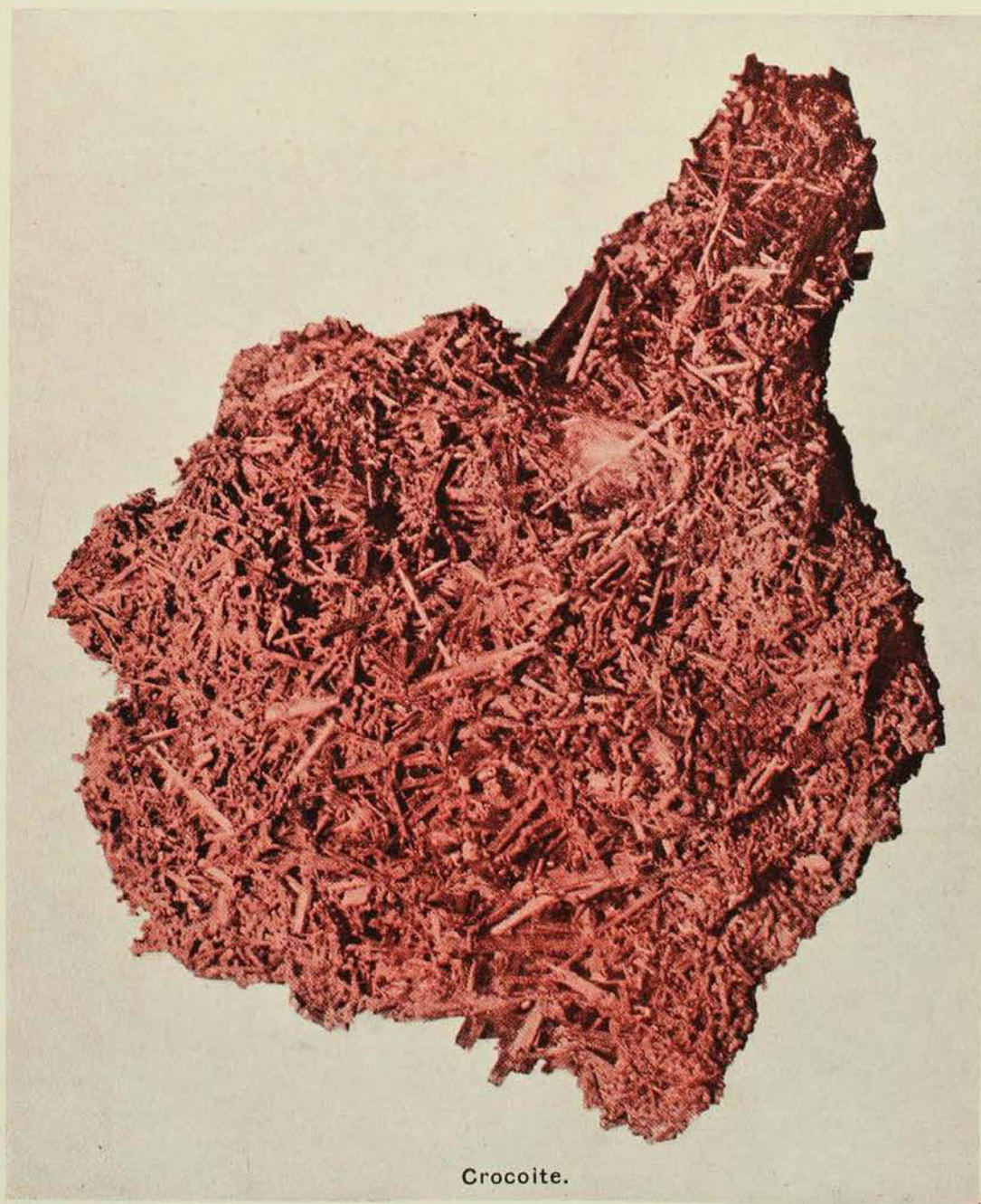


*The*  
AUSTRALIAN  
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MAGAZINE

Vol. IX, No. 5.

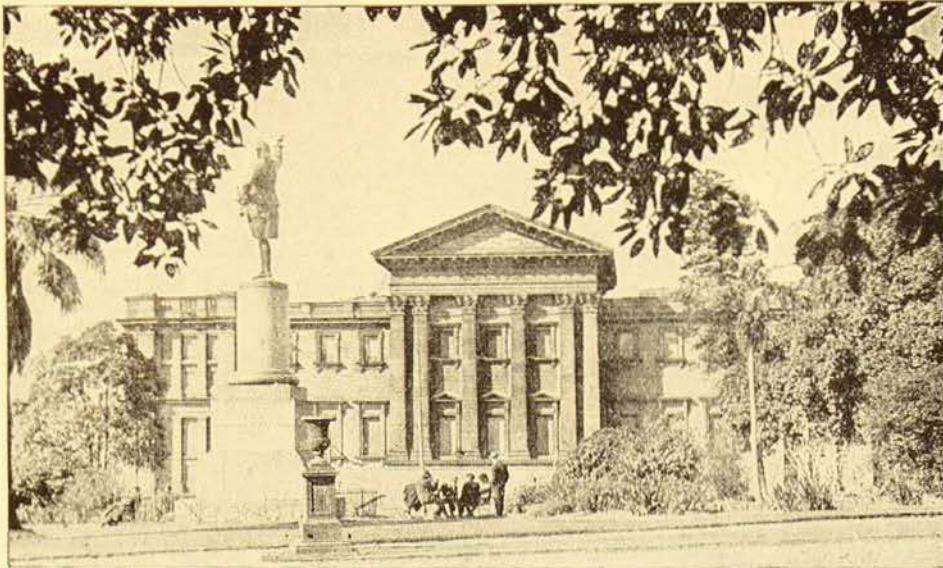
MAY-AUGUST, 1947.

Price—ONE SHILLING.



Crocoite.





# THE AUSTRALIAN MUSEUM MAGAZINE

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

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● OUR FRONT COVER. Crocoite is a rare and beautiful mineral. Prior to 1895 it was known from only a few localities in the world and then in no great abundance. In that year it was found in several localities in western Tasmania, particularly the Adelaide Mine, Dundas. There it occurred in an abundance of perfect crystals and showed great beauty of colour. So outstanding were these qualities, and so far did they surpass all hitherto known material, that even now, long after the supplies have been exhausted, the name Tasmania immediately brings this beautiful mineral to the minds of mineralogists the world over.

The fine Dundas specimen figured here is from the Combe collection (see page 147), which contains some very fine crocoite specimens and notably augments our stocks of this rare mineral.

Photo—Howard Hughes.



**A miniature figure, one-third natural size, of an Australian aboriginal. This is the first of a series prepared for an exhibit to illustrate the races of man in Oceania. The aboriginal is stalking. He is using a spear-thrower, which adds greater power and accuracy to the use of the spear.**



# THE AUSTRALIAN MUSEUM MAGAZINE

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MAY-AUGUST, 1947.

## The A. D. Combe Mineral Collection

A MINERAL collection, large and valuable, has been presented to the Trustees of the Australian Museum by Mr. A. D. Combe, whose generosity is greatly appreciated.

As long ago as 1908 Arthur Combe was a keen mineral collector and as he actually worked in many metalliferous mines in Australia his opportunities for collecting were unparalleled. This in itself would be sufficient to stamp the collection as a unique one, but in addition Mr. Combe has also collected extensively in foreign localities. After a period of working in Australia, when he gained his geological training at the Sydney Technical College, he joined the staff of the Geological Survey of Uganda in 1921 and today holds the position of Senior Geologist.

Most of his furloughs have been spent in collecting minerals in England, Scotland, Switzerland, Italy, Yugo-Slavia, U.S.S.R., Canada, India, Japan, Malaya, Indonesia, and last but not least, in numerous parts of his adopted country, notably the Union of South Africa, Rhodesia, Belgian Congo, Tanganyika, Kenya, and Uganda.

The collection comprises some five hundred specimens and actually is only part of the total number, collected largely by personal effort over the years, so that not all the above mentioned foreign localities are represented. The collection has been stored in the Museum on loan for the last ten years and some of the outstanding

specimens have been on display during this time in the Mineral Gallery.

Space will not permit mention of more than a small fraction of this fine collection. Worthy of note is that a number of the Australian mining fields from which Mr. Combe obtained specimens some thirty years ago have long since ceased working and may never be re-opened. Such are the Tolwong Mine, near Bungonia, Yerranderie and Leadville in New South Wales, and Dundas in Tasmania. Interesting specimens are the rare bournonite (a sulph-antimonide of lead and copper) and fluorite from Tolwong, pyrargyrite (sulph-antimonide of silver) and tetrahedrite (copper sulph-antimonide, usually silver bearing) from Yerranderie. Quite a number of specimens of the rare, but spectacular, crocoite (chromate of lead) from Dundas, Tasmania, form a most welcome addition to the Museum collections; one of these is depicted on the front cover. Mr. Combe was an early visitor to our only two uranium mineral fields, Mount Painter and Olary, both in South Australia. The fine specimens of autunite and torbernite (both hydrous compounds of phosphorus and uranium, the former in addition containing calcium and the latter copper) from the first-mentioned field and carnotite (hydrous compound of potassium, vanadium and uranium) from the other field bear witness to Mr. Combe's energy and perseverance in the days when these



isolated fields were almost inaccessible. It is now common knowledge that after many years of idleness, a new period of development on these two fields began during the war in connection with the atomic bomb project.

Outstanding among the foreign material are specimens from classical English localities, such as barite (barium sulphate) from West Cumberland and the world famous fluorite (calcium fluoride) from Weardale, Durham. Interesting African localities represented in the collection are notably Broken Hill in Northern Rhodesia and Katanga in the Belgian Congo. From the Rhodesian field come those rare and interesting zinc phosphates, hopeite and tarbuttite. Katanga, that remarkably prolific locality, is represented by a range of copper minerals, the carbonate malachite, the silicates diopside and chrysocolla and the chloride atacamite—above all by an outstanding series of uranium minerals which, in addition to the reasonably common uraninite (chief source of the metal) and torbernite, include such rarities as the hydrous uranium silicates soddite, kasolite, sklodowskite and the hydrous lead uranate curite. Mr. Combe

visited Katanga some twenty years ago. Then it was difficult to gain access to the uranium mines and no doubt today it would be almost impossible. For this reason, as well as on account of the rarity of the majority of them, these uranium minerals from the Belgian Congo probably form the most valuable and interesting part of the Combe collection, although confronted with such a wealth and variety of material it is difficult to allot preferences.

Mr. Combe is in Australia once more enjoying a few months' furlough before returning to Uganda. He spent some of the time visiting Western Australia and had not been there very long before a fine specimen of a new mineral from the feldspar quarries at Londonderry, near Coolgardie, arrived at the Museum from him. This is duplexite, a beryllium mineral, and is to be described shortly for the first time by an officer of the Western Australian Government Chemical Laboratories. Apparently the instinct for collecting interesting minerals never leaves one.

