warning of danger. Models—Australian Museum exhibit.*





# The Life History of the Gippsland Crayfish

By ELLEN CLARK.\*

ALMOST everyone knows at least one of the many species of freshwater crayfishes and yabbies which are

found throughout Australia. These creatures, by their size, abundance, and destructive habits, literally thrust themselves upon the notice of the community, whether city or country dwellers.

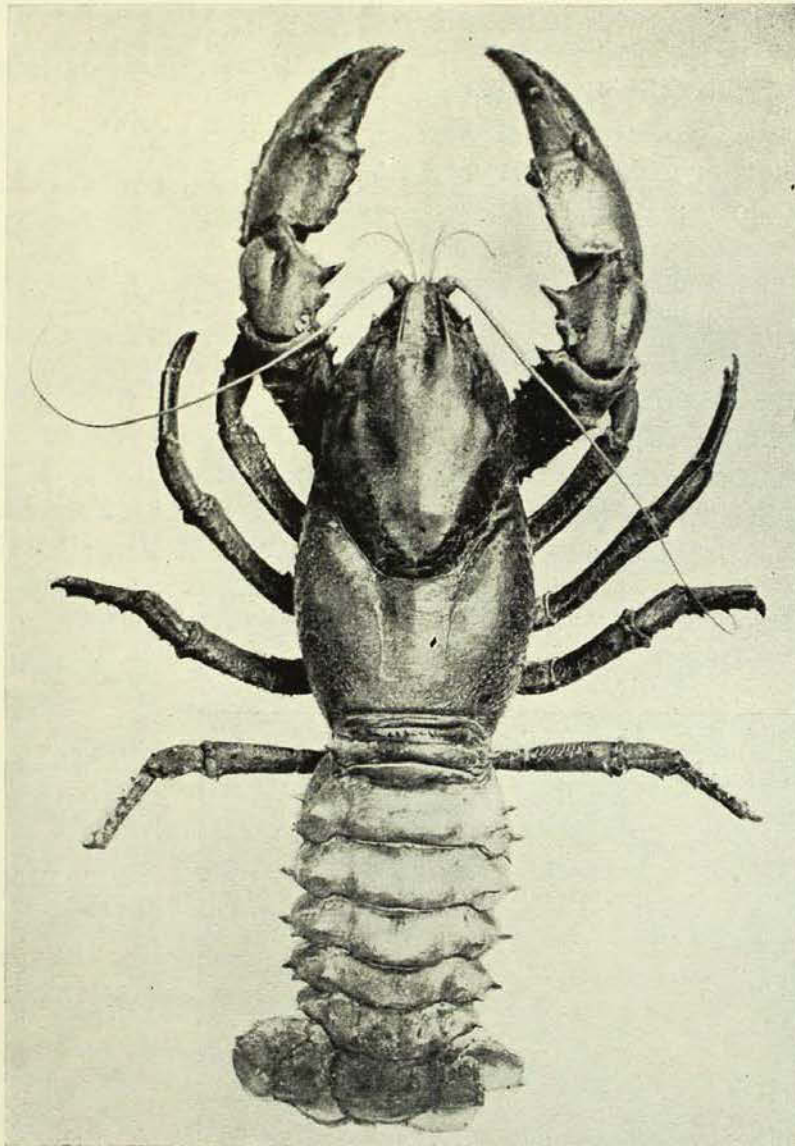
More than thirty species are known, and they can be grouped, according to their habits, into aquatic, semi-aquatic, or terrestrial forms. The notes below concern only the genus *Euastacus*, the typical genus of the first group.

The aquatic species live almost entirely in running water, usually in fairly large rivers, where they walk about on the bottom, swim slowly along, or dart backwards by means of a flip of the large tail. Even though they spend the greater part of their lives in running water, they sometimes creep ashore at

night, or during dull days; occasionally specimens are found a hundred yards or so away from water, and one female, with

eggs attached, was captured amongst bracken fern near the Glenelg River. This is the only instance of which I know of an egg-bearing female voluntarily leaving the water.

There are three known species and two subspecies of the genus *Euastacus*: *E. serratus* (the Murray Crayfish), and its variety *hirsutus*; *E. nobilis* (the Sydney Crayfish), and its variety *kershawi* (the Gippsland Crayfish); *E. yarraensis* (the Yarra Crayfish); and *E. fleckeri* (the North Queens-



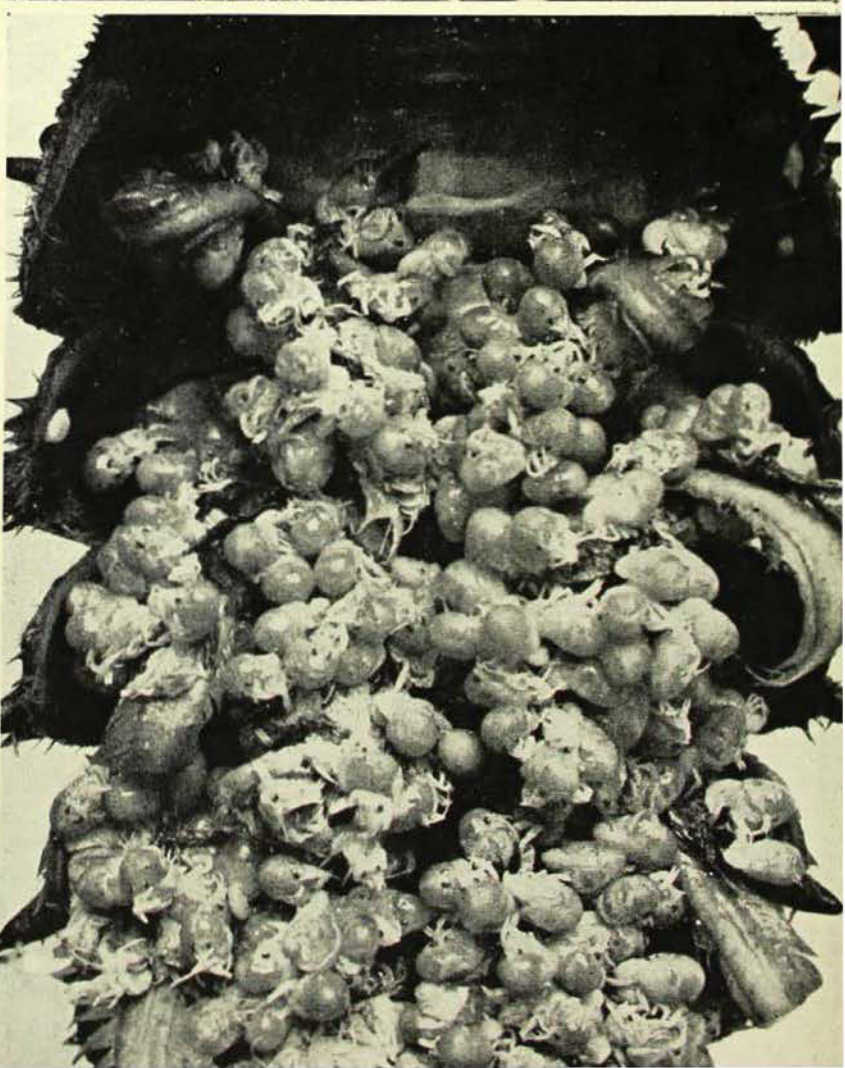
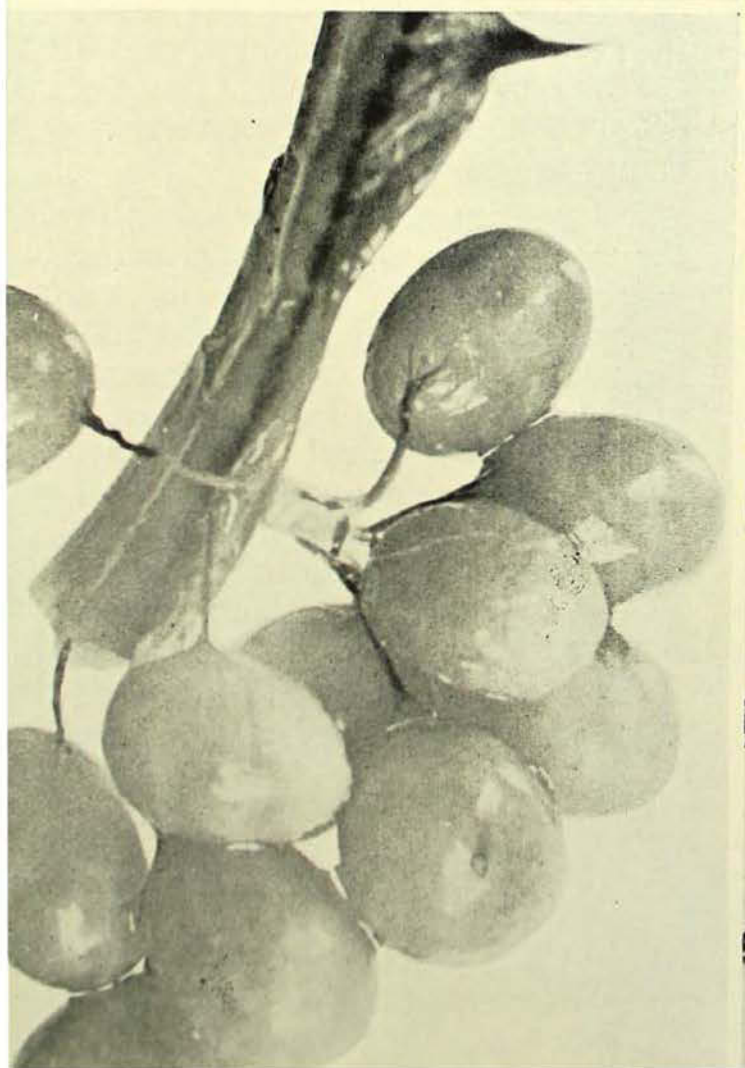
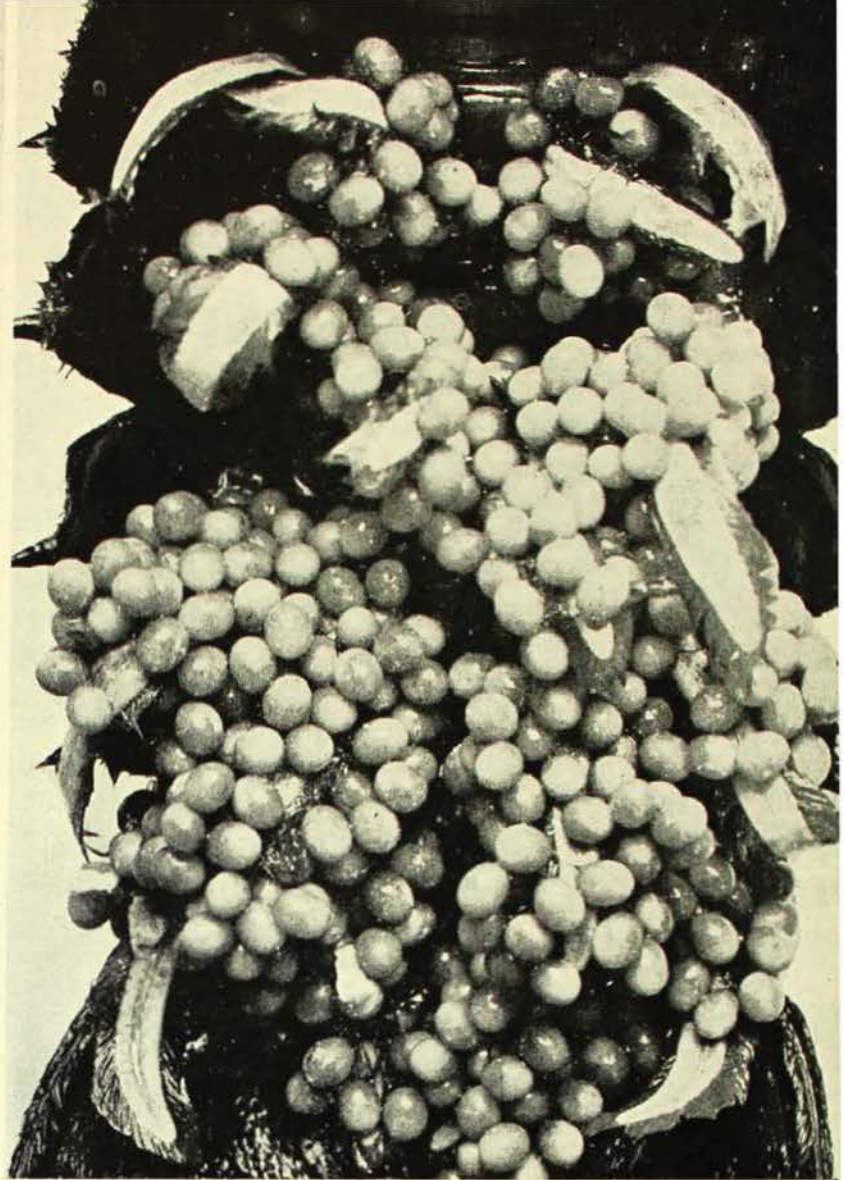
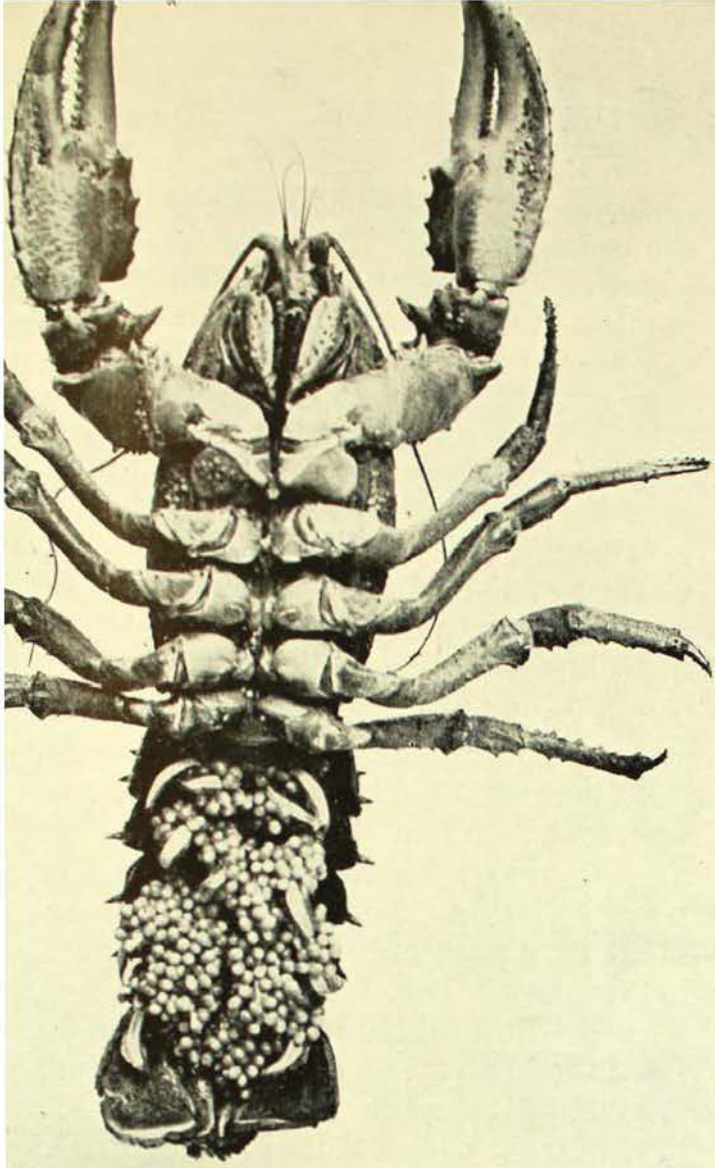
*The fully developed Gippsland Crayfish.*

land Crayfish). These species are distributed in the coastwise rivers from Coen in North Queensland, southwards to Victoria, and thence westwards to the South Australian border.