This notable collection is a considerable augmentation to that already housed in the Australian Museum.

R.O.C.

Two recent losses to the Board of Trustees were the resignations of Professor Eric Ashby and Dr. G. A. Waterhouse. Professor Ashby has been appointed to the University of Manchester. He had been a trustee since 1940, and his association with the Museum had been marked by an interest in its scientific and educational activities. Dr. Waterhouse has been in ill-health for some time past. His early associations with the Museum were when he was appointed Honorary Entomologist in 1919, shortly afterwards to be elected Honorary Correspondent: these appointments were in recognition of invaluable assistance rendered the Museum. In 1926 he was elected a Trustee, and was President for a period. Some years ago he presented to the institution his valuable collection of Australian butterflies, the finest collection extant.

With profound regret news has been received from Cambridge, Massachusetts, of the death of

Dr. Hubert Lyman Clark on July 31. Dr. Clark was recently awarded by the Royal Society of New South Wales the Clark Memorial Medal for his distinguished work in natural science, the medal having reached his hands a few days prior to his death. He had visited Australia and had endeared himself by a charm of natural grace seldom met. He did much for this continent; his researches on the rich echinoderm fauna placed us under an obligation recognized by the Royal Society in awarding him its highest distinction, not surpassed by any similar honour within the Commonwealth. With this Museum his name is associated with the report on the "Thetis" echinoderms, a paper in the *Records*, and the "Endeavour" report, in which this Museum was actively interested. His magnificent monographs on our Australian echinoderms are perhaps the finest of those issued anywhere. Other important papers of his appeared in the publications of other Australian museums.



## Native Commerce in Oceania\*

By FREDERICK D. McCARTHY

With the Melanesians of New Guinea and neighbouring islands of the western Pacific, in contrast to the comparatively highly civilized Indonesians, we find trade on a somewhat different basis because it has not reached the purely commercial phase associated with buying and selling. Their simplest mode of commerce is direct barter, usually at established meeting places where the coastal villagers exchange fish for vegetables and other products with the bush natives. The women carry out most of this work. It is unpopular with the men, although the mountaineers visit distant lowland villagers with stone axe-blades and club-heads. The reason is that the men maintain in many areas a complex system of reciprocal gift exchanges. Large areas of the country, or groups of widely scattered islands, are linked in this manner. Thus in the triangle formed by the Sepik river and the coast adjoining it to the westward, Dr. Mead has reported a gift-exchange system operating along paths inherited by sons from

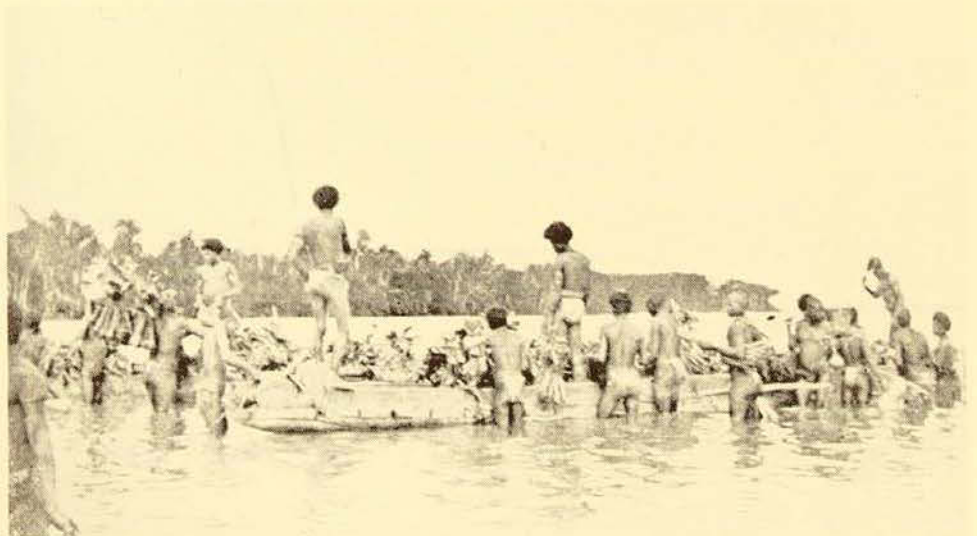
their father or mother's brother. Members of families travel along these paths, and along the roads between hamlets and villages. It is organized so that all adult men of a group have a different route to follow. These paths are sanctuaries along which no one may be attacked and along which food and lodging are available to the possessors. This system extends from the beach natives, who are visited by canoe-men from distant islands, through the mountains to the grasslanders on the high plateau beyond. The mountaineers are the intermediaries, and act as carriers; they produce very little themselves, and are thus able to keep moving the gifts of netted bags, pottery, bows and arrows, shell rings, wooden pillows, tobacco, feathers, pigs and their tusks, dogs and their teeth, sago, salt, and shell-disc currency between the coastal and inland natives. For this service the mountaineers are repaid with gifts.

There are, too, many canoe-trading circuits, two of the best known being the Hiri and the Kula. In the Hiri, the Koita and Motu villagers of Port Moresby

\* Concluded from page 120 of Vol. IX, No. 4.

The bartering of fish by coastal villagers for vegetables and fruits from inland people is a universal custom amongst the Melanesians of the Western Pacific. These natives are exchanging fish for taro in the Trobriand Islands.

(After Malinowski.)





take clay pots and shell ornaments 200 miles to the natives living in the vast swampy bushlands of the Purari Delta in the Papuan Gulf, where they get canoe hulls and sago. Each man sets out the pots made by his womenfolk, the buyers make their selection, and each man keeps a tally stick for the payment in sago. The men exchange the ornaments with their own trading partners. The Kula system of the Massim people in the wide-spread islands of south-east Papua is perhaps more highly organized than elsewhere among the sea traders. Here, island dwellers like those of Tubetube act as intermediaries in the transfer of fine armshells, shell pendants and belts, canoes, boars' tusk pendants, wooden bowls, lime spoons and mortars, baskets, skirts, and other articles from the northern to the southern islands where pottery, axe and adze blades are produced. The shell arm-bands circulate one way through the ring of islands, and the shell pendants in the opposite direction, from partner to partner, each of whom tries to give better value than he received. Each of the fine specimens, including those among the adze-blades, is named, and its possession is esteemed because of

its genealogy, its connection with the past, and as an insignia of rank, wealth and prestige. Side by side with this ceremonial gift-exchange is carried on the bartering of essential goods which enables communities on small islands to secure the necessities and luxuries of life.

We have hitherto considered peoples living in settled villages, but as a further contrast let us glance at the Australian aborigines. They have a limited range of possessions, and they carry weapons, stone, bone and shell implements, baskets of twine, ornaments and a few other things. Each of the local groups or hordes of an Australian tribe barter with its neighbours and also receives articles from far distant localities. The impulse for such trade springs from a number of causes, including the occurrence of raw materials in confined localities, particularly in places sanctioned by the spiritual ancestors, the production of very fine weapons by a talented craftsman to whose skill is usually added a magical potency, and the desire for social intercourse.

The local barter among the Australian aborigines is principally an exchange of ochres, weapons, baskets and wooden



Preparing for the Hiri Voyage. The pots being loaded into the canoe in the foreground are to be transferred to the Lakatoi nearby. The graceful set of the crab-claw sails adds a picturesque beauty to the ruggedness of the massive craft.  
After Lindt.

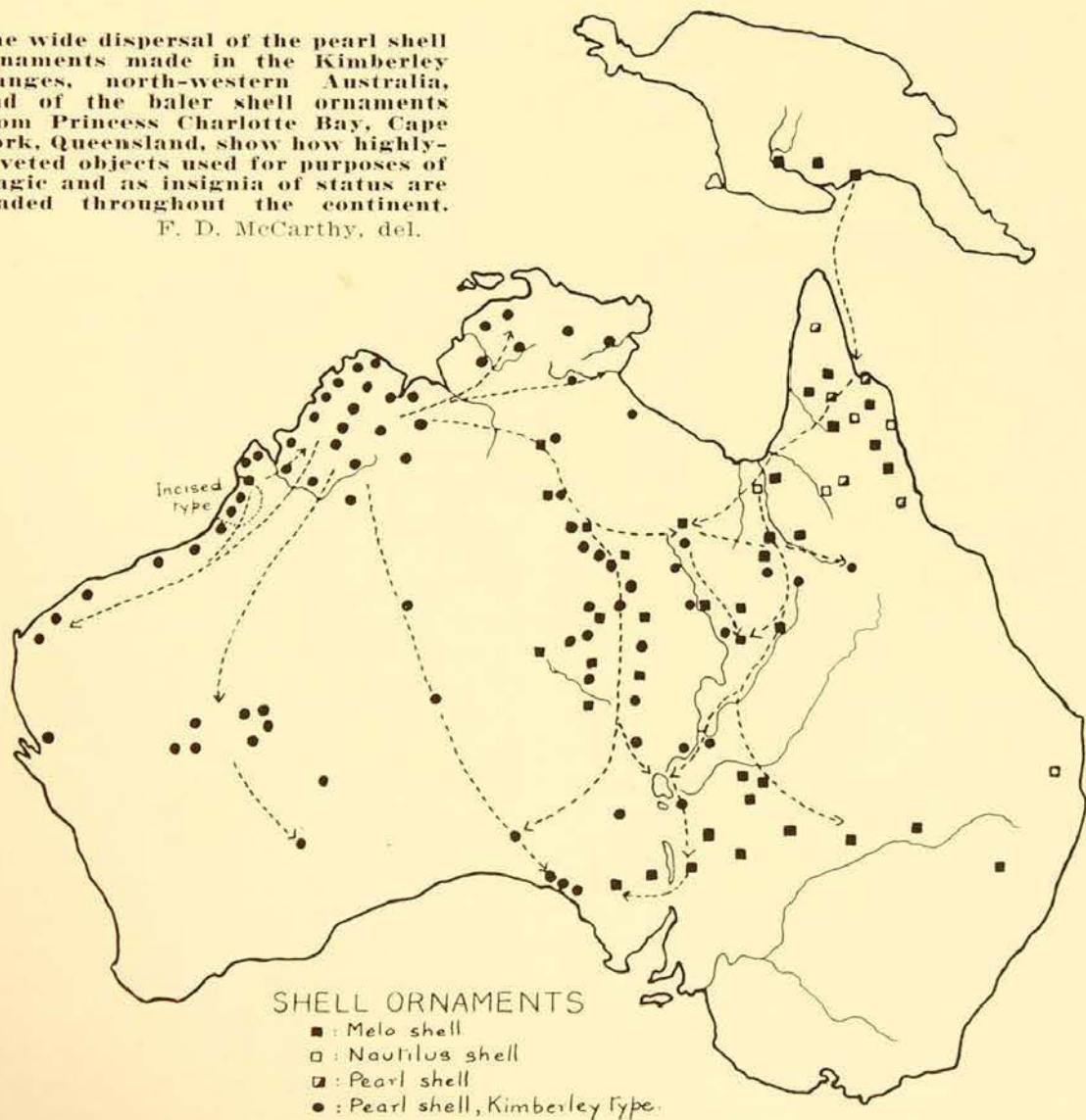


containers, stone implements, mammal hair for twine, feathers and ornaments, gum, and other articles. There are, however, a number of objects which are transported vast distances across the continent. Thus fluted boomerangs made in the Northern Territory are bartered to the Kimberleys, Arnhem Land and central Australia, red ochre from Parachilna in the Flinders Ranges, South Australia, reached all places as far north as central Australia, western and central Queensland, and also western New South Wales, and groups of men travelled hundreds of miles to the quarry. Pitjuri, chewed as a narcotic, grows at the head of the Mulligan river in western Queensland, and was traded on all sides in bags as far as central Australia, north and