Among these are found the largest known freshwater crayfishes in the world, the

\* Photographs by C. Brazenor.







adults measuring from twelve to twenty inches in length, measured from the tip of the head (the rostrum) to the end of the tail-fan (the telson), and from two to four inches across the middle of the back (the carapace). These adults are decorated with large sharp spines, measuring an inch or more in length, and from this ornamentation of spines they are referred to frequently as spiny crayfishes.

Before it acquires this spinous armature, however, the crayfish undergoes a long series of moults, during which time many changes take place in the size, shape and armature of the animal. The following description and figures, illustrating these changes, have been taken from specimens of the Gippsland Crayfish, large numbers of which have been received alive at various times during the past two years.

Crayfishes begin breeding when very young; females measuring only five inches in length have been found carrying eggs. Occasional specimens with eggs are caught during all seasons, but the main breeding season appears to be in early spring.

The number of eggs carried by the fifteen females examined varied from 1,000 to 1,200. Compared with its Australian allies, and with the crayfishes of the northern hemisphere, this is an extremely large number of eggs to be carried by one female, the average number for the other species being between 200 and 500. Of all these eggs, however, only a small percentage reach maturity, as great numbers of young crayfishes are devoured by various species of fish and birds.

The females carry their eggs on the small hairs on the swimmerets of the abdomen (the small, biramus appendages on the underside of the abdomen). The eggs are carried on only the inner of the two branches of each swimmeret, although

there are sometimes a few near the base of the outer branch. The eggs are each surrounded by a thin membranous covering, portion of which is wound around and fixed to a few of the small hairs; as many as ten eggs may be attached to the same group of hairs. Suspended by this short stalk, the eggs hang loosely, and have the appearance of a bunch of berries, both in colour and in shape. They are moved about in the water by the action of the swimmerets, and are thus aerated by the surrounding water, until hatched.

The enclosing membrane is transparent, and, without dissection, the external development of the young crayfish can be watched. When the young crayfish is almost ready to hatch, its form is distinctly visible through the membrane; the large eyes particularly are noticeable, and below them the legs are seen bunched together and folded over the tiny abdomen. The membrane then splits and the abdomen is pushed through the opening, followed by the legs, which remain folded together, concealing the antennæ (or feelers) and the mouth parts. As soon as they are free, the last two pairs of legs quickly fasten on to the hairs of the swimmeret near the empty egg-case.

The young crayfishes remain attached to the mother for some time, clinging to the hairs of the swimmerets by means of special modifications of the limbs and appendages. The terminal segment of each of the last two pairs of legs is provided with a small, sharply curved hook that closes down on a number of small spines on the lower margin of the segment. These little claws seize upon the hairs, and cling so tightly that it is almost impossible to remove the young crayfish undamaged.

Other modifications of the newly hatched crayfish take the form of hooks, which are

*Top left: Gippsland Crayfish carrying eggs under her tail.*

*Lower left: Portion of swimmeret enlarged to show how the eggs are attached to the small hairs.*

*Top right: Close-up of eggs showing how they are crowded on the inner branch of each swimmeret.*

*Lower right: Close-up of day-old crayfishes clinging under the tail of their mother, showing the swollen carapace and huddled appearance.*



*Portion of swimmeret enlarged to show the hind legs clinging to the hairs, and the abdomen tucked up between the legs.*

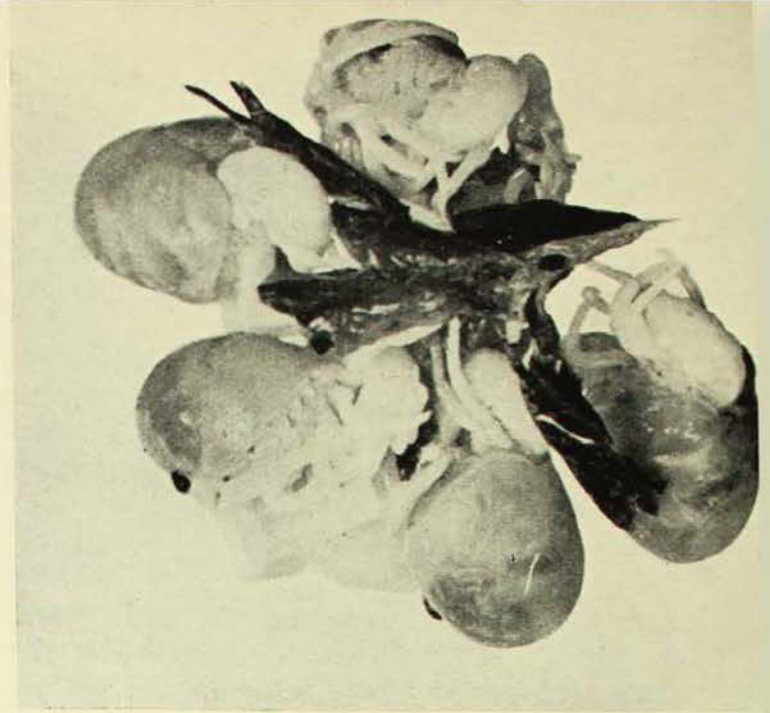
large in proportion to the animal, but are not present in the adult forms. These hooks must serve some definite purpose, but, as the photographs show, they are not used for clinging to the mother.

The tips of the large pair of claws (the great chelæ) and of the two small pairs of claws on the first and second pairs of walking legs, are sharply incurved to form hooks. The squame (the pointed scale at the base of the longer of the two pairs of feelers) is relatively very large in the newly hatched crayfish, and has its inner margin finely serrated and the terminal spine bent to form a large hook.

This process of hatching, and the subsequent attachment of the young to the mother, is very different from that of the crayfishes of Europe and North America. The crayfishes of the northern hemisphere emerge head first from their egg-cases and cling to the hairs of the swimmerets by the large claws, the tips of which are sharply incurved to form hooks which snap together on the hairs.

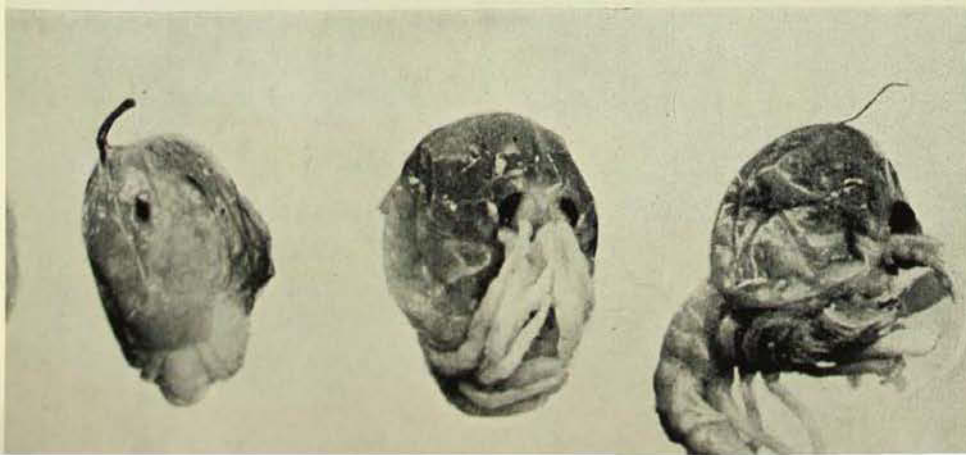
The young of the northern hemisphere crayfishes, therefore, are suspended by their front legs, and have their abdomen hanging downwards. But the Australasian crayfishes, by clinging to the mother with their hind legs, are suspended head downwards in the water, and, in this upside-down position, they spend the first two or three weeks of their lives.

When but a few hours old, the young crayfish differs considerably, in general appearance, from the mother to which it



clings so tightly. The carapace (the hard shell that covers the head and anterior half of the body) is greatly extended in front, with the result that eyes are at the underside of the body instead of at the top. The eyes, which are very large, are not projected on stalks, but give the impression of being sessile; as the eyes are directed outwards, the intervening space appears considerably greater than it is. The rostrum (the "nose", or raised portion of the shell, which projects between the eyes) is only slightly developed, and is bent downwards between the eyes. The two pairs of feelers are relatively very short, and are held, by the legs, against the underside of the body. The swollen carapace contains a quantity of egg-yolk to supply the young crayfish with food until after the first moult, as at this stage all the mouth-parts are soft and undeveloped.

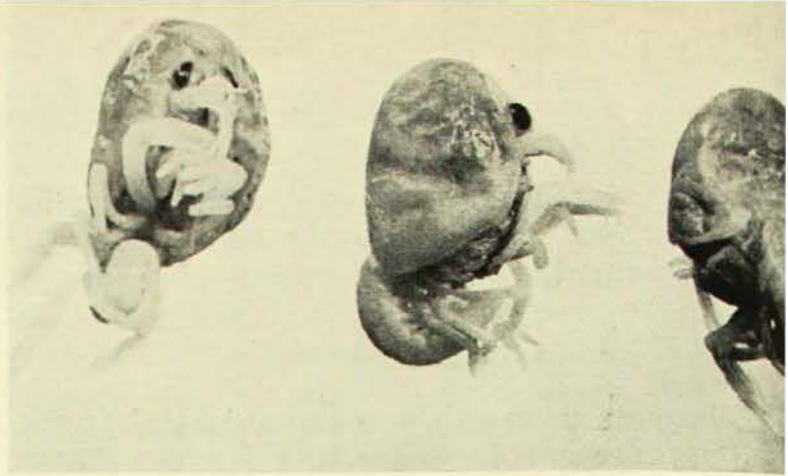
The young crayfish is very smooth. The spines and tubercles on the carapace and abdomen, which are such a striking feature in the adults, are absent; and so are the deep grooves which later divide the carapace into sections. The abdomen is



*Stages in the development of the baby crayfish, from left: The eyes and legs showing through the membrane. The abdomen and legs emerging. Just hatched. The abdomen and legs stretched out to show size.*



*Crayfish one day old, photographed from the underside, the side, and from above.*



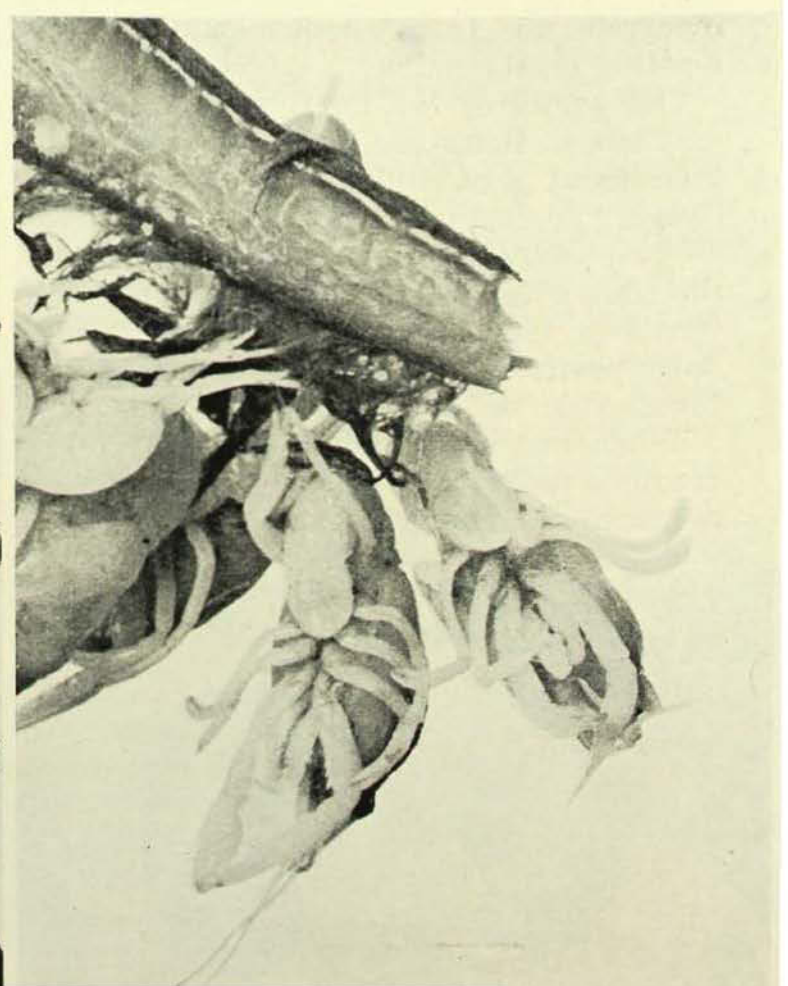
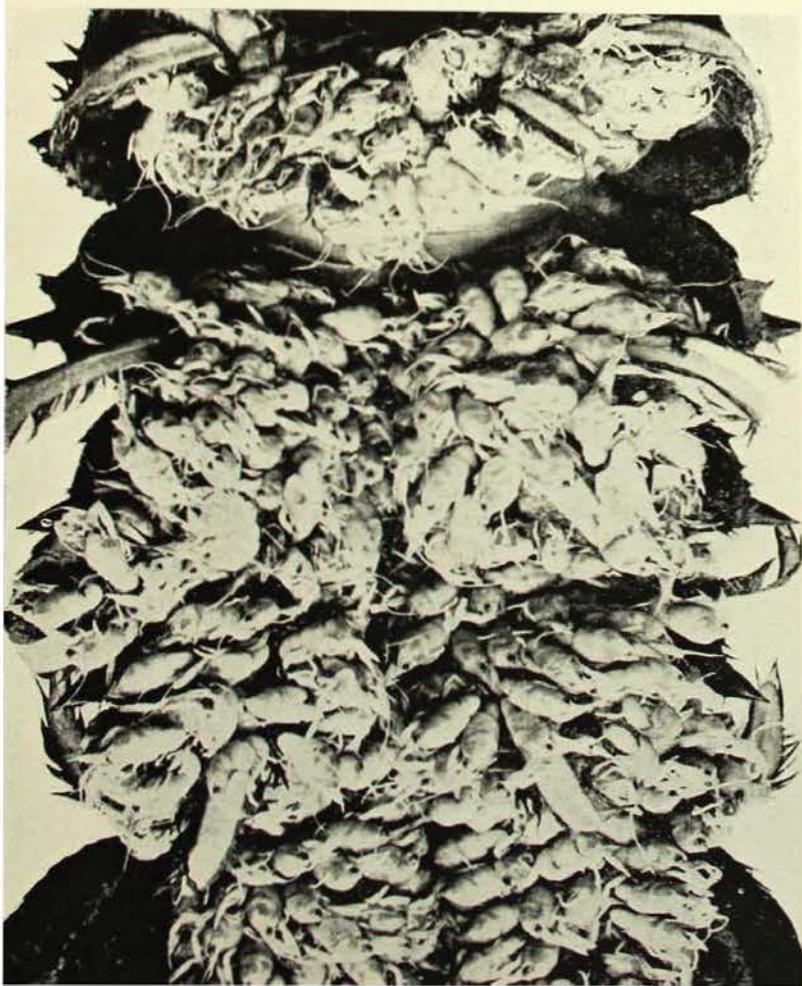
very different from that of the adult. The terminal set of fan-shaped appendages (telson and uropods) is incomplete, only the centre part is developed, the two outer pairs of appendages, which complete the fan-shape in the adult, are not discernible.

For the first two or three days of their lives the young crayfishes are very sluggish, simply clinging almost motionless to the mother; but a few days after hatching they moult for the first time, and then take on a much different appearance and a more lively disposition.