eastern Queensland, and the Flinders Ranges. The Molonglo corroboree almost encircled the continent in its travels from the Darwin district. These much sought after things pass along trunk routes which work only sectionally, from tribe to tribe. The north to south routes extend from Cape York down the east coast, or through central and western Queensland to Lake Eyre; from southern Queensland down the Darling river to south-east South Australia; from the Kimberleys and Arnhem Land through the Central Australian tribes; from the Kimberleys to Eyre's Peninsula, or through Western Australia to Eucla, and down the north-western coast. Important east to west routes link them into a continental pattern.

The wide dispersal of the pearl shell ornaments made in the Kimberley Ranges, north-western Australia, and of the baler shell ornaments from Princess Charlotte Bay, Cape York, Queensland, show how highly-coveted objects used for purposes of magic and as insignia of status are traded throughout the continent.

F. D. McCarthy, del.





To initiate a market, a messenger is sent out, bearing special insignia to ensure his safety, to arrange the meeting, which may be at a ceremony or recognized rendezvous. Each group displays its offering by laying out the pieces in separate piles or in one heap. A warlike demonstration may follow by the dissatisfied group to bring forth a better return. No medium of exchange is used. The process has, however, become a part of the kinship system and is an essential adjunct to betrothal, marriage, initiation, the settling of quarrels, and all large gatherings of natives, chiefly in the form of payment for a service rendered or as a delayed return for a gift. Amongst

the Arnhem Land natives a gift-exchange system existed which was similar to that of the Melanesians.

Barter, gift-exchange and other forms of trade act as a mechanism for the disposal of surplus goods, enable a group to balance its economy and to enrich its daily, social and ritual life. It introduces new ideas into the life of people far away from their discovery. Such exchanges assist in maintaining peace, and place a high value upon personal skill. Moral standards are thus upheld in Oceania, where bad debtors are ostracized, and reciprocity is the ruling principle.

## Australian Insects. XXX

### Coleoptera 7—The Hydrophilidae

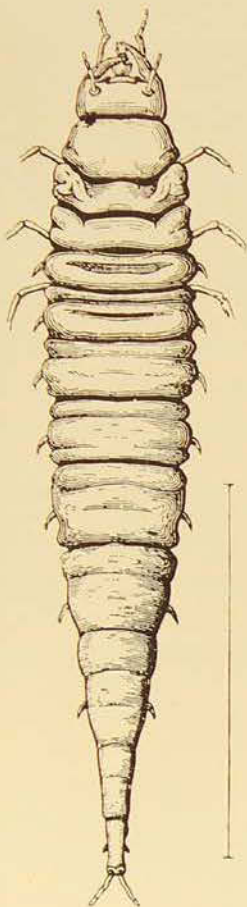
By KEITH C. McKEOWN, F.R.Z.S.

WHILE many of the Hydrophilidae are "water beetles" in the true sense of the term, we cannot broadly class the whole family as aquatic, since a large percentage of them are wholly dwellers on land, living in damp places or the fresh dung of animals. The name Hydrophilidae—"water-lovers"—is not a really satisfactory one for this reason. In form some members of the group closely resemble the true Water Beetles—the Dytiscidae, which were discussed in an earlier article of this series—but it is impossible to give a general description which would cover all forms, for there is a wide diversity among them. The palpi are exceptionally long in a number of the aquatic species, and perform the function of antennae, to advise what is going on in the world around them. The antennae themselves are short and end in a pubescent club; their chief purpose is to assist in obtaining the air supply necessary in their under-water life in a manner which will be described in due course. The middle and hind pairs of legs are considerably modified

to serve as oars to propel them through the water. In form these aquatic Hydrophilidae are markedly convex above, and in some genera they are strongly keeled beneath, the keel ending in an elongated and sharply-pointed process projecting over the basal abdominal segments from the sternum.

Like the adult Dytiscid beetle, Hydrophilids, descending from the surface film of the water, carry with them a store of fresh air held within the cavity enclosed beneath the elytra, but in addition a film of air is carried upon hairy tracts on the under surface of thorax and abdomen. On either side of these sections of the body lies an elongate area of fine pubescence, bounded above by the overhanging edges of the prothorax and elytra. The spiracles—the openings to the interior labyrinth of air tubes—open on this downy tract as well as into the cavity beneath the elytra. When renewing its air supply the body is slightly inclined to one side so as to bring the angle beneath the head and prothorax, on one side of the body, to the surface. The





Larva of the European Hydrophilid (*Hydrous piceus*).  
After Myall.

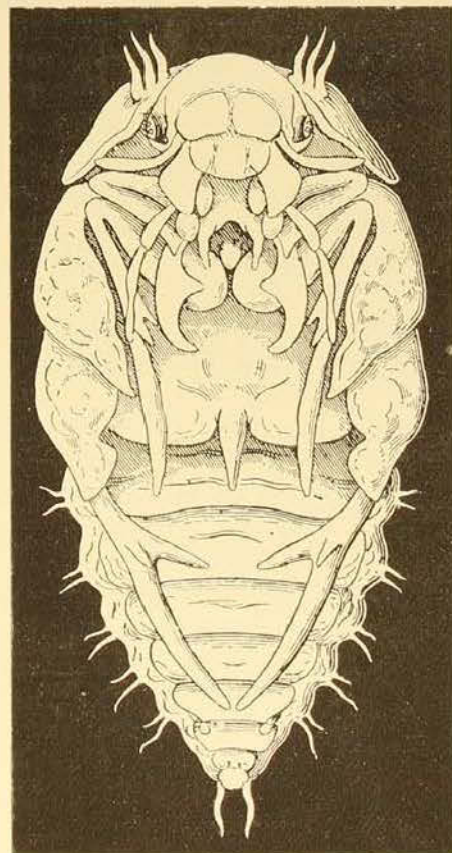
predaceous. This diversity of diet is in contrast to the strictly predaceous Dytiscids and their larvae.

The family is well represented in Australia, some one hundred and fifteen species having been described. The majority of them are small and inconspicuous, and attract little attention. In none of the Australian species, so far as I am aware, has the life-history been worked out, and the habits are only broadly known; of the terrestrial species we seem to know even less. Life-history details are desirable for all our Hydrophilids.

The eggs of some of the Hydrophilids of essentially aquatic habit are enclosed in a remarkable silken cocoon attached to floating vegetation; others deposit them in a small patch on the leaves and stems, covering them with a coating of silky secretion. The egg cocoon of the European *Hydrous piceus* L. (illustration) was described by Lyonnet many years ago. He tells how, "in the beginning of

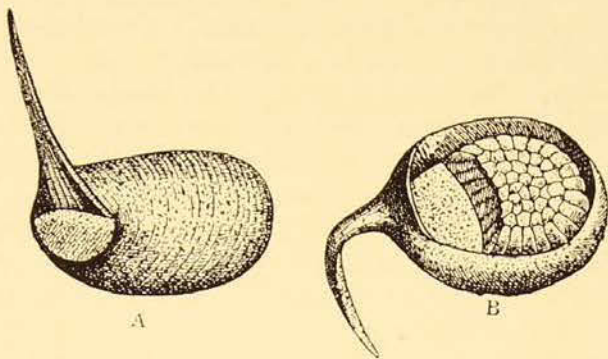
hairy antennae club plays an important part in breaking the surface film and facilitating the entry of air into the cleft already mentioned and its passage to the lateral tracts. The whole process is complicated and difficult to describe in popular language, but I trust I have been able to give some idea of its working. The film of air upon the beetle's body causes it to glisten like silver as it descends from the surface to the mud and weeds at the bottom of the water. The almost horizontal position, head upwards, of the Hydrophilid beetle contrasts strongly with that of the Dytiscid, head downwards and the body at a broad angle to the surface as it allows the air to flow in under the tips of the slightly raised elytra.

The adult Hydrophilid beetles live upon decomposing vegetable matter, varied sometimes, I believe, with animal matter in a similar condition and, possibly, an occasional living member of the smaller insect population. The larvae have similar habits, but some may be entirely



Pupa of *Hydrous piceus*.  
After Myall.



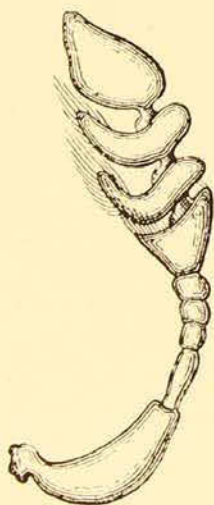


The strange egg-cocoons of *Hydrous piccus*, which are placed among water-weeds. After Myall.

July I had noticed in the ditches a kind of cocoon which I did not recognize. It was whitish, of the size of the end of the finger, nearly spherical but rather oval and flattened. The surface, which looked like tow, was not quite smooth. One of the two ends was flatter than the other, and furnished with a raised rim. From the space within this rim projected a sort of little tapering mast, about as long as the cocoon.

"I opened several of these cocoons, and found in each about a hundred eggs. They were white and oblong, regularly arranged side by side with the points upward, and though provided with a double covering were so transparent that a day or two before they were hatched one could see the animal within. The head appeared bent upon the thorax as in a pupa.

"The larvae, when hatched out, remained one day enclosed in the cocoon



Antenna of *Hydrous piccus*. The antennae of these beetles play an important part in respiration. After Myall.

before escaping. Then they made an oval aperture in the lower part of the flattened end of the cocoon, and escaped through this into the water . . ."

Nothing seems known of the eggs of the Australian terrestrial species.

The larvae of the Hydrophilidae are very diverse in form; those of some, at least, of the aquatic species being smooth, with horny chitinized plates on the thoracic segments and a stoutly armoured head. Others have fringed gills projecting from the abdominal segments. Among the dung feeders the larvae are grub-like, with the limbs absent or with vestiges only of them remaining. The jaws are stouter and not so narrowly sickle-shaped as in the Dytiscids. Illus-



The largest of the Australian Hydrophilid beetles—*Hydrous latipalpus*. Photo Howard Hughes.

trations show the appearance of the larvae and pupa of *Hydrous piccus*. Pupation takes place in a cell formed in the mud or the damp earth of the bank.

The largest and most striking of the Australian members of the family is *Hydrous latipalpus* Lap., closely allied to the European *H. piccus* L., for which we possess the most complete life-history details. It is a shining black beetle, measuring up to and slightly more than one and a half inches in length, and strongly convex above. The illustration gives a good idea of its appearance. It is amongst the most widely distributed



of our species and usually common in streams and waterholes, where it swims much more slowly and lazily than the swiftly moving Dytiscids. Smaller in size—about one inch in length—smoother and with a more olive tint is *H. ruficollis* Bois. with a distribution similar to that of *latipalpus*. *H. albipes* Lap. and *gayndahensis* Macl. are superficially similar to, but smaller than, the other species. The insects included in the genera *Sternolophus*, *Limnoxenus* and *Hydrobiomorpha* are more roundly ovate, more strongly convex dorsally and with a higher “polish”. The largest of them would measure about half an inch long. The commonest species are *Sternolophus marginicollis* Hope, and *Limnoxenus zealandicus* Broun (= *assimilis* Sharp), both with a wide distribution over all Australia. *Hydrobiomorpha helenae* Blkb. and *H. tepperi* Blkb. occur in north-west Australia and central Australia respectively.

The genus *Berosus* is a comparatively large one, with the insects comprising it generally of a brownish colour varied with paler and more yellow shades. Instead of the smooth and glossy surface, such a constant feature in the preceding

genera, these insects have the elytra strongly and longitudinally ridged (costate). All the species are small, the largest being no more than a quarter of an inch long.

Among the species frequenting animal excreta we find a number of forms which have almost certainly been introduced from other lands. All of them are small, and an eighth of an inch would cover the length of the largest of them. The beetles included in the genus *Cercyon* are somewhat roundly ovate and usually glossy. *Cercyon quinquelinus* Linn., and *C. haemorrhoidalis* Fab. are definitely introduced species, and, possibly, *C. nigripes* Marsh. should be included among them.

In the genera *Hydrochus* and *Ochthebius* we find the greatest divergence from the “typical” Hydrophilid form; they are narrow and elongate beetles with the elytra closely and strongly sculptured, producing a dull and roughened appearance. Members of *Spercheus* are only about half the size of those in the two genera above—about one millimetre in length—and bear a strong superficial resemblance to extremely minute Carab beetles.

## Bivalve Shells of a Tidal Flat, II

By JOYCE ALLAN

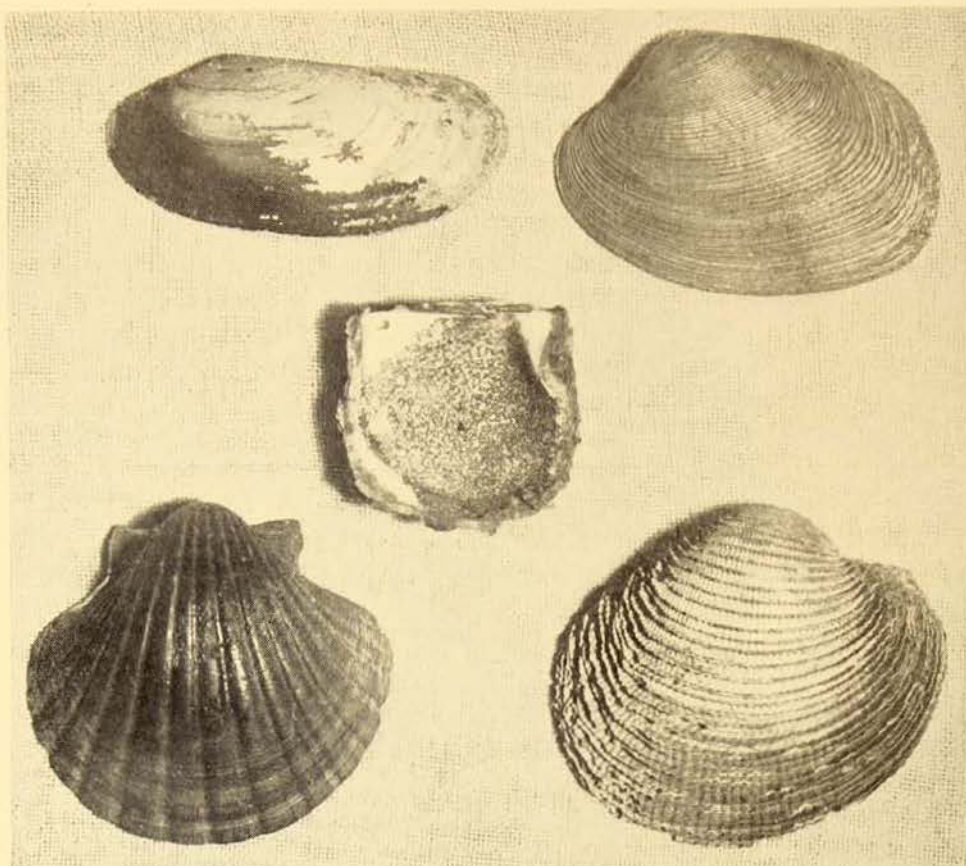
IN the previous number of this MAGAZINE the general appearance of a typical tidal flat was discussed. Reference was made to a few of the molluscan inhabitants and concluded with a note on the habit of a small fish, the Blenny, using the inside of some of the larger bivalves for deposition of its eggs.

Many of the common tidal flat pearl shells have been found at Gunnamatta Bay with one or both valves plastered inside with minute brick-red and orange eggs, some of which can be recognized in

the interior of the small Southern Pearl shell figured in this article.

This particular species of pearl shell lives in beds below low water level, but odd specimens may occasionally come out of their depths for various reasons, and appear in shallow waters. Numbers of empty shells are usually noticeable over the tidal flat at low tide. Some years ago, there was reported a most unusual influx of this small species into shallow water, and washed up on the shore, in the vicinity of the Bunnerong Power





Four types of tidal flat bivalves within which a small fish, the Blenny, frequently deposits its minute eggs. A single valve of the common tidal flat pearl shell (*Pinctada perviridis*) is shown in the centre with a mass of brick-red eggs actually attached to its pearly interior. Above it, on the left and right respectively, are the solid Scoop Shell (*Lutraria rhynchaena*) and the honey-coloured Tapestry Shell, a common inhabitant of the flats and favourite food of the octopus. Below are the Scallop or Fan Shell (*Notovola fumatus*) and Mother Cockle (*Proxichione materna*), a strongly ridged and very solid shell.

House, Botany Bay. The live shells appeared in hundreds and local residents found many of them, when opened, contained small, but rather valueless pearls. The reason for this sudden influx of pearl shell at that time, was thought to be due to the warming of the water in the immediate vicinity of the Power House, by its activities. This warmth, or at least, upset of normal conditions, had brought the shells up from their usual depth, below the low tide level. Sydney is too far south for a pearl shell of marketable value to exist, but it is possible for a pearl of reasonable value to be found in this small species of shell.

Fan shells or Scallops live below low tide. In their early stage of growth, they swim actively but later settle on beds. In Tasmania, several species are collected extensively for food, and an established fishery exists there. Those sold in Sydney fish shops are Tasmanian Scallops.

The Circular Tapestry shell is much admired for the pretty dark brown zigzag markings closely set over its surface, rather like those appearing on the true Tapestry shell, which, however, it in no

way resembles in shape. From an almost central hinge point, the two sides slope out at angles to meet an almost semi-circular shell margin. This shell is rarely found alive on the flats as it lives below the surface towards the low tide level, but empty shells are occasionally found, and it is sometimes noticed in the shell debris round the nest of the octopus.

Much larger bivalve shells live on the tidal flat than frequent the sandy beach. Several of these occur in New South Wales, two of the largest being the Mud Oyster, and the Hammer Oyster.

The Hammer Oyster is one of the most curiously shaped shells in the whole molluscan phylum, and is a constant source of inquiry at the museum. Its resemblance to a hammer is most pronounced at times, and is brought about by the hinge line being expanded into hammer-like projections at each side. The remainder of the shell, the upper portion of which contains the animal, resembles the handle of a hammer. This extraordinary shell lives anchored to sandy mud or other substance by a short byssus, some feet below low tide level, and is



only found, as a rule, when odd valves are washed inshore, or when brought to light by fishermen. It is frequently found round Woy Woy and Gosford, Port Hacking and Pittwater. It has a somewhat similar relative in South Australia and Queensland. Inside, the shell is smooth and creamy buff, the position of the oyster-like animal being indicated by an almost opalescent dark blue area, in which can be seen the muscle scar by which it was attached to the shell. The shell grows to eight or nine inches in length. I have not heard of the animal being eaten at all.

The Mud Oyster is the largest oyster in southern Australia. At one time plentiful in New South Wales, it is now seldom seen in many places where once it was frequently found. In the last year or so, there have appeared signs that it is re-appearing. Its range in the past extended from Leeuwin, along the south coast and up as far as the Clarence River in New South Wales. It was, like many other tidal flat shells, a favourite food of the aborigines. Considerable quantities were once sold in the fish markets of Adelaide and Melbourne, but there is at present no organized interstate marketing of the New South Wales form. It thrives best in South Australia where it is known as the Port Lincoln Oyster.

The Mud Oyster is rarely, if ever, found alive above low-tide level. Unlike the rock oyster, which continues to grow along the surface to which it attaches itself in its early growth stage, the Mud Oyster grows out from its early basal attachment, and owing to its large size, usually becomes detached and falls to the bottom. Should this be firm, it will continue to live and thrive, but if soft mud, it will doubtless be smothered in a short time.