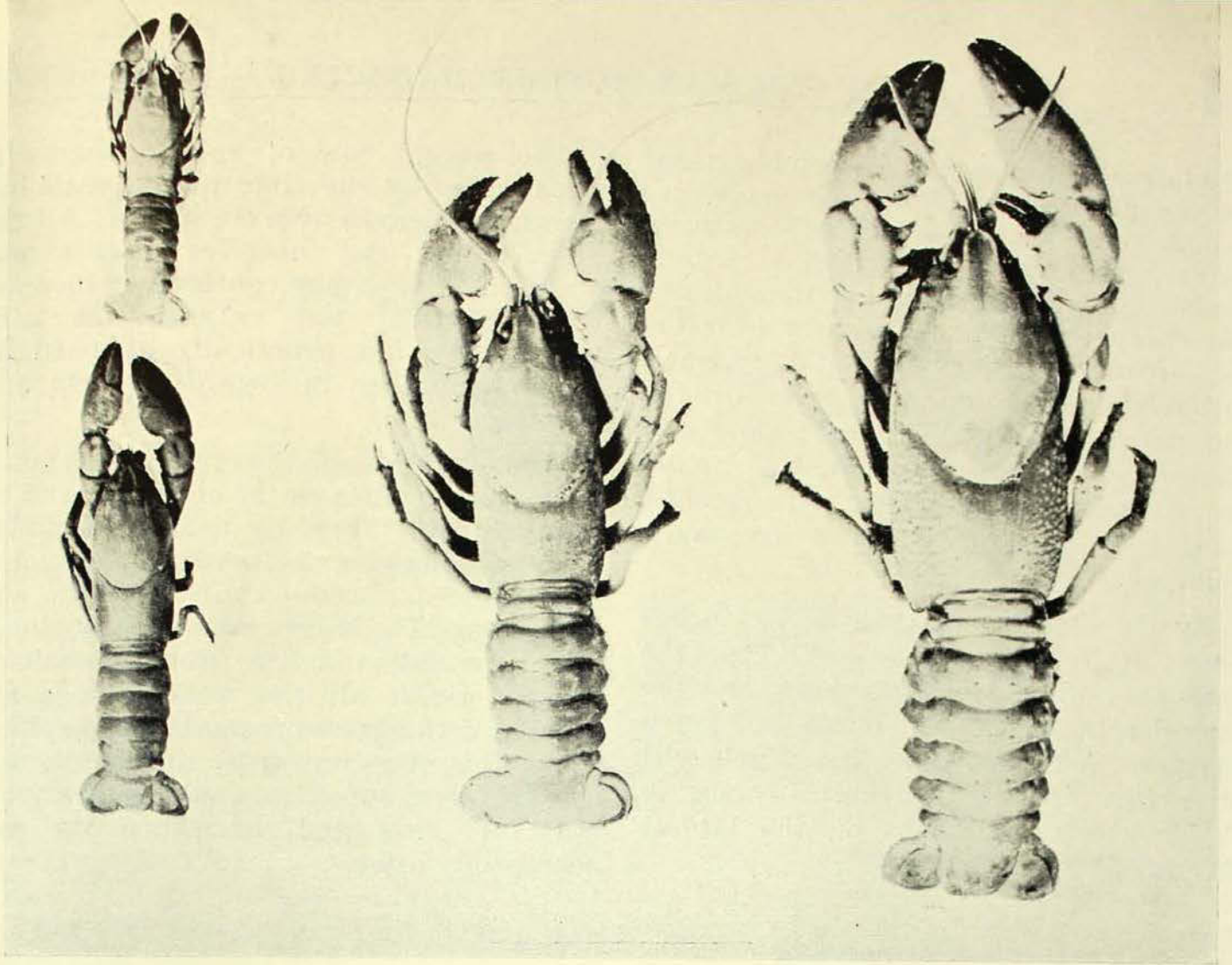
The most noticeable difference is in the length, which appears to be almost doubled, as the swelling is considerably reduced on the front of the carapace, making the body appear more elongated,

although the length is not appreciably altered. The eyes and feelers are thus brought nearer to the position they occupy in the adult. The feelers become much longer, and are held away from the body, being thrust out in front as they are in the adults. The eyes, although still relatively very large, are projected on prominent stalks; the rostrum is elevated, and, whilst still somewhat bent downwards, is larger and quite prominent. The lateral margins are formed into small carinæ, but there are, as yet, no tubercles on the carinæ. The limbs bearing the large claws (the great

*Left: Crayfishes nearly a week old, clinging under the tail of the mother, showing how they have altered during their first moult. Right: Close-up of week-old crayfishes, showing the undeveloped tail-fan, and the hind legs clinging to the swimmeret.*







*Various stages in the development of the Gippsland Crayfish, showing how the armature of spines and tubercles is gradually acquired.*

chelæ) become longer, and are stretched out in front of the body, whilst the remaining legs assume a more natural, out-stretched position. The grooves on the carapace become noticeable, although not prominently so. The hook on the basal scale of the feelers is less curved, and the edge of the scale is less serrated, whilst the hooks on the tips of the claws of the first three pairs of legs are almost straightened.

The young crayfishes are now so large that they become densely crowded, with the result that many of them are crushed to death by their fellows. Far from being sluggish as they were previous to the moult, they now become very lively, twisting and turning as much as their crowded surroundings will allow. The hooks on the hind legs loosen their hold on the hairs of the swimmerets, making it now fairly easy to remove the young crayfishes without damage.

The young crayfishes remain attached to the mother for some time, even after they

are able to release their hold and swim freely, returning to her abdomen for shelter.

During the first year of its life the young crayfish moults many times, and so considerably increases in size and alters its appearance by the end of the year. After the first year the moults become less frequent, until the crayfish moults only once or twice a year. As many of the changes at each successive moult are scarcely noticeable except when examined in detail, only the stages in which most difference is shown are referred to below.

When the young crayfish has grown to an inch in length the carapace and abdomen are still quite smooth, but two or three spines appear on the upper margin of the wrist (the carpus) of the large claws. By this time the tail-fan is developed, and now resembles that of the adult.

By the time the crayfish is two and one-half inches long, numerous minute tubercles develop on the sides of the carapace (the branchiostegites) and on



the lateral margins of the second segment of the abdomen. After each successive moult these tubercles become relatively larger, until, when the crayfish is four inches long, the tubercles on the sides of the carapace, particularly those near the top, are quite conspicuous, and a few small tubercles appear on the front of the carapace between the cervical groove and the eyes. Spines appear on the lateral margins of each of the abdominal segments, and the spines on the wrist are much enlarged.

By the time the crayfish is five inches long, deep punctures appear on the carapace and on the large claws, and the lateral spines on the abdomen are much sharper. A row of tubercles, which will later turn into large, sharp spines, is visible above the spines on the lateral margins of the abdomen.

By the death of Dr. A. J. Spiller Brandon, which took place at Woollahra on the 8th April, 1937, at the age of 57, Australia has lost a well-loved citizen, and one who will be missed in scientific circles.

Dr. Brandon's interests were wide. He carried out important experiments with grasses to determine their suitability for golf greens under Australian conditions. He was a skilled angler, and for many years was President of the New South Wales Rod Fishers' Society. His energy was unbounded, and he would travel many miles to undertake the establishment of trout fry in remote streams. His skill in the intricate study of the scales of trout was almost unique. It was largely through his interest that the investigation of the food of trout was undertaken by the Australian Museum, and its results are due in a great measure to his constant help and encouragement.

His interest in Australian animal life was not confined to angling, and as a member of the Council of the Royal Zoological Society he was a staunch

The second row of spines makes its appearance by the time the crayfish has grown to a length of seven inches. All the other spines and tubercles have become quite large, and they continue to increase in size until the crayfish, at nine inches long, has practically assumed its final appearance in regard to form and armature.

In the adult stage the crayfish has many large sharp spines on the abdomen, and on each segment there is a large rounded ridge, which characterizes the species; and the carapace is studded with tubercles and punctures. The large claws are very large and powerful, and bear numerous sharp spines, whilst all the walking legs are covered with numerous small sharp spines. From this time onwards, the moults are less frequent, sometimes only once a year, but the size and armature do not perceptibly alter.

advocate for the protection of our fauna. His love of Nature extended to all its forms, and often when angling on the Tuross River he would delight to sit quietly and watch the varied life of the stream and its surroundings, so that he had acquired an amazing fund of reliable information regarding the habits and behaviour of the bush creatures. The Museum collections have been enriched by many specimens which he gathered in this district—an area which he had made particularly his own.

But, to those who knew and loved him, it is as a friend that Dr. Brandon will be most truly missed, for he had a ready understanding of his fellow-men, and many who fell under the spell of his kindly personality will miss the genial companionship and constant encouragement which he gave to all so willingly.

Spenser's beautiful lines may form a fitting epitaph to our friend:

Sleep after toyle, port after stormie seas,  
Ease after warre, death after life, does greatly  
please.

K.C.McK.



# The Cyclops Mountains of Dutch New Guinea\*

By L. EVELYN CHEESMAN, F.R.E.S., F.Z.S.

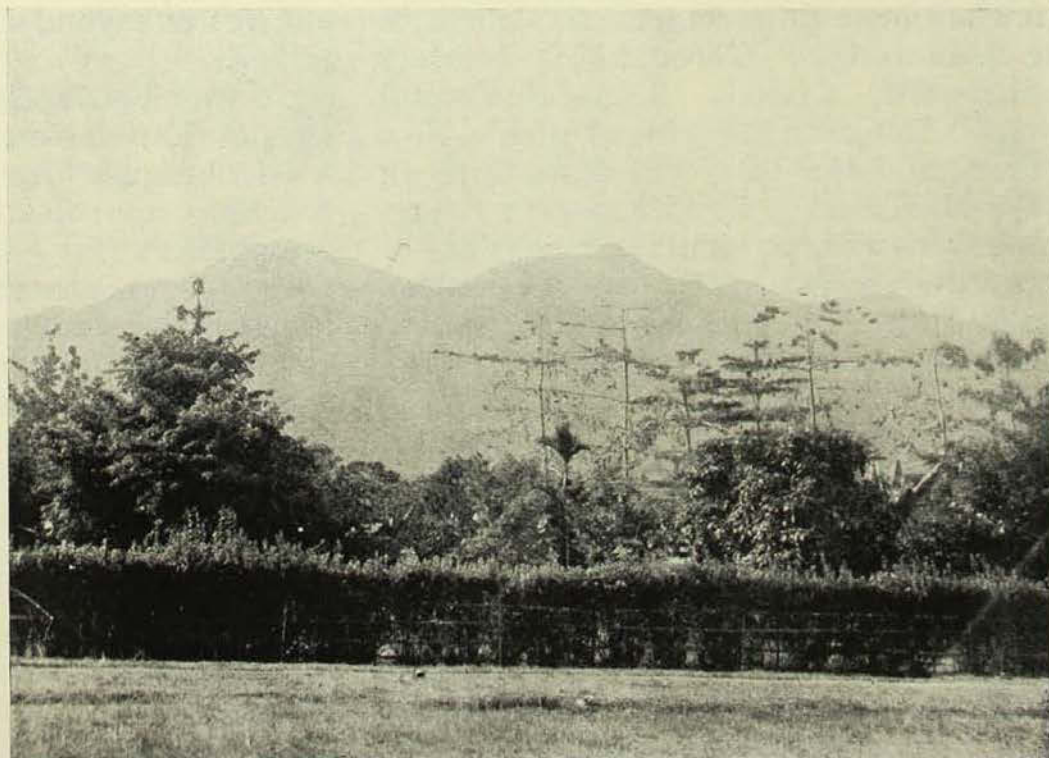
THE object of my recent expedition to the Cyclops Mountains was two-fold: firstly to seek information on the origin of the Papuan fauna, and secondly to make general collections from that district.

The Papuan insect fauna, as well as the flora, extend to the mid-Pacific, becoming gradually poorer, as would be expected, the farther the archipelagoes are from New Guinea. Why we should find Papuan forms of insects on distant Pacific islands has not been satisfactorily explained, and before it is possible to study the problem thoroughly we need far more material from New Guinea, from the interior as well as coastal areas, so that it may be more definitely known what are the true Papuan forms. It is a very distinct fauna, with a strong oriental element. This leads to confusion, because certain species found in

the Pacific have been recorded by authors as being of oriental origin, whereas, strictly speaking, they are Papuan of oriental descent. Australasian is also used rather loosely, the faunal area indicated by this term having different limits when used by different authors. The range of many species cannot be decided until faunal regions are more clearly defined.

I have already made an expedition into the central mountains of the Territory of Papua. The insects collected on that occasion proved very interesting; but the Cyclops Mountains being one of the few relics of old land of New Guinea, the results of this last expedition should help us greatly in determining whence the Papuan fauna originated, and also in separating old types from the more modern types derived from them.

*The Cyclops Mountains from a distance of five miles.*



\* Photographs by the author.





*Hollandia, at one time  
an important plumage  
trading centre.*

It must be recalled that the huge island of New Guinea is known to have been raised from the ocean bed in geologically recent times, as a result of the high, folding movement of the Late Miocene, which raised the Himalayas in Asia and the Alps in Europe. So the very rich flora and fauna of New Guinea cannot possibly have evolved since that period; there must formerly have been some connection with older land.

Clues to that old land must be sought in a few old mountains which exist north of the main ranges. Those which I lately visited—the Cyclops Mountains and Mount Bougainville in Dutch New Guinea, and the Torricelli Mountains in the Mandated Territory—are pre-Cambrian, with a similar formation of crystalline schists. So far, no marine deposits have been found on them; this point is, of course, essential in any question of distribution of species. What adds to their interest is that apparently all of these mountains were formerly islands, for we can trace their old shores inland by dead coral and shell limestone. So it is more than probable that these old islands were the foci from which the new land was populated.

New Guinea must, therefore, be regarded as a centre of distribution of species, and

the rich variety of forms so characteristic of the Papuan fauna and flora may be attributed to former isolation on islands.

We may go farther in this general argument, for it is not unreasonable to suppose that these islands once formed part of a larger land mass or continent, now submerged and represented only by scattered islands and coral atolls. If land formerly extended to the Indo-China sub-region, this would account for the oriental element in the Papuan fauna. But this part of the subject is beyond the scope of the present paper.

It was distinctly an advantage to me to enter Dutch New Guinea from the northwest, because for twelve hours before reaching my destination—Hollandia in Humboldt's Bay—the steamer was passing along the northern side of the Cyclops Mountains, which are a coastal range thirty miles long. One could thus form some idea of the general conditions to start with. Steep faces of the peaks in terraced silhouettes gave one a foretaste of what the climbing would be in dense and lofty forest on almost vertical slopes. The terrific bombardment which was proceeding at the time was a fitting introduction to the climate, for scarcely a day passes without a thunderstorm in some part of the range.



Hollandia is a charming little settlement, very picturesque with its thatched houses in a deep valley. The inhabitants are Malays and Chinese, with two Dutch officials. It was once important as one of the chief centres of the plumage trade in New Guinea, but now that the export of plumes is prohibited, the bird-hunters and traders have drifted away or found some other means of a livelihood.

What is very characteristic of all Dutch settlements is that straight dykes are cut for the streams. The villagers wash their pots and pans in one small canal, drink from another, and bathe in a third. This is quite a good system to follow in the tropics.

My first question was about roads and trails. Luckily, there is a good road which runs south of the range from Humboldt's Bay to Tanahmerah Bay at its western end. Somewhere along that road I had only to cut a trail in order to strike off into the centre of the mountains.

Having fixed on a suitable camping place, one has next to hire natives to cut trails, make clearings and build huts. This may sound simple, but is always complicated by the fact that natives are not accustomed to work for white women; it takes time to break them in to my ways, and needs unlimited patience in handling them. Language, too, was a stumbling-block. In British territory one speaks pidgin—which has to be studied, as it is a language and not only bad English; in Dutch territory, Malay is taught to the Papuans. I learnt enough Malay on the voyage out to carry me through, but was never able to speak it very fluently, for a great deal that I learnt was of no use in that district, where the language might be more aptly described as Dutch-pidgin-Malay. However, all things considered, I suppose I did get a fair amount of work out of my boys.