Considerable research work has been undertaken in the past years on the Australian Commercial (rock) oyster, and mud oyster, but even so, investigation work is only in its infancy, and results are not nearly complete. It is assumed that the mud oyster has the same habits as its English relative. It is known that it does not

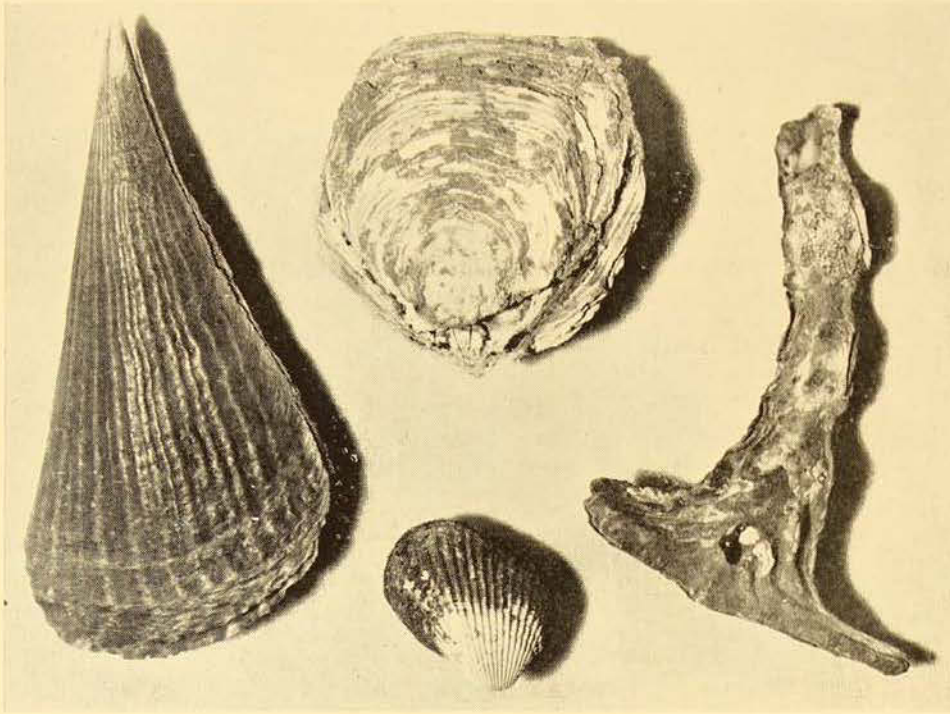
fertilize its eggs in the water, as does the rock oyster here, but after leaving the gonaducts of the parent, the eggs are retained within the mantle, where sperm from other oysters, drawn in with currents of water, effect fertilization. About half its larval life is passed thus, under parental care. In this position the young develop shells, and resemble sand grains. When cast into the water, they measure about approximately 1/150th of an inch long, and at once begin to swim about. From then on, their development is similar to that of the rock oyster at the same stage of growth, and like its larvae, they must rapidly attach themselves to some object in the water, and in a favourable environment, otherwise they will perish.

The rock, or Commercial, oyster is not present on the tidal flat, unless attached to small rocks. It is, however, found on the rocks lining the shores of the tidal flat, and is prevalent in the mangrove regions, where masses of them are noticed attached to the roots and trunks of the mangroves; it thrives in estuarine waters. The rock oyster can live out of the water for upwards of two or three weeks, but the mud oyster succumbs after a few days after its removal.

One of the few reasons to watch your step when walking on the tidal flat, or wading through the shallow water between mid and low tide, is the presence of the Pen or Razor shell. The wide, sharp edges of the valves are at the surface, and when walking over it one may receive a very nasty cut from the razor-like edge. This long, dark brown, very brittle and triangular-shaped shell sinks down into the sandy mud and becomes attached to anything solid by a silky byssus—the same type of silky byssus from which, in the Mediterranean in olden days was woven fine, silken articles. The common form found round Sydney grows to almost a foot in length. This is a shell which for some years will be quite common on the tidal flats, and will then become rare for a period.

The Chinamen's Finger Nail, or Finger shell, is sometimes known as the Razor





Large bivalve shells of a tidal flat. On the left is the sharp-edged Pen or Razor Shell (*Subitopinna menkei*) and on the left, the large Hammer Oyster (*Mallius novelesianus*). The Mud Oyster (*Ostrea angasi*) is shown in the upper centre and below it the commonest shell of many tidal flats, the Sydney Cockle (*Andara trapezia*).

shell in Australia, the popular name abroad. This mollusc prefers the sandy environment of the tidal flat, and thrives on sandy, almost semi-ocean, beaches, at the entrance to harbours, where they are subject to ocean influence. This was referred to in a previous article in this MAGAZINE, dealing with bivalve shells of a sandy ocean beach. When the Finger shells do occur on a tidal flat it is usually on banks at the low-tide level, where they burrow in colonies down to about eighteen inches below the surface of the flat. A broad, expanded foot protrudes posteriorly between the two elongated, gaping valves. In burrowing, the foot is extended to a position, and the shell is then drawn by muscular action to that position. By a series of such contractions, the mollusc burrows to its required depth below the surface. On the surface a hole indicates its presence below, and jets of water can be seen issuing periodically from this hole. These have come from the siphons of the mollusc. These molluscs make excellent bait for black bream, and when the tide is out, fishermen collect quantities for this purpose.

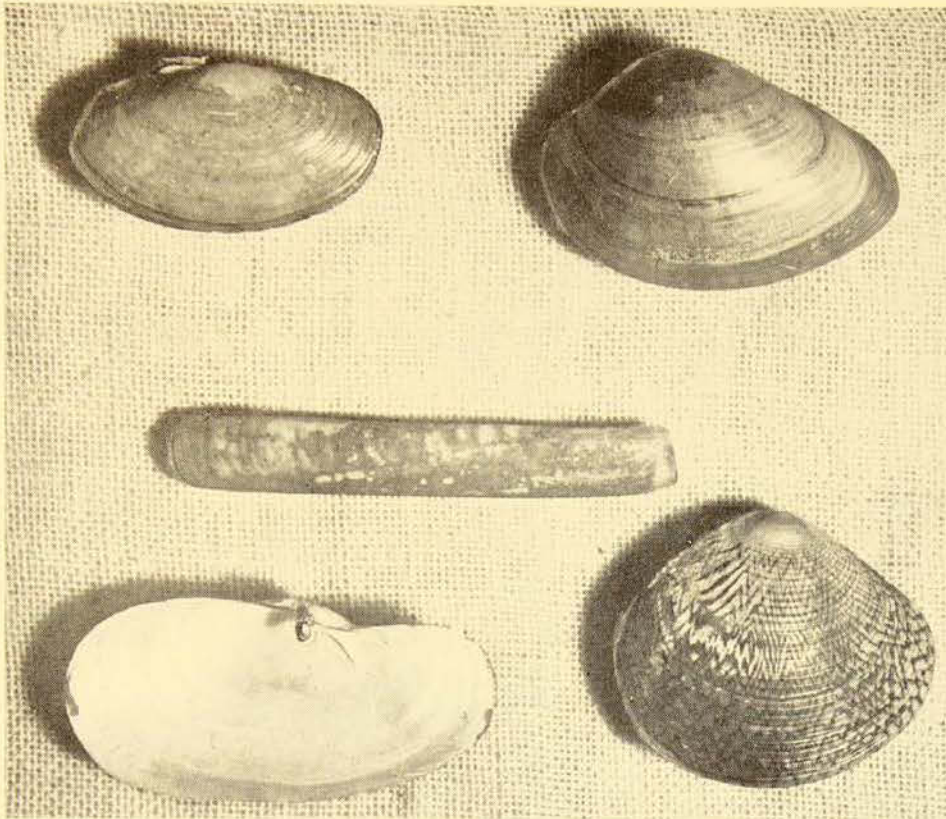
A larger, stronger and broader form of Finger shell, at times a rich orange-pink colour, is found in northern Australia.

In southern Australia, a form very similar to that of New South Wales occurs.

Odd valves of several smaller kinds of tidal-flat dwellers are found at various tide levels over the flats. Sometimes the complete shell and animal are found, at others only empty shells. The Soft Clam is a very fragile white representative of these smaller shells. The valves gape at the anterior end to enable a large, rounded siphonal tube to protrude and maintain contact with surface water, after it has burrowed. The southern Australian form of this is much broader in comparison. Specimens of a still larger form were brought back from Commonwealth Bay by an Antarctic expedition some years ago when they were collected in twelve fathoms of water.

The Scoop shell has a somewhat similar shape to the Soft Clam, but otherwise it is a very strong shell, with a porcellanous interior, with which its orange-brown outer surface is in marked contrast. It receives its popular name from the fact that, like the Shield shell of the Elephant Snail of the rocky shore, it forms an excellent little sugar or flour scoop. A cup-like structure on the hinge-line of





The well-known Chinaman's Finger Nail (*Solen correctus*) figured in the centre frequents the sandy regions of the tidal flat where it is sought by fishermen for bait. The two shells shown above it are the tidal flat Sunset Shell (*Flavomala biradiata*) and the Tan Tapes (*Aeritopaphia transfusa*). The very fragile Soft Clam (*Laternula creccina*) is on the lower left, and the Circular Tapestry Shell (*Circe sugillata*) on the right.

both the Soft Clam and the Scoop shell helps to distinguish these shells.

The tidal flat Sunset shell, known in southern Australia as the Double-Rayed Sunset shell, and the Tan Tapes are two other prominent bivalves of the flat. The latter shell I have found frequently in a living state on a muddy flat, near a mangrove belt in the upper reaches of Middle Harbour, beyond Roseville Bridge. While the specimens do not seem to be as large as some living nearer the coast, as at Gunnamatta Bay, nevertheless they appear to thrive quite well in this situation.

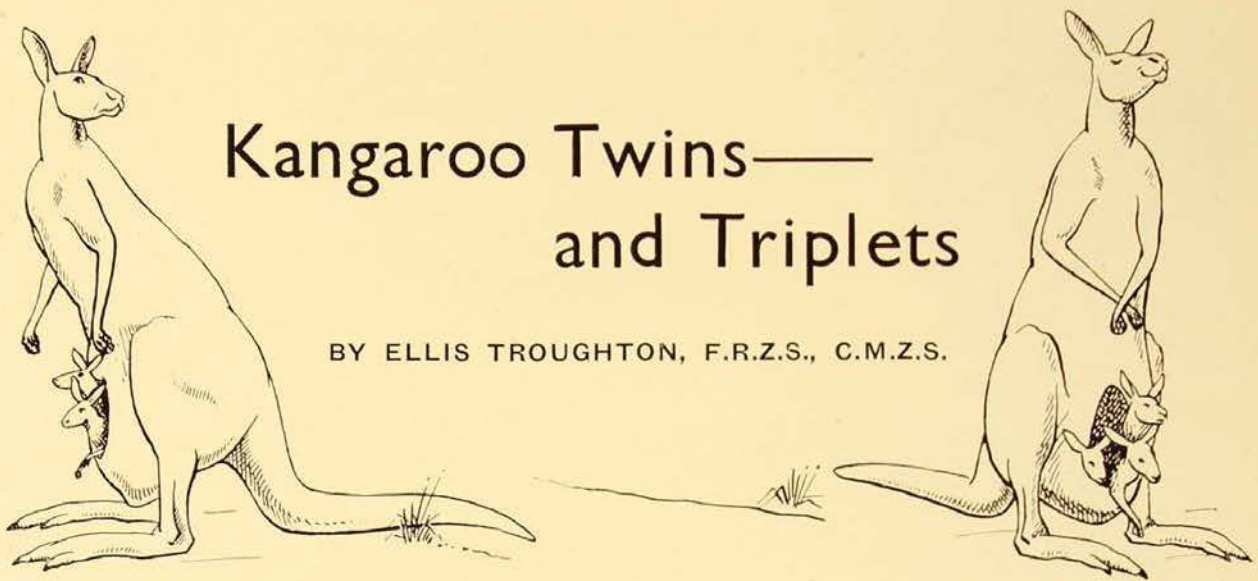
A considerable number of small bivalves will be found on the flat with the characteristic small hole bored in them, the result of attacks from predatory molluscs, such as Sand Snails. Also a large number of small bivalves will be washed on to the flat from the sandy beaches in the vicinity

of the tidal flat, and should not be confused with its true living bivalves.

The most satisfactory way to collect on a tidal flat is to commence an hour or so before the time of dead low tide. By commencing at high tide level, and working in the wake of the tide as it goes out a collector gains a good knowledge of the marine life generally, which lives at various tide level heights. He, or she, can work systematically over the various zones and can study any interdependence noticeable amongst the animal and plant life. Working in this manner, a considerable amount of retracing of areas can be avoided. With the turn of the tide, however, it is advisable to commence working back again without delay, always keeping ahead of the water. It is inadvisable for a collector to remain in the deeper water of an incoming tide in estuarine areas.

(Concluded.)





## Kangaroo Twins— and Triplets

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

G.B.

**I**N spite of quaint legends of the Red Indians about the birth of the American Opossum, it was discovered soon after settlement that the young of this most prolific marsupial were actually born after the manner of all mammals. But long after the anatomical facts became known to scientists of the day, there was prolonged disagreement upon the actual method of transference of the tiny young to the teats, within the pouch.

It was generally concluded that the mother, with lips or paws, was entirely responsible for this remarkable act of juvenile commutation. However, as early as 1806, Professor B. S. Barton of Philadelphia had recorded in a scientific pamphlet his observations that the newly-born young of the American Opossum actually travelled unaided to the pouch and attached themselves to the teats. The original observation, overlooked or discredited for almost a century, was absolutely confirmed by Dr. Carl Hartman of the University of Texas in the *Anatomical Record* for 1920.

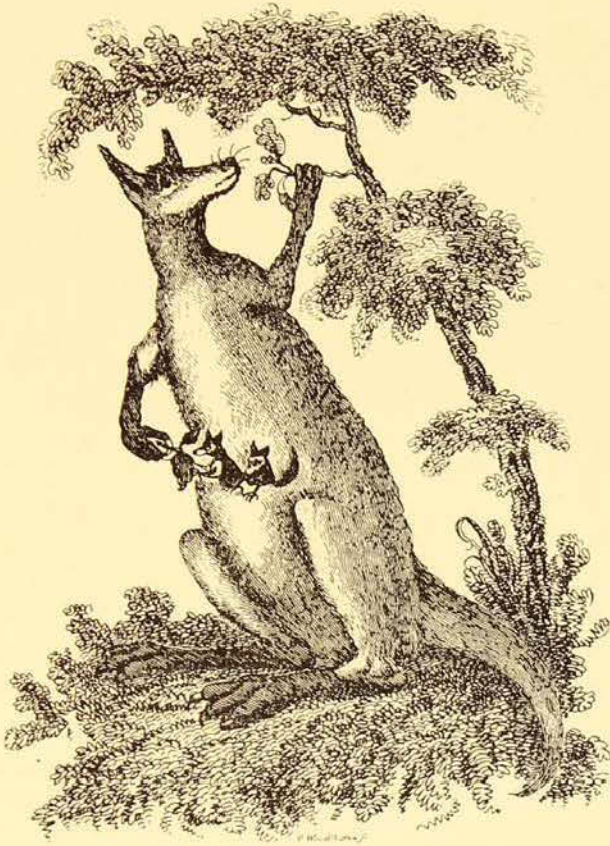
When her young were born, insulated from disturbing sounds in a window-cage, the mother was in a sitting position. Unerringly, the embryos were observed to travel with a kind of overarm swimming action, clutching their way through the mother's fur upwards to the pouch. When a teat was touched the embryo stopped and at once took hold and one wanderer,

missing out in the first scramble, attached itself after twenty minutes' delay, showing that the instinct both to travel upwards and to grasp a teat persists for some time.

Subsequent examination of the pouch showed eighteen squirming embryos, of which twelve were attached, though thirteen could have been accommodated. The remainder were, of course, doomed to infantile starvation, and some of these unfortunates were observed clinging by their mouths to the minute tip of another's tail, or to a flap of skin. In the far greater variety of Australian marsupials, doubtless due to their general dominance throughout age-old isolation, such multiple births tend to be the exception rather than the natural rule.

A normal maximum of twelve teats occurs in a genus of pouched-mice (*Antechinus*), while in some larger relatives in their family, which most nearly resemble the American opossums, our spotted native or pouched "cats", there are only six teats, although they are known to give birth to as many as twenty-four young at the one time. The number of teats tends to be less in our larger herbivorous marsupials, as the maximum of six is attained in the pigmy or "dormouse" possums, while the koala, wombat, and the large possums are limited to two teats, although an excess of three young has been recorded for a ring-tail possum birth.





This quaint engraving is from "The History of New South Wales" originally published in 1802 as "The Voyage" to that colony, and mainly credited to the actor-adventurer George Barrington. The work does not refer to the "double-event", but the author evidently thought that "the oblong pouch, of vast depth" was a suitable nursery for several young.

#### Kangaroo Birth—Early Records

In Australia, however, popular interest in marsupial birth has generally concentrated upon the largest members of the kangaroo family, which evolved to occupy the place of the foreign grazing mammals, such as deer and cattle, in the natural economy of the long isolated southern continent. As with those large non-marsupial mammals, the birth of twin kangaroos is a rather unusual event and, of course, the relatively much greater disparity in size between the embryo and giant kangaroo caused the interest of the early explorers, and country folk, to centre mainly on the kangaroo family, regarding erroneous theories of pouch-birth.

Contrary to popular belief, members of the kangaroo family were not *first observed* on the eastern shores by Captain Cook's party, at Cooktown in 1770. The

first known account of a small kangaroo was given by the Dutch navigator Pelsart in 1629, when wrecked on Houtman's Abrolhos, off Geraldton, Western Australia. It is interesting to note that this enterprising observer, misled by the relatively minute proportions of the pouch-young, stated that "it seems certain that they grow there out of the nipples of the mammae, from which they draw their food".

Appropriately enough, the first of the several authentic accounts of the unaided transference of newly-born kangaroos to the pouch, referred to the same species, the Tamar or Dama Wallaby (*Thylogale eugenii*) of Western Australia. The observations were recorded by Alexander Collie, Surgeon on H.M. Sloop *Sulphur*, in a letter dated January 26, 1830, to the Secretary of the Zoological Society of London, and published in the Society's *Journal* the same year. The wallabies were taken from Garden Island, off the port now known as Fremantle, when Collie's ship was anchored in Cockburn Sound.

The trained surgeon was naturally not to be side-tracked by those superficial features which have misled most country observers to the present day. Expressing delight at the capture of the small kangaroos with young at the teats within the "sac", Collie referred to having dissected "embryos" from the parent which were either "at, or very near to, the termination of the period of gestation". One of these, he said, was "about the size of the smallest young already mentioned as being in the abdominal sac".

His account also included the following observation by an officer of H.M.S. *Success*, of the actual birth of a young wallaby:

When the foetus was expelled . . . the mother was lying partly on her back, resting against the side of the cage . . . and the very diminutive young, when brought forth, crept among the fur of the mother towards her belly and towards the opening of the abdominal pouch; whilst she, with head turned towards her tender offspring, seemed to watch its progress, which was about as expeditious as that of a snail. After it had made some advance, my informant, unconscious of the remarkable oeconomy of genera-





Twin kangaroos, attached to the teats, in the pouch of a Great-grey or Forester Kangaroo (*Macropus major*); collected by Mr. N. Geary of Offham, southern Queensland. Difference in size of the well-nourished "pouch-embryos" is indicative of the variable nature of pre-natal development in the kangaroo family.

Photo—N. Geary.

tion in this class of Quadrupeds, removed the newly born animal before it had reached its destination, which must have been the mouth of the sac.

Such remarkable observations, appearing only twenty-four years after similar authentic details concerning the American opossum, and more than fifty years before other recorded observations of unaided transference of the newly-born kangaroo, cannot fail to interest lovers of natural history the world over.

#### *Kangaroo Twins—and Triplets*

If marvelling at the very minute size of newly-born marsupials, one should remember that the furry platypus hatches from a very small egg, a fortnight *after* it is laid. Also that the sightless nestling proceeds instinctively to suck up milk exuded from the mother's breast glands, there being no teats at all. But in the more advanced pouched mammals, the embryo is not encased in a leathery kind of shell and is therefore able to absorb a certain amount of nutrition before being born in an active though relatively unformed state.

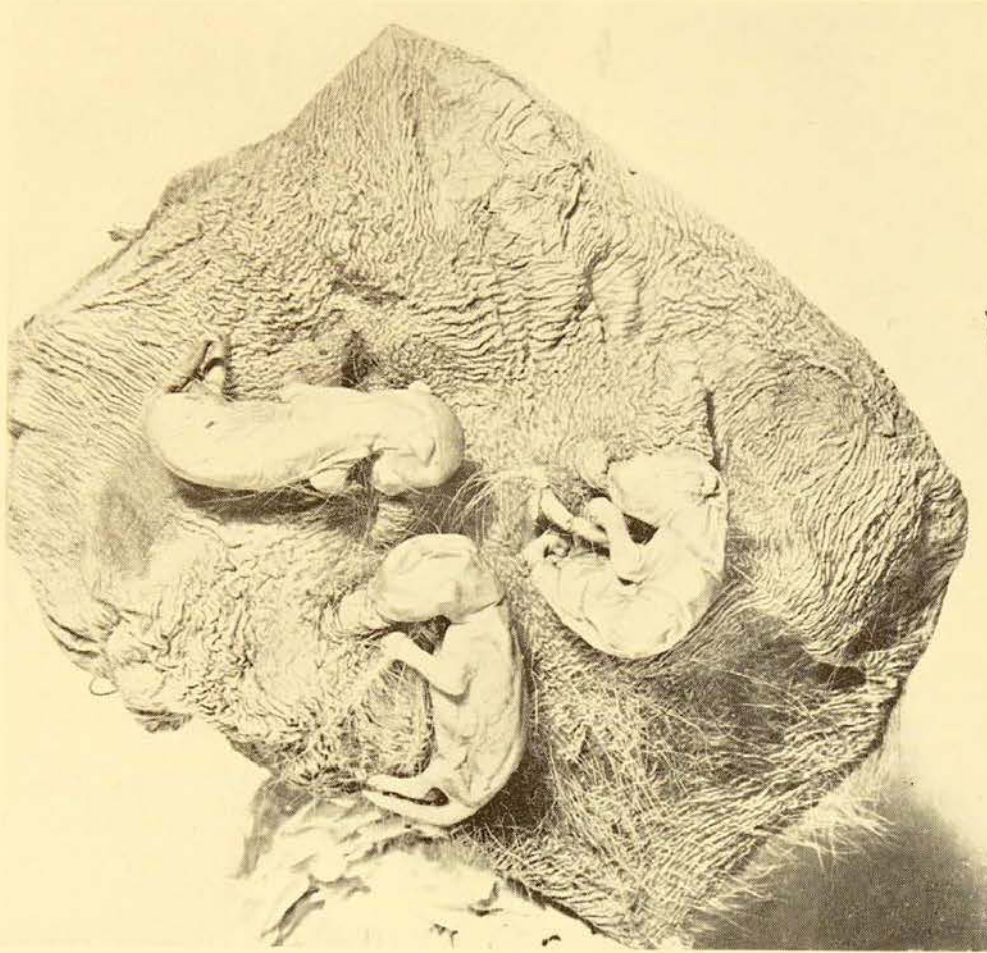
In the "higher" or non-marsupial mammals, however, prolonged sustenance for the unborn is provided by means of the placental or "navel-cord" connexion