Four mountain camps altogether were made, at different points, each with rather different conditions. I spent a month at Hollandia in the rest-house; a month near open hills of the lowlands; and six weeks collecting fish as well as other material round about Lake Sentani, which lies south

of the mountains. This disposal of the time gave one a comprehensive survey of the district, but it would be possible to spend several years in that region profitably.

Papuans enjoy cutting down trees and building huts, because that is work carried out by men in their own villages. It is not difficult to set them to such work, but they need constant supervision. Carrying loads they never do willingly, for that is considered women's work.

About thirty boys were necessary to prepare a camp; then I dismissed all but four. Two were sent down every week to carry the scientific material, after it was dried, outside the mountain zone into a drier atmosphere, where I got a kindly Malay official to store it for me until I could mail it by the monthly steamer. By this means the collection fortunately arrived in London in good condition.

The camps being in "mossy forest" or at its lower margin, were, of course, extremely wet. For this reason I only had two walls built to my huts, or even one. It is far healthier to have currents of air passing right through. The boys' huts, on the contrary, must have four good walls and a small entrance which can be barricaded at night. They not only require to keep out cool air, but also ghosts. There are no native villages anywhere on the range: all the Papuans of that district are "people of the sea", and are afraid of the mountains and forest. They hunt cassowary and pig on the lower spurs; collect firewood, cut down trees for making canoes, and rattan, bark for making women's skirts, and other indispensable products of the bush. But none of these things requires that they should penetrate any great distance into the mountains, which was what they disliked about my work. Only one native track crosses the range to the coast on the other side, and this is used in order to fetch salt.

It is no use encamping too high up on the mountains. My experience shows that the largest number of insects is collected between 4,000 and 5,000 feet. From this elevation daily excursions can be made to higher altitudes. The highest peaks in the



Cyclops Mountains are between 6,000 and 7,000 feet. The forest changes, but scarcely shows any sign of thinning; rhododendron, heather, climbing ferns and lawyer palm make a dense undergrowth, but the trees are still lofty.

My clearings attracted a certain number of diurnal insects, and were, of course, admirable collecting sites for Coleoptera and Hemiptera. Ants are fairly abundant, but other groups of the Hymenoptera were not well represented. Parasitic Hymenoptera were difficult to collect because

beating and sweeping were usually out of the question; individuals seen in clearings among fallen trunks and limbs of trees are taken more by luck than by agility. Bees and wasps are very scarce; I saw more in one day spent on the lowlands among low, flowering plants than in many months spent in the forest. An interesting species of Bristle-tailed Scorpions lived under rocks in the gullies.

The night work of mountain camps is the most important. The bulk of my collection of insects consists of nocturnal



*The moth sheet in a mountain camp.*



species which came to light. These actually belong to the lower forest, but after sun-down insects from the treetops seem to fly upwards, thus coming into the influence of the lighted zone on my clearing. Moths, beetles and bugs, and in addition many belonging to the lesser orders, such as mayflies, caddis-flies, night-flying dragonflies, Embids, ant lions, *Mantispa*, Tipulids and stalk-eyed flies, all appeared on the moth sheet. So the night work is very important, and the sites of my mountain camps are chosen to suit it. When I can set up the

plumage traders, and to that I am indebted for specimens, brought to me for payment, which I could not have collected myself. This was when I descended to the foot of the mountains to investigate Lake Sentani and the deforested, low hills lying round it. Sentani natives were keen to collect for me: before daylight scores of them would form queues outside the rest-house—grown men, women and small boys—with snakes in split sticks, large lizards lashed to branches by creeper stems, bats, flying squirrels and cuscus. Large fruit bats had

*Lake Sentani.*



moth sheet near the hut this avoids a long tramp in the dark, and, therefore, whenever possible, I stretch the sheet across the front of my hut, which faces the clearing, and lamps and sheet are sheltered from rain by the eaves.

That large area of undisturbed forest must surely be the home of interesting small mammals, but as the natives had so little bush lore, it was not easy at first to obtain any mammals at all. I watched the pools on the higher slopes, and made the boys smooth the soil of the margins so that one might detect spoor of any animal coming to drink. But nothing came that way, which is not surprising, considering the superfluity of moisture all round.

It is fortunate that in that district the natives have learnt to value money, a heritage of that time not long distant when money flowed freely round about the

their formidable claws muffled and bandaged in leaves. Coconut shells and containers made out of bracts of a palm were filled with all sorts of creatures—frogs, fish, hairy spiders, snails, and even tadpoles and earthworms. These last were collected unwillingly, for all Papuans are afraid of anything which wriggles; but I persevered in asking for them in the hope of obtaining some of the Cœcilian snakes, and finally a good series was brought, to my great satisfaction.

Lake Sentani, which is sixteen miles long, but not very wide, is a lovely stretch of water. It is considered to have been sea that became enclosed during the Late Miocene. The bed has been raised about 200 feet above sea-level, and the only river which connects it with the sea leaves the lake by a series of small rapids formed by limestone ridges, and farther down its



course there is a waterfall over a hundred feet high. Therefore, there is no entry from the sea possible for aquatic forms, and those now found in the lake have presumably been there since it became enclosed. It is interesting to find marine forms among the fish. I also collected about ten species of aquatic mollusca, one species of crayfish and one species of sponge.

It is much too soon to estimate the percentage of new species among the material, which is now in the act of being prepared for examination by specialists, but among

my own particular groups of Hymenoptera more than three-fourths are new.

New Guinea is a colossal island wrapped in an unbroken pelt of forest. It appears to me that the most satisfactory method of collecting is by settling down for a definite period in a locality which promises a useful harvest of scientific material, rather than by trying to cover long distances. This type of work and the details in carrying it out I have tried to describe in this short paper in case there are others who are interested in the same object as myself.

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## Notes and News

Mr. F. D. McCarthy, Assistant in Anthropology, will, towards the end of June, leave for the Dutch East Indies and the Malay States, to study the prehistory of these parts. It is proposed that he take part in excavation work in the Island of Celebes, now being conducted by Professor P. V. van Stein Callenfels, who is the acknowledged leader in prehistoric research in the Far East; the experience Mr. McCarthy will gain in working with Professor van Stein Callenfels will be of the greatest value in view of the prospects that similar work will be undertaken in Australia in the near future.

The Malay Archipelago was undoubtedly the highroad by which our aborigines travelled to Australia, and there are significant parallelisms between the cultures of the Far East and the culture of the Australians. Another link between the two regions is seen in the Australoid features exhibited by certain prehistoric human remains found in the Indo-Malayan region.

Mr. McCarthy will also have the opportunity of examining the extensive archæological collections in the museums at Batavia, Bandoeng and Singapore, and participating in field work now in pro-

gress, besides visiting some of the sites where important finds have been made. He will attend the Congress of Prehistorians of the Far East, which will be held at Singapore in January, 1938, when he will contribute a paper on the relation between the cultures of the Far East and of Australia, and have the privilege of meeting the leaders in this branch of anthropology and discussing with them matters of mutual interest.

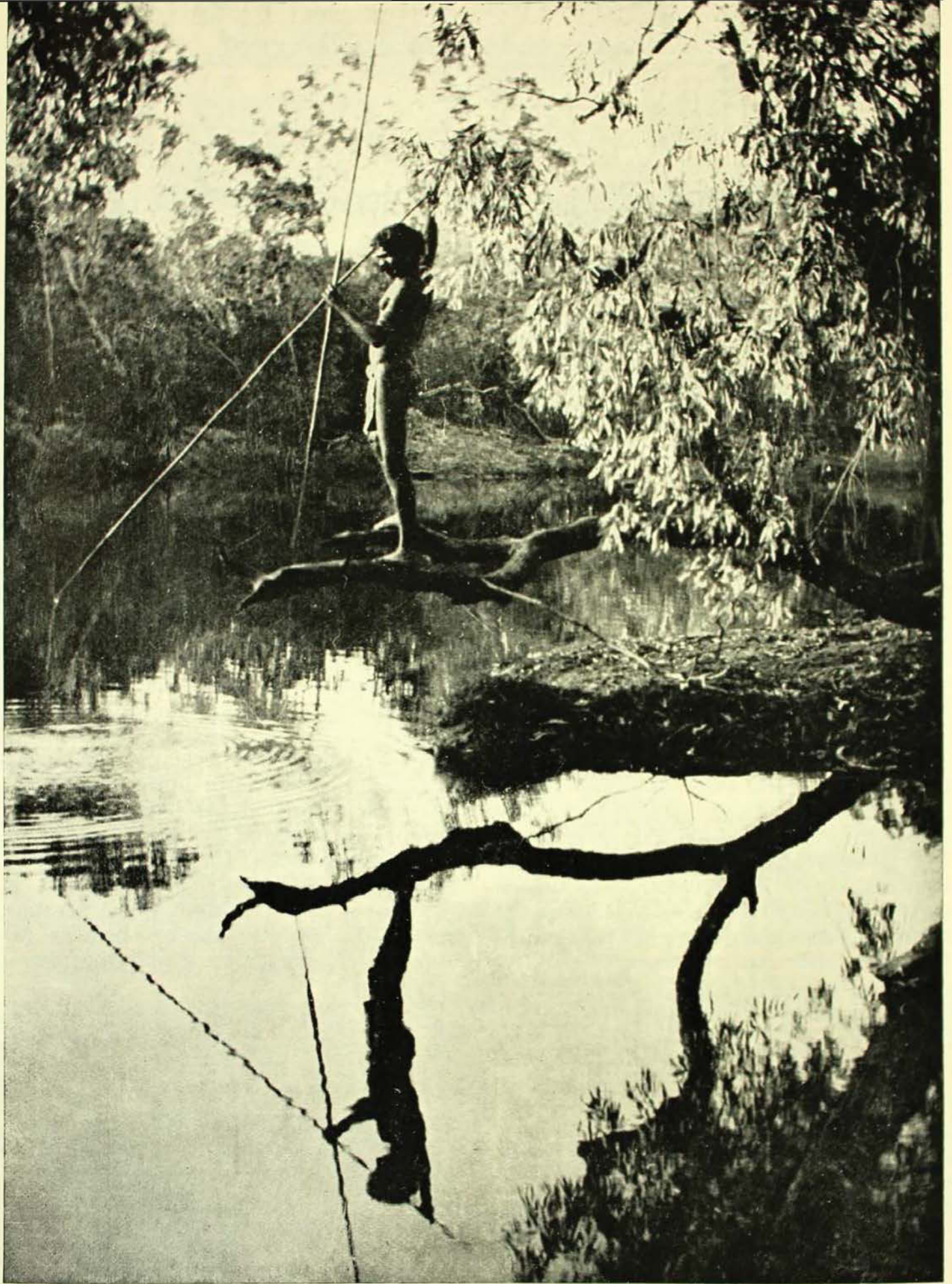
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Mr. H. B. Mathews, B.A., who will retire from the office of Surveyor-General and Chief Surveyor of New South Wales on June 22nd, will thereupon cease to be one of the official trustees of the Australian Museum.

For the past eleven years Mr. Mathews has been a trustee of this institution, and during this period has taken marked interest in the development of the Museum.

At the last meeting of the Board the President (Mr. F. S. Mance, A.I.C.A.), in referring to his services and the high appreciation in which Mr. Mathews is held by his colleagues, extended to him a cordial invitation to attend future meetings of the trustees.





*A Native Fisherman.*

*The fisherman spits a ball of small pebbles and native bees' honey into the pool and spears the fish as they come to the surface to investigate; multi-pronged spears are usually employed for the purpose in this locality, Alligator River, Northern Territory.*

*Similar spears are on view in the ethnological halls of the Australian Museum.*

*Photo.—Francis Birtles.*



# The Domestic Sheep and Its Origin

By C. ANDERSON, M.A., D.Sc., C.M.Z.S.

THE domestic sheep is one of the most useful of the various animals that man has succeeded in bringing under his dominion; from it we obtain meat, milk, and clothing, and a tall strong sheep called the Hunia has been used to carry salt and borax over the Himalayan passes.

For Australians the sheep has a special interest and value. How often have we heard the expression "Australia is carried on the sheep's back"? And the same thing was once true of England, for in Seeley's *Expansion of England* we read that, in the time of the Plantagenets:

England subsisted on her lucrative trade with Flanders. She produced the wool which was manufactured there; she was to Flanders what Australia is now to the West Riding. London was as Sydney, Ghent and Bruges were as Leeds and Bradford.

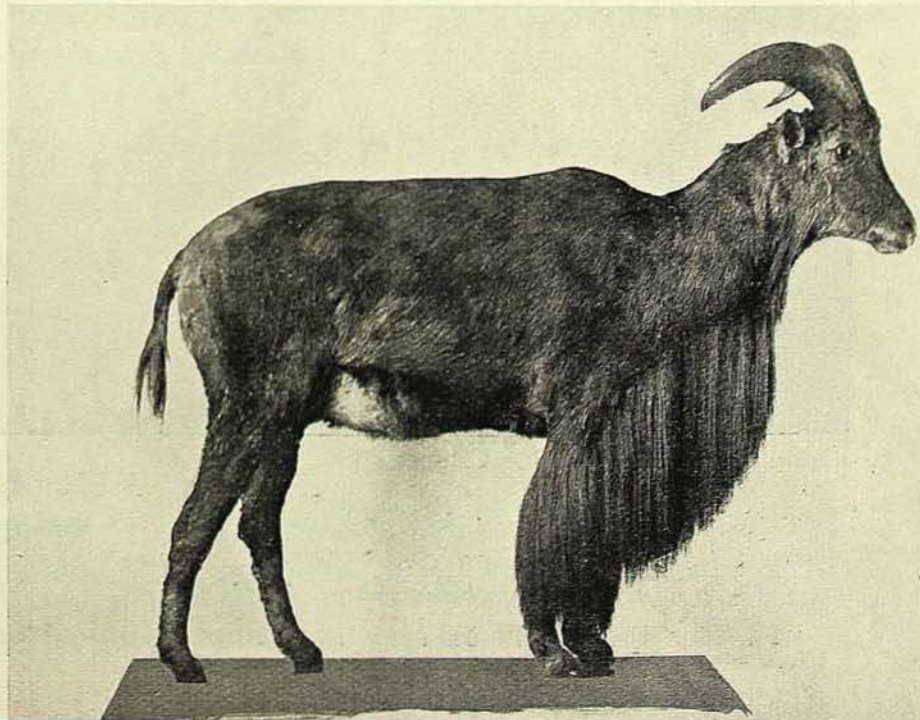
When and where the first steps in the domestication of wild animals were taken is an interesting question, but to find an answer is little less difficult than to discover what song the Sirens sang. For the art of taming animals and adapting them to man's needs was practised long before

any written records were kept, and we can raise no monument in honour of the great benefactor of the human race who first conceived the idea of subjugating the sheep. We know, however, that the Neolithic lake-dwellers of Denmark kept sheep, and the tending of flocks may have been one of the earliest industries of our rude forefathers.

Man has not only brought the sheep into subjection, he has transformed it to a much greater extent than is the case with the dog, ox, or horse. Our sheep are pre-eminently woolly animals, but the wild form is as hairy as an antelope or a goat, except that beneath the hairy covering is an 'under-fur' such as is found in the seal and certain other animals. Centuries of skilful breeding have developed this under-fur, which is specially noticeable in the cold season, until it has become a woolly fleece covering the whole animal except on the face and limbs; the merino, the wool sheep *par excellence*, has wool even on these parts. Even today, however, certain breeds of domestic sheep, such as the African long-legged race and the maned

*Barbary Sheep. This wild sheep has no wool, and the throat, chest, and forelimbs are covered with long hair. From a specimen in the Museum collection.*

Photo.—J. Kingsley.





sheep of Abyssinia, have no proper woolly covering. Again, as a very general rule, all wild species have short tails, which in the typical domesticated sheep is long, though there are some breeds which retain the short tail of their wild progenitors, or have tails of medium length.

#### ZOOLOGICAL POSITION OF THE SHEEP.

The sheep belongs to the Even-toed Suborder (Artiodactyla) of the great Order of Hoofed Mammals (Ungulata), and to the Group Pecora, or True Ruminants, which include deer, giraffe, oxen, sheep, and antelopes. With oxen, antelopes, and goats it forms the Family Bovidæ, the Hollow-horned Ruminants, the sheep and goats constituting the Subfamily Caprinæ. The sheep itself has the scientific name *Ovis aries*, conferred on it by Linnæus.

From oxen the sheep and goats are distinguished, among other characters, by their narrow cleft muzzle, which is covered with hair, that of the oxen being broad, naked, and undivided.

#### EVOLUTION OF THE SHEEP.

The sheep has no long romantic geological history, unlike the horse, which has evolved from the little *Eohippus*, "no bigger than a fox", which scampered over the Eocene landscape, about fifty million years ago, on its four fingers and three toes. The oldest fossil recognizable as a

member of the sheep family dates only from the Pliocene, the age of which is not more than ten million years, and even in the succeeding Pleistocene deposits fossils belonging to this subfamily have been rarely found; these fossils throw no light on the origin of the domestic sheep, or on its line of descent from earlier forms.

#### WILD SHEEP.

The ancestors of our domestic sheep must be sought in regions where wild sheep are native, and preference must be given to the wild species which present characters such as are now to be found in domestic breeds. Thus the Barbary Sheep, a native of the Atlas and other mountain ranges in North Africa, differs so much from all its kindred and has so many resemblances to the goats, that it must be excluded. So, too, the Bighorn of North America, which is also represented by an Asiatic race found in Kamchatka, is not in the direct line of domestic sheep ancestry.

We are left with three principal species of wild sheep which may have given rise to the domestic animal, namely, the Moufflon (*Ovis musimon*) of Europe, the Urial (*O. vignei*), and the Argali (*O. ammon*) of Asia, all of which in their wild state vary so much that they already possess characters found in the domestic breeds.

The Moufflon is now restricted to the islands of Corsica and Sardinia, but it

*Moufflon. This sheep was once common in Corsica and Sardinia, but it is now restricted to the highest hills of these islands. From a specimen in the Museum collection.*

Photo.—J. Kingsley.





was formerly more widely distributed in Europe, and according to some authorities ranged also to Asia. It is about the same size as an average tame sheep, but is more antelope-like in form, with a short deer-like tail and large horns; it is covered with short, close-lying hair.

Asia is the principal home of wild sheep, which inhabit that continent from Asia Minor to the Pamirs and north-eastwards through Tibet, the Thian Shan and Mongolia to Kamchatka. The range of the Urial is wide, extending from Persia through Baluchistan, Afghanistan, the Salt Ranges of India, eastwards to Tibet. Its vertical range, too, is considerable; in Tibet it lives at a height of about 13,000 feet, while in the Punjab it comes down to a few hundred feet above sea-level. It is to be expected, therefore, that the Urial would exhibit considerable variation, and several races have been recognized. In colour the Urial is, in summer, rufous grey or fawn above, light greyish-brown in winter; the lower parts, limbs, and tail are whitish. It is important to note that the Urial breeds freely with domestic sheep.

The largest and most majestic of all wild sheep is the Argali or Ammon of Central Asia, its range extending from Bokhara in the west to Mongolia and Kamchatka in the east. Its typical habitat is the Altai, but there is a number of closely related races, including the magnificent Marco

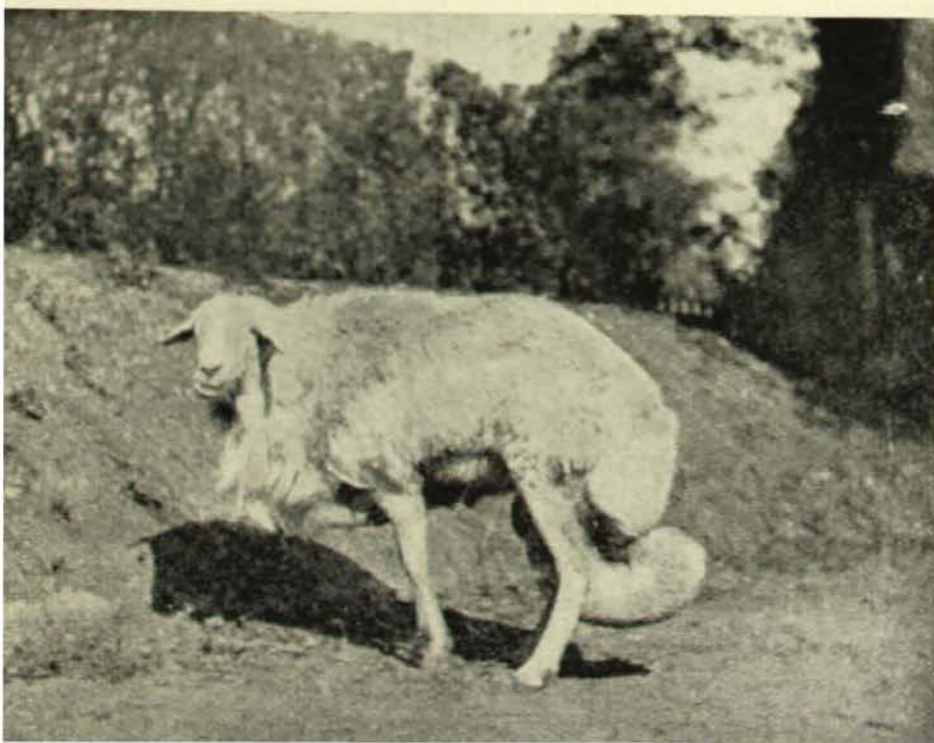
Polo's sheep of the Pamirs. A large Argali may be close on four feet high at the withers, and in the old rams of some of the races the horns may be five or more feet in length, measured along the curves. The Argali is lighter in colour than the Urial, being greyish-brown above and paler below.

#### FAT-TAILED AND FAT-RUMPED SHEEP.

Under domestication, wild animals frequently assume bizarre characters, due to extravagant development of certain parts of the body. This is the case with the fat-tailed sheep of Asia Minor, Syria and parts of Arabia, and the fat-rumped sheep of Persia and parts of Central Asia. The fat-tailed sheep is characterized by a long broad tail on which fat accumulates to such an extent that it may weigh as much as seventy pounds, and is sometimes supported on a little wheeled sled to relieve the owner of its weight. In the fat-rumped sheep, on the contrary, the tail is greatly reduced, and the fat accumulates in two great protuberances on each side of the haunches. It has been suggested that in both of these breeds the storing of fat is to form a reserve of nourishment during periods of drought.

#### PRIMITIVE EUROPEAN BREEDS.

The Neolithic lake-dwellers of central western Europe are considered by anthropologists to have been immigrants



*Fat-tailed Sheep. In some of these sheep the tail may weigh as much as seventy pounds.*

From "The Living Animals of the World".



from Asia, and it may be presumed that they brought with them their domestic sheep, which in that case would be of Asiatic origin. The sheep of the lake-dwellers was a small animal, with slender legs and goat-like horns, and in certain parts of Europe we have surviving breeds which may be descended from the earliest European sheep. Such, for example, are the Soay sheep, of which the typical form is a native of the small island of Soay in the St. Kilda group, situated in the Atlantic Ocean, forty miles west of the Outer Hebrides in Scotland. Varieties of this breed are found in the Isle of Man, the Orkneys and Shetlands, the Faroes, and Iceland, this distribution suggesting that it may have been introduced into Britain by the Norse invaders about a thousand years ago. The Soay is small and active, with a short tail. On the island of North Ronaldsay, in the Orkneys, there is a race of sheep which preserves certain characteristics of the original breed, and which are interesting in that their food consists mainly of seaweed! They are confined to the strand by a twelve-mile wall, five feet in height, the purpose of which is to keep them away from the island pasture and prevent them from mixing with other breeds. Mr. J. M. N. Jeffries has contributed a lively account of this outlawed sheep:

They are an ancient breed, perhaps the sole in these latitudes surviving from antiquity. I can see them well in ancient lands sacrificed to the gods of Carthage or driven with the Israelites into captivity. Through their hanging forelocks they keep a gaze in which centuries of servitude to man and the resentment of it are gathered, and they recall primeval epochs when all subject animals were nearer to one stock. The young of the year are fairly white and rounded, but most of them, with their manes and their odd muzzles, remind you of anything but sheep; remind you of bulls, of bison, of llamas and of yaks. They are small and thin-legged, spectral at a distance. They are all sorts of wild, wolfish, rusted and quagmire colours, are patterned and stained and blotched. Black wool grows, however, in a rough diamond shape round the eyes of a number, and to meet the lambent glare of these masked sheep, peering at you from some shelf or hollow of the black and tortured coast, makes you think of Afrites and of transformed genii and of enchanted flocks of the East.

It is said that the flesh of these North Ronaldsay sheep, owing to their diet, has a flavour of iodine. It should be a sovereign remedy for goitre.

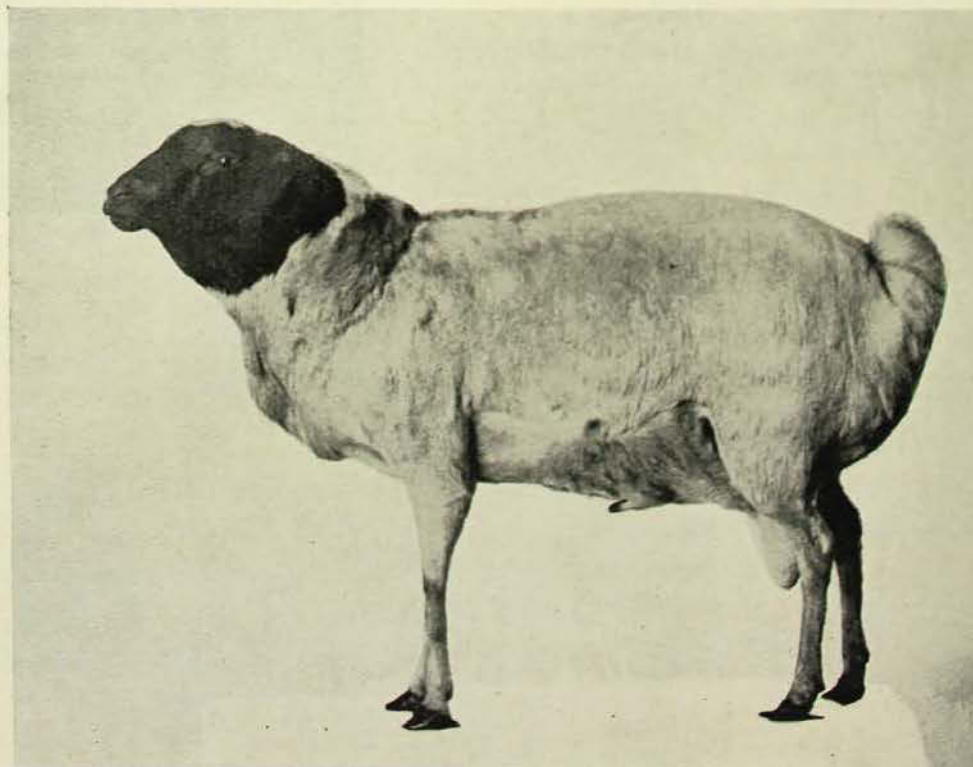
#### THE BEGINNINGS OF DOMESTICATION.

Dr. Max Hilzheimer, who has made a close study of domestic sheep,<sup>1</sup> is of opinion that the sheep were first domesticated in Asia in the lowlands round the Caspian and Aral Seas, in the Punjab, in Baluchistan, and in South Persia. In Mesopotamia, the cradle of the human race, in

<sup>1</sup> *Antiquity*, June, 1936.

*Black-headed or Fat-rumped Sheep. Certain varieties of this domestic breed are remarkable for the accumulation of fat on the haunches. This sheep has a hairy covering in which it resembles the wild species. From a specimen in the Museum collection.*

Photo.—J. Kingsley.





the Jemdet Nasr period, about 3,000 B.C., there were already three breeds: a fleecy, a broad-tailed, and a hairy sheep. In Egypt the sheep goes back to the second prehistoric culture period. Dr. Hilzheimer considers that the wild progenitors of the domestic sheep are the Asiatic Moufflon, the Urial, and the Argali, although he does not regard the last as important so far as European breeds are concerned. According to him, the fat-tailed and fat-rumped sheep did not reach Europe.

The late Professor J. Cossar Ewart, who devoted much research to the origin of domestic sheep,<sup>2</sup> held somewhat different views. He concluded that the Moufflon and the Urial gave rise respectively to a Moufflon-Soay and a Urial-Soay breed, and

<sup>2</sup> Report on Sheep-breeding Experiments. British Research Association for the Woollen and Worsted Industries. Leeds, 1922.

that from these sprang a mediæval mixed Soay. From the Argali came the fat-tailed and fat-rumped sheep of Asia, and crossing of these various races produced the early European and African breeds, from which all the European breeds are descended. The fact that two British breeds, the Cotswold and the Romney Marsh, have a tendency to accumulate fat on the rump, may indicate that the fat-rumped breed has had some small share in the ancestry of European breeds, as Professor Cossar Ewart supposed.

The various breeds of sheep of more normal type, which are now spread over the civilized world, the lordly Merinos, the Southdowns, Hampshires, Cheviots, Blackfaces, and many others, are so familiar that little need be said about them in this short article.

*Champion Merino Ram,  
"Strathaird of Dalkeith".  
Bred by Sir Frederick  
McMaster. Age 11 years. The  
skin of this animal is now  
being mounted by the taxidermists of the Australian  
Museum, for exhibition in the  
Technological Museum,  
Sydney.  
Sydney Mail photograph.*





# *Bathytoshia*, the Giant Stingaree of Australia

## The Largest of the Sting-ray Tribe in the Seven Seas

By E. W. GUDGER,

*Associate Curator of Fishes, American Museum of Natural History.*

TO one who works in a great museum, information about rare or extraordinary fishes comes in many unexpected ways. A recital of these would perhaps make an interesting story, but ichthyology *via* the daily press may be to the reader a new and unusual avenue of approach to a scientific subject—but it all depends. Years ago there was sent me from the rotogravure section of a New York newspaper a picture of a pug-headed trout. Eventually I secured the original photograph and the specimen itself. This approach led to a long and interesting and to me valuable study of pug-headedness in salmonid and other fishes—which is not ended yet. And here is another article which starts from a newspaper picture.

### I LEARN OF THE GIANT STINGAREE.

Here is how I came *via* the newspaper route to learn of this great Australian stingaree and eventually of its long and honourable history as related later.

On August 16, 1936, while visiting friends at Norfolk, Virginia, U.S.A., my attention was called to the issue of the *Virginian Pilot* with a figure labelled "Skate, Oversize Model". This picture was of not only the largest sting-ray I had ever seen, but the largest ray I had ever heard of except the huge stingless Manta ray. A telephone call to the *Virginian Pilot* brought the information that the photograph had been supplied by Mr. W. Carleton Jones. The telephone book gave Mr. Jones' address, and a personal call resulted in a photograph of the fish and an

account of its capture. The negatives were taken by Mr. Salvatore Ferro, of New York, who has kindly loaned them to me to have enlargements made. This, then, is how the knowledge came to me of this unusual fish captured some 11,000 miles away from New York, and almost diametrically on the other side of the globe—in the waters of southern Australia.

### THE CAPTURE OF THE HUGE AUSTRALIAN STING-RAY.

This account is from the notes of Mr. Jones, to whom my best thanks are due and are given for his courtesy.