with the parental bloodstream, so that birth is at a far more advanced stage. Such pre-natal connexion amongst marsupials becomes fairly complete in the bandicoot family, but is quite rudimentary in the kangaroos, and their embryos are therefore mainly dependent upon the yolk-sac for pre-natal growth, with consequent reduction of the period of gestation, so that the young kangaroo is necessarily born at a remarkably early stage of development.

It may be stated anatomically that it is the primitive arrangement and division of the female generative ducts which has been responsible for the premature birth of all marsupials. It has been responsible likewise for the extremely variable periods of gestation recorded in the larger kangaroos, resulting in the birth of twins of unequal size, and triplets of even development, as shown in the accompanying photographs. In the kangaroo family, the period of gestation, or intra-uterine development, has been quoted as from about one month to thirty-eight days, and as averaging about five weeks.

According to Professor Wood Jones, a Red Kangaroo was actually born about 130 days after the death of the male parent, the embryo at first observation being "not so large as the diameter of a





Part of the pouch of a Red Kangaroo (*Megaleia rufa*) showing triplets attached to the teats. The even development of these pouch embryos provides a unique record of multiple birth in the kangaroo family. The specimen was sent to the Museum by Dr. Arthur Chenery, from Wellington, New South Wales.

Photo—Howard Hughes.

shilling". Of another pair living together in the Philadelphia Zoo, the male died on October 28, 1908, and an embryo was noticed in the pouch of the female seven weeks later; the young one suckling till November 7, 1909. Meanwhile, on September 25, 1909, another, apparently new-born, embryo was noticed in the pouch, the interval in this instance being only three days short of eleven months. Probably the shortest period of marsupial gestation recorded is that of eight days for the American Opossum (*Didelphys*), while a little more than eight days was recorded by Professor J. P. Hill for the Australian Native Cat (*Dasyurus*) from mating to birth.

In view of the evident rarity of twin birth in kangaroos, the present photo of twins of a Great Grey Kangaroo (*Macropus major*) received some time ago from Mr. N. Geary, of Offham, southern Queensland, may be regarded as of special interest. After stating in his letter that

"I am enclosing a photo of a very rare and unique subject, twin young of a kangaroo, of natural size, *in situ* fastened to the nipples", Mr. Geary stated that "they were very healthy young, the smaller one showing no sign of having been stinted of nourishment". The answer to his enquiry "Could it be that one was born about a month before the other?" may be deduced from the details already given concerning the erratic nature of marsupial gestation. The section of pouch with twins attached is preserved in Mr. Melbourne Ward's Gallery of Natural History at Medlow Bath in the Blue Mountains.

Even more rare, and apparently unique, is the occurrence of triplets, as illustrated by the photo of a section of the pouch of a Red Kangaroo (*Megaleia rufa*) from Wentworth, New South Wales, presented to the Museum by Dr. Arthur Chenery some years ago. In this instance, the three young are of comparable size, indi-



cative of a multiple birth at the one time. It is notable that the milk glands at the rear of all four teats are fully activated, while the remaining teat was distended and capable of receiving the fourth infant had such been born.

It remains to be said that limitation of the teats to four in the entire kangaroo family renders the survival of quintuplets anatomically impossible, while the failure of kangaroo shooters to report twins throughout the years of incessant slaughter, shows that the occurrence is extremely rare. The rarity of twins was recently confirmed by a report in the *Sydney Sun* of June 26, 1947, from Perth, that "Two kangaroo-shooters at Walk-away recently shot a doe with a male and female joey in the pouch. Both were well developed. Throughout their long experience as kangaroo-hunters, the shooters have not previously known of twin kangaroo progeny."

Actually, it is the usual thing for the mother 'roo to have a quarter to half grown young one hopping beside her, while the next "joey" occupies the other active teat. It is not a fact, therefore, as recently stated in the press by supporters of prolonged "open seasons", that the "breeding of kangaroos is enormously accelerated by bountiful seasons". The facts are that not more than two young are normally born annually, while Mother Nature has actually imposed an antique form of birth control which leaves these gentle giants of the marsupial world an easy prey to drought and man-made denudation of their native haunts. It may be truly said in their defence that only in much more moderate exploitation and benevolent control, with immediate provision of adequate sanctuaries for their conservation, rests any hope of ultimate survival for the entire family of kangaroos.

## Some Sea Animals that Sting and Bite

By ELIZABETH C. POPE

**N**EW-COMERS to seashore collecting generally show great reluctance to pick up many of the creatures found lurking in crannies or hiding beneath stones. As a rule, anything unknown, or prickly in appearance, or creatures whose colours are brilliant, are suspect. In reality, there are few harmful animals to be encountered by the shore collector along the New South Wales coast and it is quite safe to handle almost all the creatures seen, with a few exceptions discussed here.

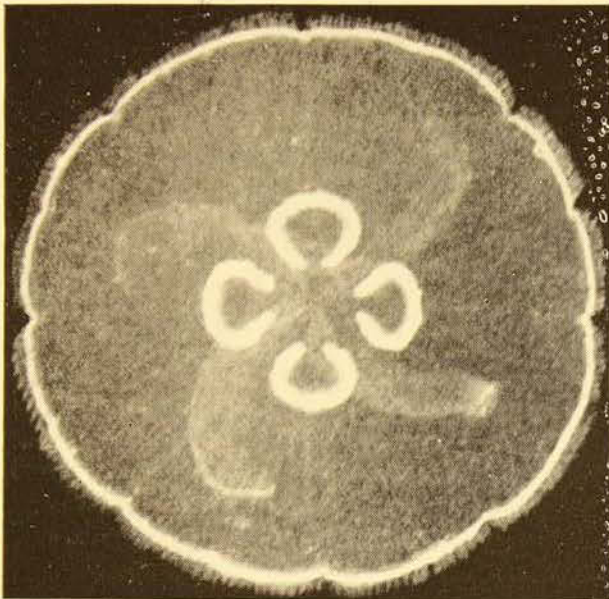
The same thing cannot be claimed for the community of animals which float in the waters just off the beaches or in our harbours and inlets, for a number of the jellyfishes and the floating Portuguese Man-of-War, or Bluebottle as it is called locally, sting quite painfully and are not a little dangerous. When these creatures come within the reach of the shore

collector he must know which ones can be handled with safety.

Sometimes when the wind blows onshore for some time, the Bluebottle (*Physalia utriculus*) whose balloon-like float lies on the surface of the water, cannot help but be blown on to the beaches and rocks. In the latter case, should it lodge in a rock pool its long, trailing tentacles should be avoided and it is unwise to put any part of the body with the skin exposed into the pool. The stinging cells are situated in the long, trailing tentacles\* which hang down below the water line so it is safe to handle the creature by picking it up by the crest on the float. As a precaution hold it to leeward of yourself and your friends for a breeze may blow the tentacles on to

\* The mechanism of the stinging cells has already been described and illustrated in the *Australian Museum Magazine*, Vol. VIII, No. 4, April-June, 1945, p. 130.





*Aurelia* or the Saucer Blubber seems to be one of the few large medusoid jellyfish which can be handled without fear of a sting at all times of the year.

someone and, till thoroughly dead, they are quite capable of inflicting agonizing pain. Even the ones newly stranded on the beaches have to be treated with extreme care. Should you encounter a tentacle unwittingly the most effective way to get rid of it is to rub wet sand over the skin and so remove all the minute stinging cells that are there. A soothing lotion may be used if the pain continues to be severe and the best recipe for it will be found in the handbook published by the Surf Life Saving Society, though funnily enough the surf clubs rarely use it.

In the warmer months of the year visitations of the Bluebottles often drive surfers from the water to avoid being stung. Though this sting is severe, causing local pain, breathing upsets by paralyzing the muscles, and profuse sweating, the only deaths attributed to this creature in New South Wales have been in one or two very young children or in some grown-up with a weak heart. Nevertheless the sting can be very serious and uncomfortable—it is surprising that no bio-chemist has tackled the problem of finding out the nature of the stinging fluid and evolving some specific antidote for it. In a recent issue of *Natural*

*History*, published by The American Museum of Natural History, is an account of their Portuguese Man-of-War (*Physalia*) which had caused frightful stings to two young American servicemen.<sup>1</sup> The interesting thing about their case is that the naval doctor (Dr. M. A. Stuart) who attended them noticed the similarity of their symptoms to those of persons suffering from the bites of the Black Widow spider. He had met with some success by treating spider bites by giving intravenous injections of a solution of calcium gluconate, so he decided to try this same treatment for *Physalia* stings. To one of the two servicemen he gave the normal morphia treatment used for *Physalia* stings and to the other one he gave calcium gluconate and he found a surprising difference in the rate of recovery of the two men. The man given morphia felt a considerable improvement, but did not become entirely well quickly. The fellow treated with the calcium gluconate behaved entirely differently. To quote Dr. Stuart, "The effect was instantaneous and dramatic". His pain was relieved, his cramped chest muscles relaxed, enabling him to breathe freely and he was completely cured in a very short time. It would be interesting to have this treatment tried out at one of our principal beaches next summer.

Occasionally the amateur collector is tempted to handle some of the beautiful jellyfishes which, at certain seasons, are so common in our waters. Some can be handled with impunity—notably the clear saucer-like blubber *Aurelia*, known to the fishing fraternity as the Saucer Blubber, which is so common in some of our swimming baths in the coastal inlets. Other jellyfish should, however, be treated with caution in case they are stingers. The stinging mechanism of these creatures is exactly the same type as that of the Bluebottle.