Late in January, 1935, the American Pioneer Line motorship *City of Elwood*, operated by the Roosevelt Steamship Company, was anchored in about forty feet of water some three miles offshore from Adelaide, South Australia, waiting to go into dock to take on cargo. The whole crew (Mr. Jones among them), finding time hanging heavy on their hands, made out of rope yarn a large conical net 5 or 6 feet wide and deep. This they baited with raw beef and lowered into the sea to catch hard crabs. After several hauls, the net came up loaded with a fair-sized shark. Brought to the surface, the shark tore the net to pieces and escaped. Hoping to capture it again, a shark hook was baited with a large piece of beef and lowered to near the bottom.

Presently a bite was had, the hook was "set" and three or four men "tailed on" the line to bring the supposed shark in. Now, a ray lying flat on the bottom offers much

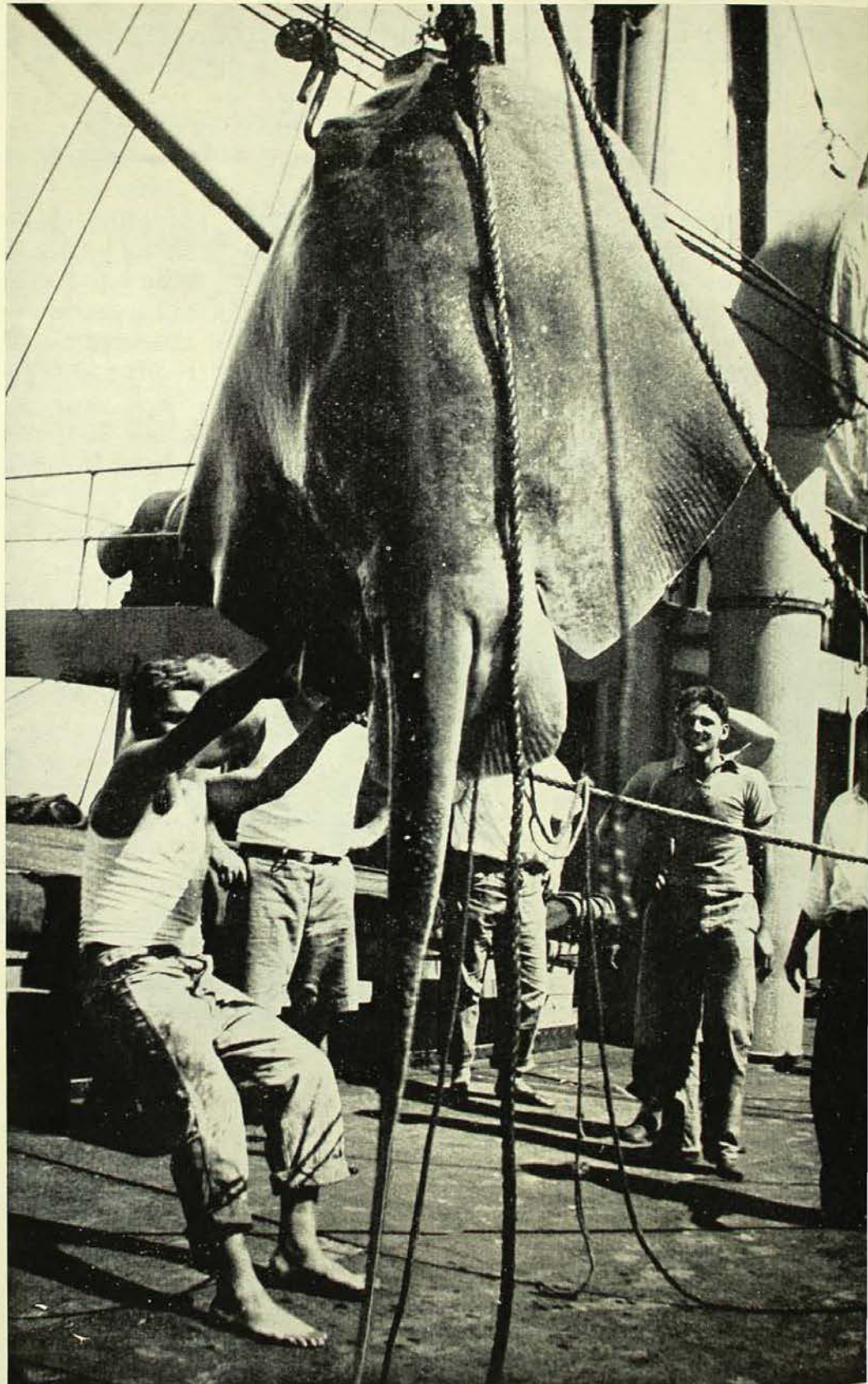


more resistance than a shark to an upward haul. One has to lift against a column of water whose base is the area of the ray's body and whose height is the distance to the surface. By hard pulling, the animal's head was lifted from the bottom, and with the body in an oblique position the lift

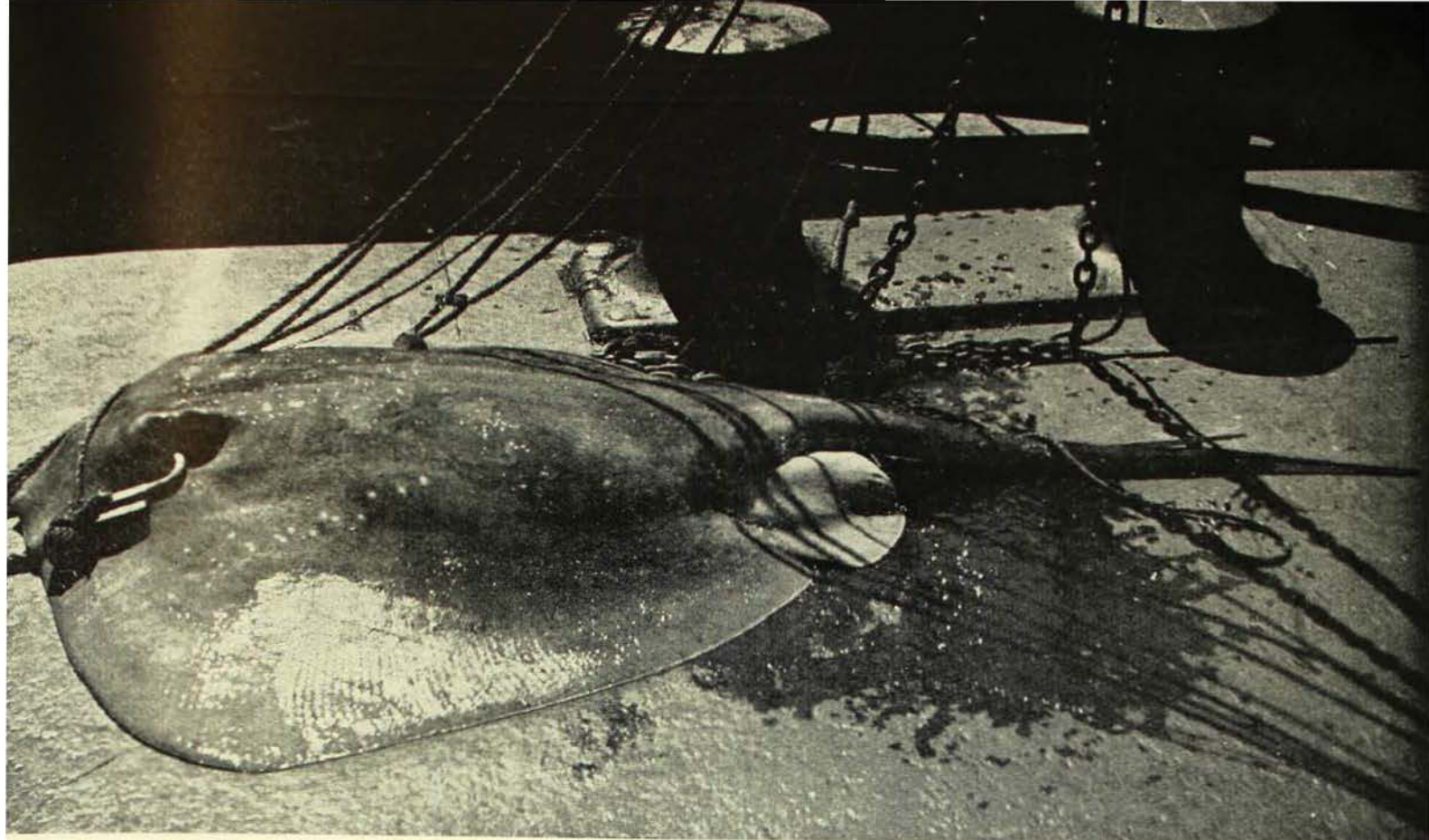
became easier. But when the fish was brought to the surface, all hands were surprised to find that they had hooked not a shark but a giant ray, which, however, put up as hard a fight as a shark would have done. Incidentally, it may be remarked that catching a ray on a hook seems rather

*The giant sting-ray suspended by the "beam hooks". Judge its size by the height of the man to the left. Note particularly the length of the tail and its size at the base.*

Photograph by courtesy of Mr. Salvatore Ferro.







*The great stingaree lying on the deck. Note its great thickness, also its huge club-shaped tail with the large spine about midway on its upper surface.*

Photograph by courtesy of Mr. Salvatore Ferro.

unusual. I do not recall such in my experience in fishing for sharks. However, there is no reason why a ray should not take a hook, and I have learned that others have thus caught rays.

#### THE SIZE OF THIS AUSTRALIAN STINGAREE.

When the giant was finally brought to the surface, it was realized that, if an effort was made to lift it on board by the line, this would break or the hook tear out; so a man was sent down a rope ladder to attach a pair of beam hooks, large icetongs-like hooks used in handling heavy cargo like barrels of salt and bales of cotton. These were lowered from a block hanging to a boom, the whole being activated by an electric winch. The man put a hook in each spiracle (or breathing hole) of the huge ray, the power was turned on, and the great fish was brought abroad and was suspended by the hooks as the figure shows.

There were no means at hand for weighing this gargantuan fish, but its weight was estimated at 750 lb. The fish was very thick and solid through the body, as is indicated in the figures, and I judge that its weight has been little, if any, exagger-

ated. Unfortunately, this specimen was not measured, but its length from tip of snout to tip of tail was estimated at about 14 feet (of which the tail was more than half), and its width at 6 to 7 feet. In the first figure the great wings are curled backward (from the observer) and do not show the full width. In the second figure one cannot see the right pectoral fin, but the left is surely larger by several times than that found in any ray I have ever observed.

Since there are only estimates for the giant, it may be worth while to give the exact measurements of a smaller specimen taken near Babel Island in Bass Strait between Australia and Tasmania. These are: snout to tip of tail 71 inches, tail alone 34 inches, width 42½ inches. This ray was about half the size of the big fellow, and, on a basis of these measurements, the estimates for the large ray are probably not far from correct.

The huge club-shaped tail is long and large beyond any with which I can make comparison. At the base it looks to be as large as a man's leg. One wishes for a measurement around it at the base. The large spine nearly midway of the tail is not



visible in the first figure, but in the second it may be found in the line between the reader's eye and the right-hand bollard. These rays are often found to have several large spines instead of the one here present.

#### THE PULLING POWER OF A STING-RAY.

A ray of any kind swims by flapping its "wings" or side fins, which make up most of its body. The pull exerted by such a huge sting-ray as that figured is almost beyond belief. Two personal experiences with smaller rays may be of interest to the reader.

At Key West, Florida, U.S.A., in June, 1913, a spotted eagle ray, *Aëtobatus narinari*, 5 feet 2 inches wide and 3 feet 8 inches long (body only), weighing 120 pounds, after being harpooned, dragged the launch with engine, propeller and three men aboard wherever it wished. The combined weight of these must have been about 1,800 pounds—nearly a ton. Finally, the ray made a quick turn and pulled the harpooner overboard. The water being only about 4 to 5 feet deep, no harm was done. So we rescued the man and secured the ray.

More striking still was another exhibition by a smaller ray. At the Marine Biological Laboratory of the Carnegie Institution of Washington at Tortugas, Florida, U.S.A., in July, 1912, a medium-sized black stingaree, *Dasyatis hastata*, was harpooned from our launch. For fifteen minutes it dragged around our dock the 22-foot launch, with engine, propeller and fittings, having an estimated weight of 1,200 pounds. In the boat were two men and a live car, together weighing probably 400 pounds. It was amazing to see this boat and crew carried hither and yon by this erratic sub-aqueous locomotive.

Yet this ray when beached measured only 3 feet 1 inch wide over the "wings" and the body from tip of snout to the end of the pelvic fins was but 2 feet 11 inches. The ray was hung up on the scales, and when I announced its weight as only 58 pounds, not a single onlooker who had witnessed its feats of strength would

believe me until he had read the scales for himself.

We have no data for the pulling power of the gargantuan Australian ray, but since it is two or three times larger than either *Aëtobatus* (the eagle ray) or *Dasyatis* (the black sting-ray), I suspect that its power of traction is greater by more than two or three times—that this tends to increase in geometrical rather than arithmetical ratio of the size of the fish.

#### THIS GREAT RAY KNOWN IN AUSTRALIA SINCE 1770.

This oversize sting-ray is peculiar to and has long been known from Australian waters—167 years as a matter of fact. This we know since there is a reference to such great rays in Captain Cook's original journal of the voyage of the *Endeavour*, which is preserved in the Mitchell Library in Sydney. Captain Cook was keenly interested in natural history, and in his journal, under date of May 5-6-7, 1770, are recorded the first captures of our ray. Since this record is a matter of historical interest, it seems well just here to reproduce photographically a part of the page in Cook's journal. The handwriting is either Cook's or that of his ship's clerk. This photograph I owe to the courtesy of Mr. Gilbert P. Whitley, the learned ichthyologist of the Australian Museum.

The location is Botany Bay, to the south of the city of Sydney. Cook speaks of one ray caught there in the morning of May 5 which weighed 240 pounds dressed, or about 275 pounds as it came from the sea. In the afternoon of May 6 two others were taken weighing together 600 pounds. Later in their sojourn there was harpooned a still larger ray, one which disembowelled weighed 336 pounds or about 375 pounds natural. Unfortunately, no measurements are given. From the great numbers of these large rays found in it, this body of water was first called Sting-Ray Bay by Captain Cook, but later he changed the name to Botany Bay, by which name it is known today. Its chief affluent is Cook's River, named for the great navigator.



# New Wales or East Coast of New Holland

1770  
- being to the Boat we found they had caught a great number of small fish which  
the Sailors call leather Jackets on account of their having a very thick skin. These  
are known in the West Indies, I had sent the yawl in the morning to fish for  
Sting rays who returned in the evening with upwards of four hundred weight  
one single one weighed 240 exclusive of the entrails, in the afternoon the wind con-  
tinued Northerly I sent the yawl again a fishing I went with a party of men  
into the country but met with nothing extraordinary  
Sunday 6<sup>th</sup> In the evening the yawl returned from fishing having caught 2  
Sting rays weighing near 600 lbs. The great quantity of plants <sup>2<sup>d</sup> September</sup> ~~found~~ <sup>found</sup>  
this place occasioned my giving it the name of Bathurst Bay, it is situated  
in the Lat. of 34:0 S. Long. 208:37 W. it is spacious safe & Commodious  
may be known by the land on the sea coast which is a pretty even good, being  
rather higher than it is inland with steep rocky cliffs near the sea & looks like  
long Island lying close under the shore, the entrance of the Bay lies abt. the  
Middle of this land, in coming from the Southward it is discovered before you are  
abreast of it, which you cannot do in coming from the Northward, the entrance  
little more than a Quarter of a Mile broad lies in WNW. To sail into it keep the  
shore on board until within a small bay Island which lies close under the N. S.

A page from Captain Cook's "Journal of the Voyage of the Endeavour", on which is recorded the fishing for sting-rays in "Sting-ray Bay".

OUR RAY NAMED *Bathytoshia brevicaudata*.

This is a most extraordinary name, and the reader is probably wondering why such has been "wished on" our fish. It must be confessed that the name is nearly as formidable as the fish, and for a while its origin and meaning had me confused.

*Bathytoshia* is a compound word, and dissection reveals its origin as follows. *Bathy* is a Greek word which means deep sea, and *toshia* is derived from the name of the man, Dr. James Tosh, who in 1903 gave a scientific description of the ray. *Brevicaudata* is of Latin origin and means short-tailed—which our ray is only in comparison to the whip-tailed rays, wherein the long slender whip-lash tail is

sometimes twice as long as the body proper. So the name when translated is "Tosh's deep-sea ray with the short tail".

## WHY CALLED A STINGAREE.

This fish is called a sting-ray because of the sting or stings found on the upper side of the tail. In most sting-rays, as the eagle ray and the black stingaree referred to above, the sting is found close to the base of the tail, but in the Australian stingaree it arises about in the middle part of the tail. Stingaree is, of course, only a corruption of sting-ray.

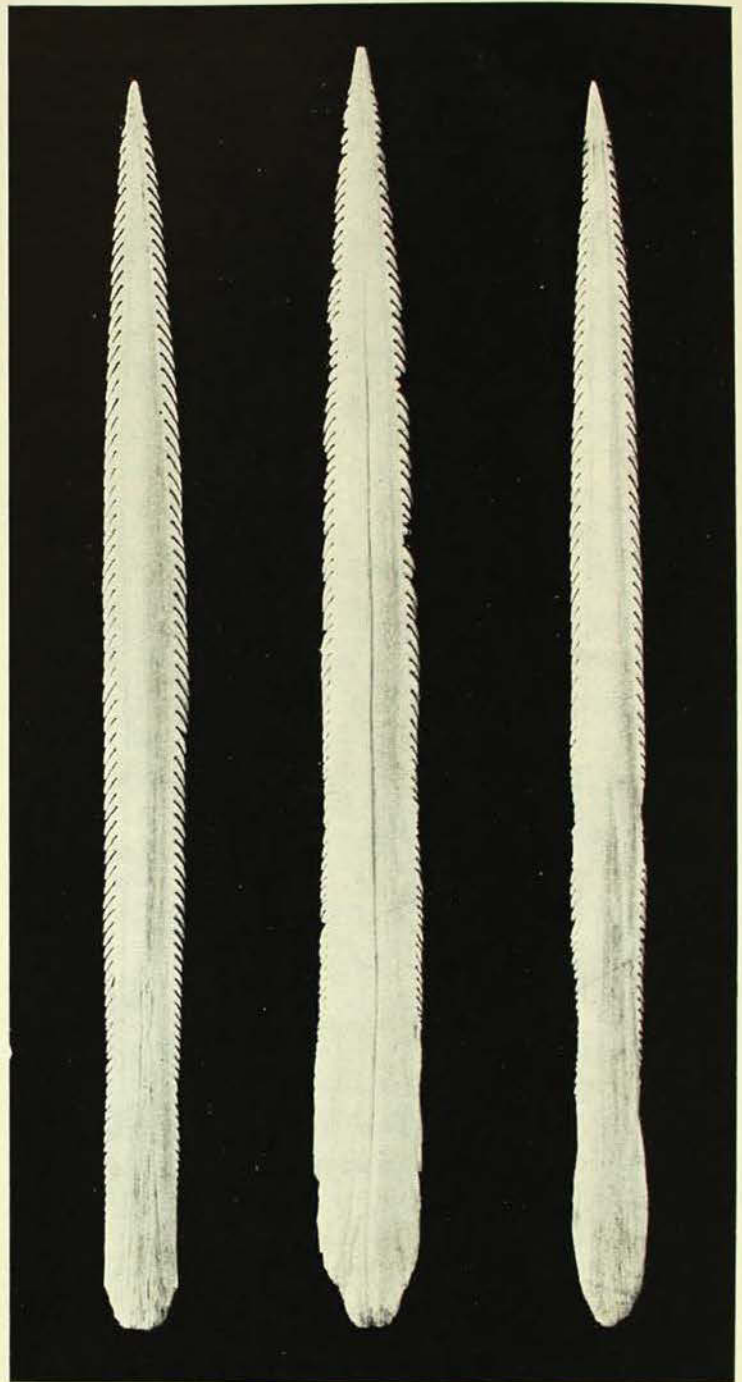
Sting-rays when captured, and especially if wounded, are dangerous. I have had a black stingaree lash out savagely with its



tail and drive its barbed "stinger" into the side of the boat so deeply that to free the fish the barb had to be broken off and the point left in the wood. The stings, with their backwardly pointing barbs, inflict very painful and dangerous wounds. The sting can only be got out by enlarging the wound with a knife or by cutting off the sting and pushing it through; hence fishermen dread these wounds. Most of them think that the sting is poisonous. I long pooh-pooled this idea, attributing the pain and inflammation either to the introduced slime acting as a chemical poison, or thinking that the trouble was due to bacteria carried in the slime. However, it takes bacteria as much as one, two or three days to incubate and get into full activity, whereas after a stroke by the ray intense pain follows at once and suppuration begins shortly. Now today it is known that some and probably all sting-rays have a small poison sac at the base of the sting and a small groove in the upper side of the spine which conveys the poison into the wound. In the figure this groove can be seen in the centre of the upper side of the central spine. However, the poison transmitted down this groove is fortunately less virulent than that of other poisonous animals—snakes, for instance. All the stings show the retrorse barbs which make the extraction of the stings such a difficult and painful operation.

#### OTHER NATURAL HISTORY MATTERS.

As the flat body of this fish indicates, it is a bottom-dweller and feeder. Like other rays, its food consists largely of crustaceans. Other than this and the matters already set out above, we know little of its natural history. Unlike the skates, which are found in cooler waters and are egg-layers (oviparous), our ray, like its congeners, is a temperate water form and is viviparous; that is, brings forth its young alive. But it does not "suckle its new-born on milk" as was asserted in a book much read a few years ago in America and written by an intrepid marineress who had never been further to sea than to the seashore resorts around the mouth of New York Harbour.



*Stings of the American ray, Dasyatis hastata. Each of the lateral stings shows its ventral surface without a groove; the central one in dorsal view shows the groove through which the poison runs.*

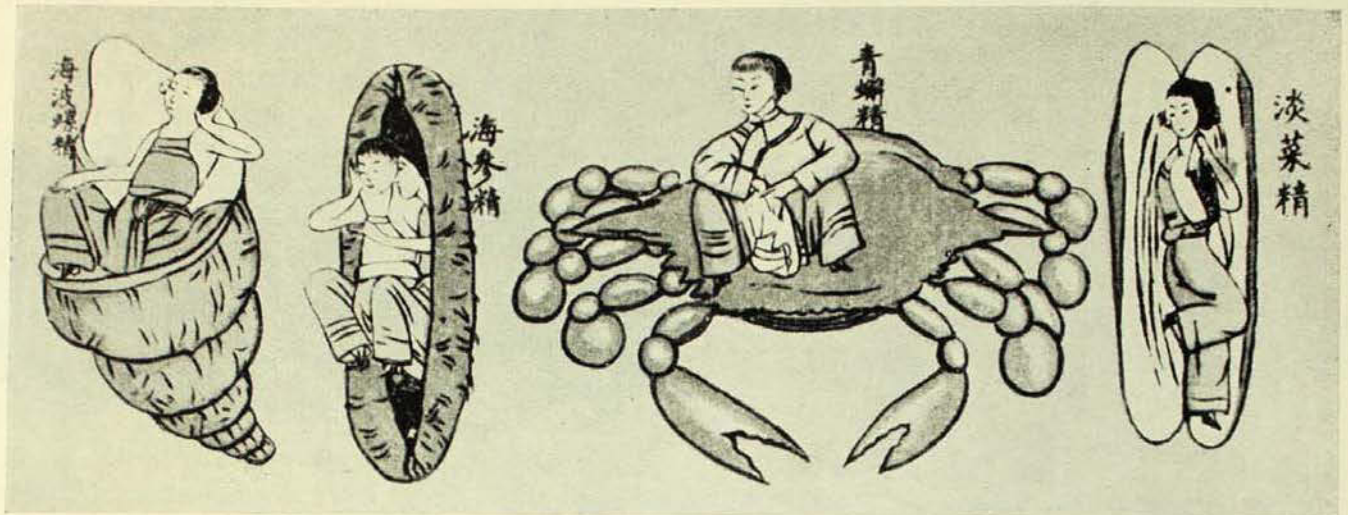
Photograph from American Museum of Natural History.

These baby rays are born active and mildly dangerous. This I know, because many years ago a new-born sting-raylet, delivered from the body of its mother by me, in base ingratitude lashed out vigorously with its infantile tail and attempted to drive its as yet unhardened miniature sting into my thumb. Here, then, we have a case of the ruling passion rampant at birth.



# The Crab in Medicine, Magic and Myth

By MELBOURNE WARD, F.Z.S., F.R.Z.S.\*



*Transmigration of human souls into marine creatures as depicted by an oriental artist. Bêche-de-mer and a crab are the central figures.*

**N**OWADAYS the crab holds a place in our esteem largely on the excellence of its cooked flavour. There are few people who interest themselves in the living creatures and their quaint habits, but to other peoples and in other times the crab filled various functions from medicinal uses to illustrating the movements of celestial bodies.

Several supposed characteristics of crabs made them fit objects for imaginative and magical purposes. They were believed to progress backwards. Their eyes were always staring, and it was supposed that they never slept. Head and body were inseparably fused, so that in Russian folklore we find the story of a husband who beats his wife because she cannot solve the riddle he proposes, to provide him with a fish which is not a fish and which has eyes but not in its head. She is saved from her cruel punishment by one of her sons or brothers, who tells her to cook the crab, which lives in the water like a fish and has eyes but not in its head.

## THE CRAB AS MEDICINE.

The use of the crab in primitive medicine today is varied; in one region it appears

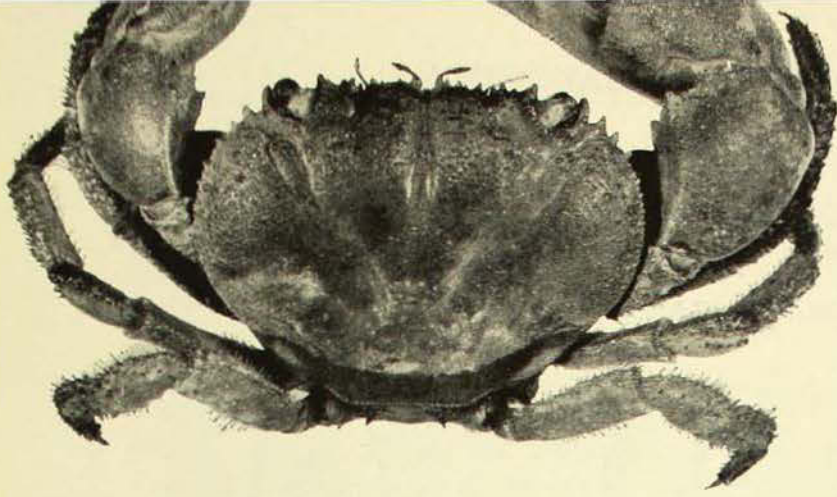
as a cure, in others as a deadly poison. In the Purari delta, Papua, invalids are strictly forbidden to eat crab; a native interpreter suffering with a festered toe found that it became much worse after a meal of crabs. In another region a crab, *Grapsus pictus*, was used as an antidote for spider bite.

Pliny remarks on the use of crab's eyes in the cure of various ills, and it appears that not only were real crab's eyes used, but that curious white nodules of lime which form in the stomachs of fresh-water lobsters were considered useful for absorbent and antacid purposes. An ancient European remedy for sore eyes relied for its efficiency on the procuring of a living sea crab from which the eyes had to be torn while it was alive, the crab being then liberated. The eyes were tied around the neck of the patient and allowed to remain until a cure was effected.

Pliny also tells us that a potion composed of river crabs beaten up and mixed with water, or of their ashes, was deemed a certain cure for cases of poisoning, acting as a counter-poison. Mixed with ass's milk, they were especially effective against the poison of the scorpion, and crab's flesh mixed with the herb basil formed an

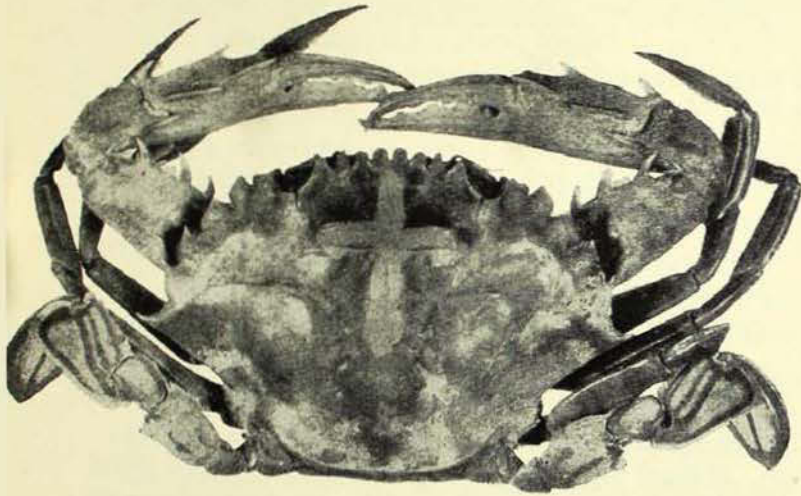
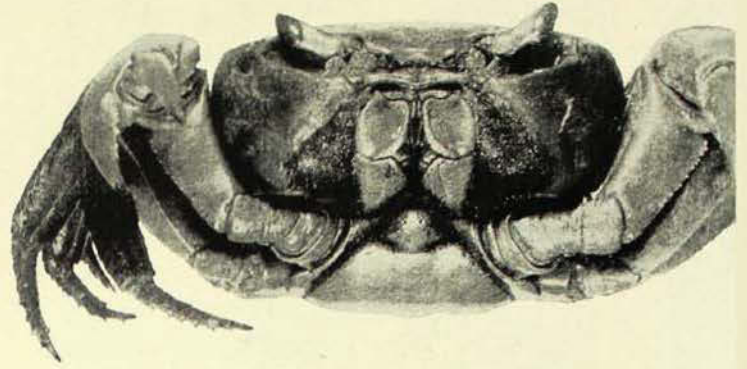
\* Photographs by V. Seaniger, M. Hope Studios.





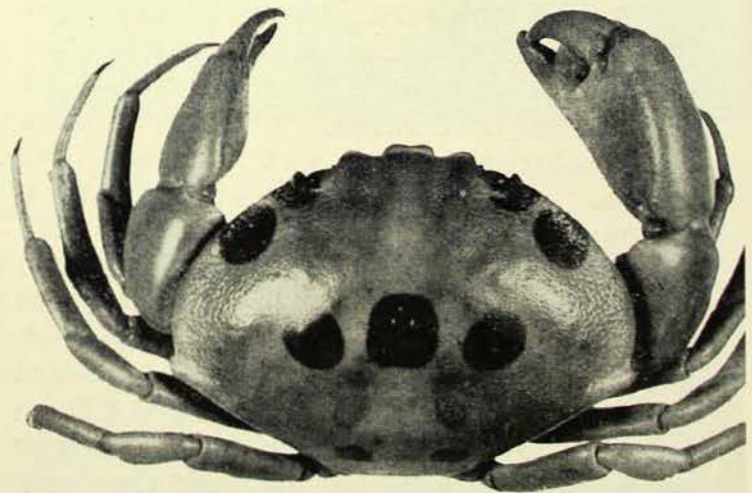
*The Red-eyed Reef Crab, Eriphia sebana, is tabu as food to the descendants of Ae ni korro Tauto at Su'uholo, Solomon Islands.*

*The Land Crab, Cardisoma carnifex, threatens with its gaping jaws, and instils fear into the hearts of Murray Islanders, Torres Strait.*

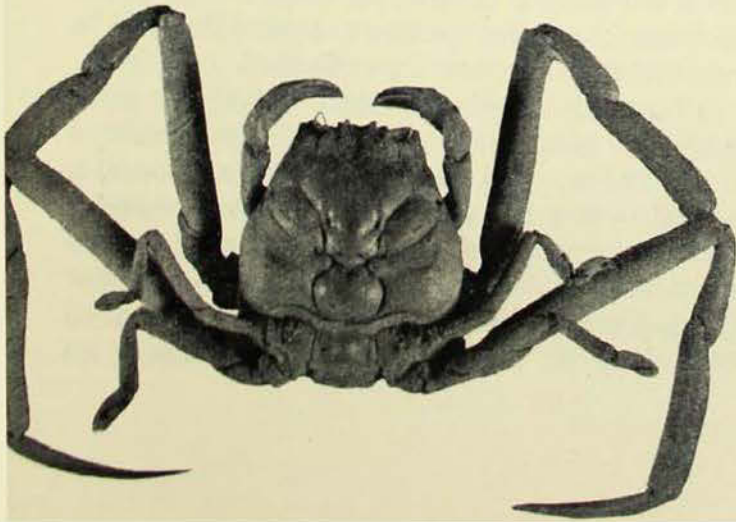


*The Crucifix Crab, Charybdis cruciatus, bears a design similar to a cross, hence its name.*

*On Hawaiian coral reefs is found Carpilius maculatus. Legend has it that the beautiful red markings are imprints of the sea god's fingers.*



*Heike gani, the Japanese Man-faced Crab (Dorippe japonica), is considered to have the grinning face of a drowned warrior on its back.*





unfailing exterminator of scorpions. When ass's milk could not be procured, either goat's or any other kind of milk could be used. Wine and crab's flesh is also recommended as an antidote for poison. Pliny especially mentions river crabs, *Potamon*, as potent against the bites and stings of sea-hares, adders, and bramble frog. In classical times crabs were believed to be the mortal enemies of serpents, and that when swine were bitten by snakes they immediately ate crabs, thus curing themselves. Galen prescribed pounded crab as a cure of the dreaded disease hydrophobia.

In the beginning of the eighteenth century Rumphius, a Dutch naturalist, who wrote about the fauna of the Island of Amboina in the Dutch East Indies, recorded the death of a woman who ate the claws of a coral reef crab. The bad reputation enjoyed by this species induced Rumphius to call it *Cancer noxius*. So far as I can discover, this is known today as *Carpilius convexus*, and the related species, which Rumphius called *Cancer ruber*, known today as *Carpilius maculatus*, had a more doubtful claim to notoriety; some natives declared it to be poisonous, while others extolled its palatability.

#### SPONTANEOUS GENERATION.

One of the quaint theories of ancient and mediæval philosophers is known today as spontaneous generation, by which it was contended that the putrefying bodies of various kinds of animals gave rise to quite different creatures—usually insects, worms, or fish—and there are two instances of crabs in this connection. If the body of a crab with nippers removed were buried in the ground, a scorpion would come forth from the part so buried, and threaten direfully with its barbed and crooked tail. While the sun is passing through the zodiacal sign of Cancer, the Crab, the dead bodies of crabs which were thrown upon the shore were believed to be transformed into serpents.

#### SPELLS AND CHARMS.

The tremendous vogue of magical amulets has exercised man's ingenuity and credulity to an extraordinary extent—the

more bizarre and difficult to obtain the desired object was, the more value was set upon it. Even the most cursory inquiry into these twilight realms of man's history leaves one with a feeling of astonishment, for nothing is ignored from the horrible to the sublime, from dragon's teeth and blood to beautiful gems. Bearing this in mind, it will not come as a great surprise to find that parts of crabs or the whole animal have found their way into the magician's bag of tricks; the only remarkable circumstance is that such usage of crabs was not common. In China the carapace of a crab hung on a string in the house is still supposed to drive away evil spirits. There is an especially vicious devil which preys upon Chinese mothers at the moment of child-bearing; hence, in order to silence this evil spirit and render him innocuous, the priest recites the classics appropriate to the occasion. Ten or twenty pieces of a kind of grass are cut up into lengths of about an inch, and several likenesses of the crab are cut out of common paper and placed in a censer and burned. Sometimes several live crabs, after being used in the ceremony, are taken and turned into the street by way of propitiating or frightening the spirits. When the live crab is used it is said that the local word for crab sounds like the name of the demon.

While in China the crab is used for a beneficial purpose, in Papua the opposite obtains. Along the mud banks of the tidal rivers the beautiful Fiddler crabs excavate their burrows, and their brightly coloured nippers make them obvious to native and white man alike. Some species have the habit of blocking up the entrance of their burrows with mud which they bring from the depths of their galleries as the tide rises. This habit has caused the evil magician to introduce it into his incantations when he desires to prevent an expectant mother from delivering her child.

In the southern United States the darkies have always been believers in spells and charms, and one of the leaders of Denmark Vesey's insurrection in South Carolina in 1822, known by the picturesque name of Gullah Jack, was an



established sorcerer of considerable repute, and as such was feared by his comrades. He was not only considered invulnerable, but it was believed that he could make others so by his charms, consisting chiefly in a crab's claw placed in the mouth.

The stag, the nightingale, and the crab were all considered to be wakeful, and in legends they frequently appear as creatures which awaken the hero in time to save him from destruction; consequently an amulet comprising crab's eyes, nightingale's flesh wrapped in the skin of a stag, is recommended by Pliny as an infallible aid to those who must remain awake.

#### THE CRAB IN HERALDRY AND TOTEMISM.

The crab appears in heraldry on the escutcheon of the English family Crabb. And turning to the South Pacific we find several instances of its use as a totem of a clan. There is a crab clan at Santa Anna in the Solomon Islands; the crab ancestress was called Agave and the members of the clan are forbidden to eat crabs, for to eat a crab means to die on the same day. Nearby, at Su'uholo, those people who were of the family of the ghost 'Ae ni korro Tauto, those who called him ancestor, could not eat the Red Eyed Reef Crab, *Eriphia sebana*, because it was found in Tauto's head when it was washed up on the beach at Su'uholo after he was killed at San Cristoval. 'Ae ni korro Tauto was guardian ghost watching over his people, guarding them against sickness caused by malignant ghosts.

At Kiwai, in Torres Strait, there is a totem Korobe, a crab living in the nipa palm, which in turn is a totem known as Soko, and is more important as a totem than the crab.

While I was visiting Murray Island, Torres Strait, on a collecting trip in October, 1928, I was interested by the ill-concealed antipathy of the natives for the land crab, *Cardisoma carnifex*, which inhabited the creek. It was with difficulty that I prevailed upon a man to assist me to collect a few, and I must admit that their appearance in the light of an electric torch was by no means prepossessing; in

fact, standing with great nippers held threateningly agape and their long eyes erect, they presented quite an evil picture, and I did not wonder that my assistant showed little enthusiasm for his job and kept muttering about them being "bad" and "poison".

Unfortunately, I did not pursue the inquiry into the reasons for this aversion of the natives for fear of alienating their friendship, as they displayed extreme reluctance to discuss it. Perhaps there was some old deeply-rooted superstition connected with the crab, for in other localities this same genus provides a large part of the native diet.

#### THE CRAB IN ASTROLOGY AND METEOROLOGY.

A favourite method of illustrating the movements of the supernal bodies in ancient Grecian philosophy was to turn to the animal kingdom and select some creature whose habits appeared to mirror the greater phenomena; hence the use of the supposed backward progression of the crab to symbolize the return of the sun in June when it entered the house of Cancer in the zodiac. At that season the sun was compared to a crab which retraced its steps or was represented as drawn by a crab. The celestial crab had a darker side of its nature, as it appeared not only as a helper of the solar hero, but also as his enemy. This idea was beautifully expressed in the legend of Hercules, who, when fighting the Hydra of Lerne, was caught and drawn back by the crab, which Hera, the Queen of Heaven, afterwards transformed into the heavenly constellation of Cancer. The celestial crab, like its mundane representative, walks "a little backwards and a little forwards", and by this inconsistency causes the death of the solar hero and in other tales the destruction of the monster. The setting of the sun was considered to be a retracing of its path, and as the crab was believed to walk backwards the setting sun either became a crab or was drawn by a crab.

The crab also became identified with the moon in a similar process of thought, and it was believed that crabs were more succulent at the full of the moon than during the dark.



From the moon to tides is but a step, and we find that the Malays believe that a gigantic crab causes the rise and fall of the tides. The fabulous creature dwells in a huge cave in which its body fits snugly, and when it creeps forth in search of food the waters of the ocean rush into the cave, and thus the tide recedes. When it returns to its lair and creeps in, its huge bulk forces all the water out of the cave back into the ocean bed, so that the tide rises. A Malayan variation of this legend contends that there is a huge hole in the floor of the sea, which is called Pusat tasek, or Navel of the Seas. In this hole there sits a gigantic crab which twice a day gets out in search of food. While he is sitting in the hole the waters of the ocean cannot run down into the underworld, the whole of the aperture being filled by his body. The rivers emptying into the sea during this time are supposed to cause the rise of the tide; when the crab goes off in search of food the waters of the ocean pour down into the underworld, and therefore the tide falls.

The Siamese believe in the existence of giant crabs in the sea which cause the death of people, and the Japanese giant crab, *Kæmpferia kæmpferi*, is credited with the death of human beings. A curious legend has sprung up around the death of the redoubtable British sailor, Sir Francis Drake, claiming that he was killed and eaten by crabs, while history tells us that he died at Panama in an expedition against the Spaniards.

In the north Atlantic impending bad weather can be foretold by an examination of the crabs dwelling on rocky coasts, where they cling tightly to the stones when a storm is expected; they also bury themselves deep in the sand to escape from rain and storm.

Weather forecasting is not confined to living crabs, and in the Chiloe Islands, off the coast of South America, the natives use the carapace of a crab, *Lithodes* sp., as a barometer, which they call Barometro Araucano. During the dry season the shell appears plain white in colour, but as the rainy season approaches fine red spots appear, which become more numerous as the humidity increases, until eventually at

the height of the wet season the entire shell becomes red.

#### CRAB LEGENDS.

The colour markings on the backs of various crabs have given rise to legends, and one species of swimming crab, *Charybdis cruciatus*, found in the tropical Pacific, has beautiful bands of colour which frequently form a distinct crucifix. Of this species we are told that St. Francis Xavier, on his way to the East, encountered a terrific storm which threatened to engulf the ship in which he was travelling, so he took off the crucifix he was wearing and cast it into the raging sea, whereupon the storm ceased abruptly. In order that the precious relic might be restored, a swimming crab seized it in its nippers and carried it up through the dimly lit ocean and swam alongside Xavier's craft. The saint joyfully received the cross from the crab, and ever since that time *Charybdis cruciatus* bears the imprint of the cross on its back.

On the reefs of ancient Hawaii the sea god was wont to search for delicacies to assuage his divine hunger, and one fine morning he espied a fine big crab, fat of body, smooth, shining, and of a uniform yellowish-pink shade, very beautiful to behold. Seized with a desire to add this delectable morsel to his repast, the god grasped the crab. This sudden attack surprised the crab, and, seizing the god by the fingers, it drew blood. The god, in surprise and pain, dropped the crab, leaving a row of red finger-marks on its back. Quickly overcoming the shock of the first encounter, the god seized the crab again, only to relinquish his hold of the powerful creature for the second time, leaving a second set of fingerprints. For the third and last time the god caught the crab, which had no doubt been greatly weakened by this contest with divinity, and killed it. The descendants of this beautiful tropical species, *Carpilius maculatus*, all display the red imprints of the god's fingers.

Interesting legends of crabs bearing the imprint of drowned heroes' faces upon their carapaces come from Japan. The well-known version is as follows. Congo,



the first Empress of Japan, lived at Simonspek, western gate of the inland sea, seven hundred and eighty years ago, and collected there a large army and started forth to conquer Korea, but when she arrived there she found that she was to bear a child, so she prayed to the gods that she should not be delivered until she conquered Korea. This conquest occupied three years, after which Congo was delivered of a son, who became a great general. He accomplished many mighty deeds of valour; nothing could stand against him. But at the age of thirty-nine, having no other worlds to conquer and no more fighting to do, in a fit of despair he went on board a ship, tied an anchor around his neck and cast himself into the sea, and ever since that time this race of crabs has been found with his image upon their shell.

A second Japanese legend tells of the defeat and annihilation of the Heike or Taira warriors, whose fleet was destroyed at the battle of Dan-ao-ura in A.D. 1185. The wraiths of the slain warriors took the forms of crabs, and Lafcadio Hearn gives us a delightful translation of a Japanese poem commemorating the event:

Having perished in the sea (those Heike) would probably have become food for fishes (anyhow, whenever) the ship-following ghost (appear), the wind has a smell of raw fish.

Marshalled (on the beach) at the ebb of the tide, the Heike-crabs obliquely glare at the apparition of this miserable world.

Though (the Heike) long ago sank and perished in the Western Sea, the Heike-crabs still display upon their upper shells the colour of the red standard.

Because of the pain of defeat, claws have grown upon their breasts, I think—even the faces of the Heike-crabs have become crimson (with an anger and shame).

All the (Heike) party having been utterly crushed, claws have grown upon the breasts of the Heike-crabs because of the resentment in their hearts." [From Japanese lyrics translated by Lafcadio Hearn.]

The tragic death of the general in the first Japanese story is reminiscent of the fate of Palinurus, Æneas' pilot, who fell overboard, and has since been associated with *Palinurus*, the crayfish.

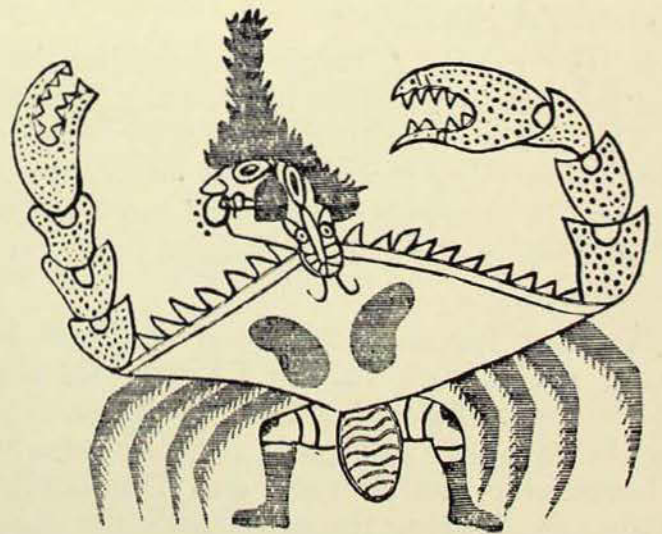
An echo of these Japanese transformations into crabs is to be found in the Chinese belief in the transmigration of

human souls into the forms of animals; I have seen drawings of these transformed souls in the bodies of crabs.

#### COLOUR OF CRABS.

Many species of crabs are coloured red in life, especially those dwelling in the deep sea. However, those which find their way to us from the fish shops are generally varied shades of green, brown, and blue in life, and change to a light red with incredible swiftness upon entering the boiling water of the cauldron. The resultant beautiful colour has proved a fatal allure-ment, for we hear of crabs which leapt precipitately into the fatal cooking pot in order to acquire the admired shade.

In the early part of the nineteenth century people generally believed that all living crabs were the same colour as those which had been cooked, and an amusing anecdote is told of the great French naturalist Cuvier in connection with this fallacy. The committee of the French Academy were at work on the Academy dictionary, and had just described a crab as "a small red fish which walks backwards", when Cuvier entered the room. They read the definition to him, and he exclaimed: "Perfect, gentlemen; but if you will give me leave I will make one small observation in natural history. The crab is not a fish, it is not red, and it does not walk backwards. With these exceptions, your definition is excellent."



*Peruvian god of the sea, a crab-like form, is taken from an ancient vase.*

After Dorman—"Origin of Primitive Superstitions".