The large brownish blubber, so common in our harbours and river mouths, is called *Catostylus mosaicus*, or more popularly the Man-of-War, and at certain seasons of the year it can give a terrible

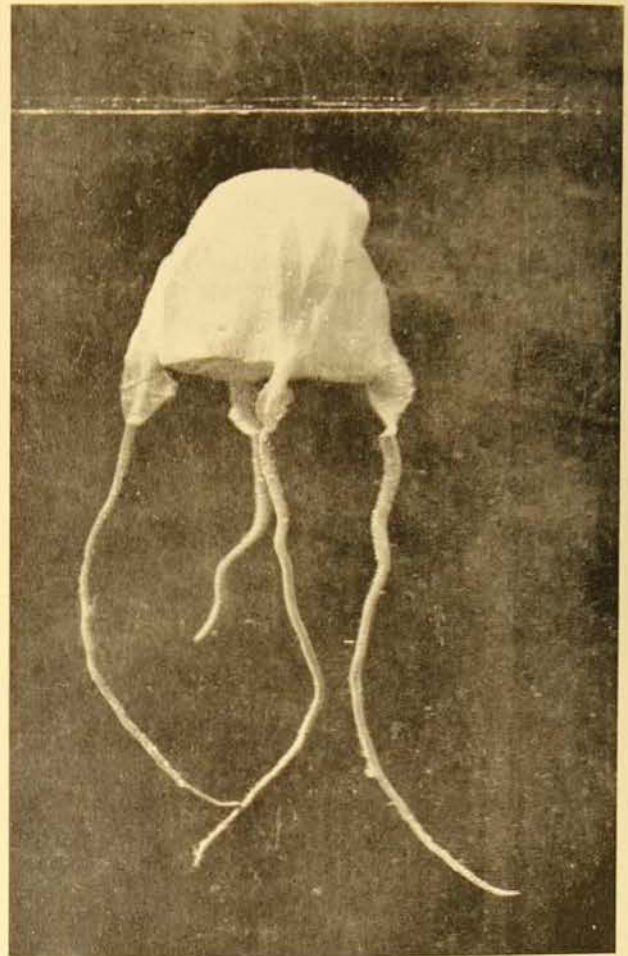
<sup>1</sup> Bernstein —: *Natural History*, Vol. 63, No. 3, March, 1947, p. 136.



sting, causing nauseating pain, so it should always be handled very carefully and then only by the umbrella-part that floats uppermost. In spite of the power of stinging with which the Bluebottle and certain of our jellyfishes are endowed, certain species of small fish can live quite cheerfully among the stinging tentacles and even brush up against them without coming to any harm. On one occasion while collecting jelly blubbers in Sailor's Bay, Middle Harbour, Sydney, I also captured nine small trevally which, when my hand approached, dived into the only shelter they knew—the stinging tentacles of a *Catostylus* and, in consequence, were captured along with it. They could easily have swum away.

One jelly fish with a rather squarish, box-shaped floating bell is a creature to be respected and given a wide berth. Belonging to the group Cubomedusae, known popularly in Europe as the Wasps of the Sea, it has one of the most powerful poisons in its stinging cells. From each corner of the "box" a longish tentacle hangs down, instead of from the middle of the lower surface as in most of our jellyfish and these tentacles may be either simple or much branched. In northern Australian waters this animal is feared as a killer, but in the waters of New South Wales it is only known as a most severe stinger and is not known to have caused any fatalities. A young schoolboy who came hunting jellyfish with me handled a Sea Wasp before I could warn him; he suffered a terrible burning pain where the tentacle touched his arm and had a weal like a burn for some considerable time afterwards. Luckily this type of jellyfish is rarely encountered.

Turning now from the jelly fishes to another group of the animal kingdom, we find in the worms a few kinds which it is wise to treat with care. One of these, known scientifically as *Eurythoe complanata*, is salmon pink in colour and appears to be almost entirely covered with long, bright, whitish bristles. These may break off and stick into the skin and then they cause an itching-burning sensation which continues as long as the bristles

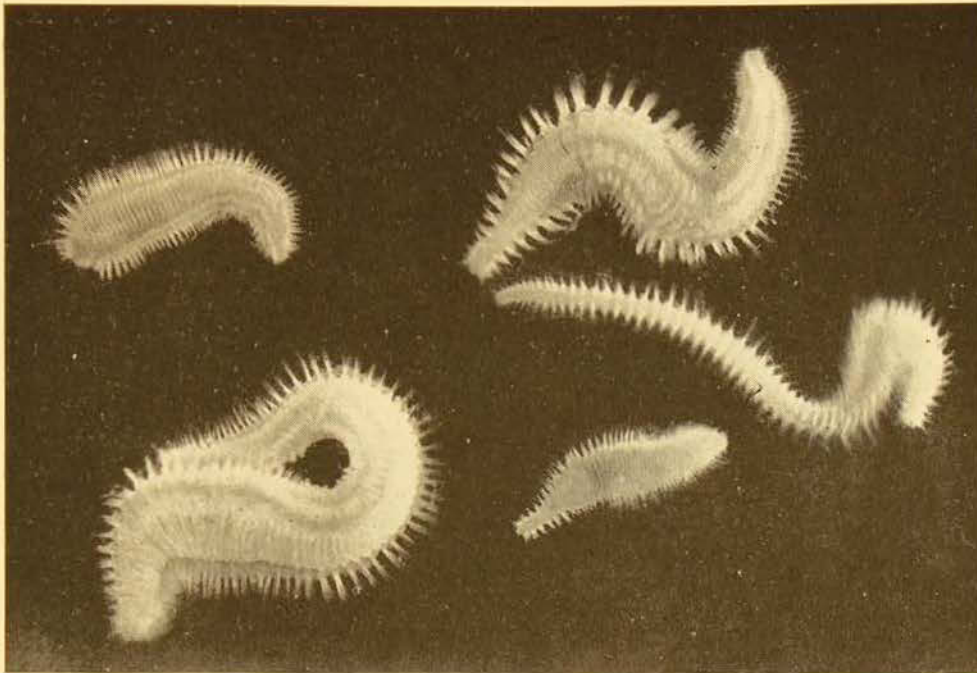


The bell or umbrella is distinctly box-shaped in the Cubomedusae which, because of the pain they inflict, are known as Wasps of the Sea. Tentacles may be simple, as shown here, or multi-branched.

remain there. Best way of removing them is to rub wet sand over the place and so grind them out of the skin. Overseas this same species, which is found throughout tropical seas, is known and dreaded because of its power to irritate.

Another worm to be avoided is the very large Reef Worm, *Eunice aphroditois*. Very large specimens are about an inch wide and five or more feet long. In the head is a battery of powerful jaws which can be extruded through the mouth to inflict quite a severe bite. The colour of this worm is a reddish-brown but on this ground colour there is the most beautiful play of iridescent hues. The worm is usually only seen when rocks are turned over, or when it ventures forth from its crevice in search of food, and a really large one looks more like a snake than a worm. Usually only small specimens are





The segmented worm *Eurythoe complanata* is a delicate salmon pink with many long, sharp bristles arranged in bunches at the sides of each segment. They are extra long and can penetrate the skin and break off. The worms may exceed two to three inches in length.

Photo—Miss G. Burns.

found and they may be handled freely without risk of a bite.

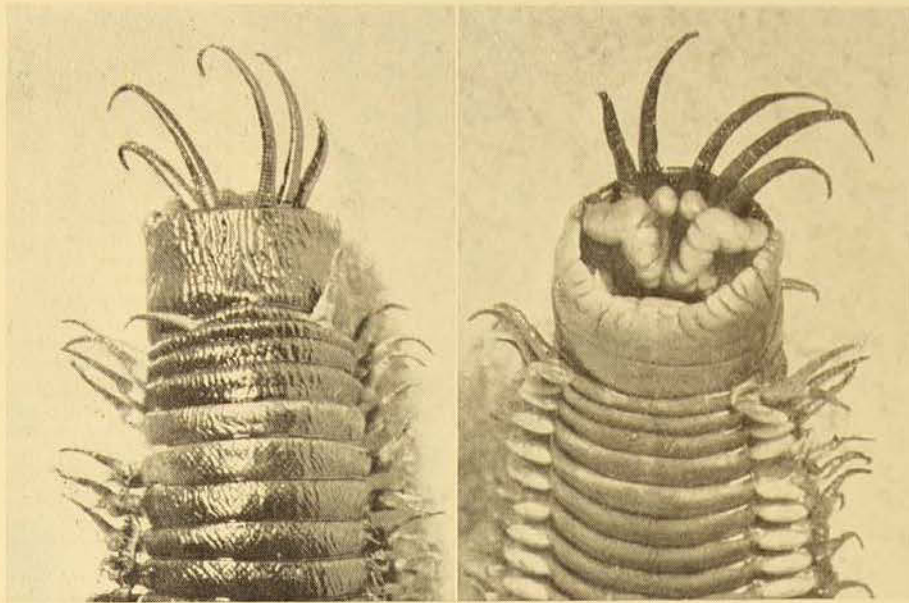
Most people are aware of such stingers and biters as the poisonous Cone Shells, the little Fortescue Fish of the rocky reefs, and the terrible Stonefish of tropical waters, or the dagger-like weapon on the tail of a stingray, so that there is little need to give warning of them; the Electric Ray or Crampfish is also notorious and people know to avoid it. There is, however, another member of the fishy clan for which it is as well to be on the lookout when collecting among rocks. It is the reef eel, *Verdithorax prasinus*. Lurking in holes and niches among the rocks, it is a nasty pugnacious creature that looks for a chance to bite the unsuspecting rambler and it goes out of its way to look for trouble. It is as well, therefore, not to poke an enquiring finger down a hole to see what lives there.

Few people would suspect a barnacle of being able to bite, but the very large species which lives near low water mark on the open coastal rocks can give quite a surprisingly sharp nip to the hand of its molester. *Balanus nigrescens*, as it is called, can pinch a bit of skin between the two pairs of valves which close the orifice of the shell; since the animal is quite large and has powerful muscles it can actually break the skin. Moreover,

one pair of these valves has a sharp little spur on it which can also spike an unwary finger. This barnacle is easy to recognize because it is the largest species found on the coast of New South Wales; it has a peculiarly brilliant cerulean blue patch of tissue which may be seen when the valves are open to allow the barnacle to feed. No other barnacle seems to be able to afflict people with bites and the only harm they can do to one is to cause nasty cuts if one falls on them; these may become septic but this feature is common to many shore inhabitants.

Among the sea urchins we find one, known as the Needle-Spined Urchin (*Centrechinus setosus*), which has to be treated with care. As the name implies the spines are very sharp, long and thin, like darning needles which penetrate the skin and break off. Quite a nasty poisoning results when this happens, in fact almost any sea urchin spine which penetrates the skin and breaks off should be treated with care. Generally the Needle-Spined Urchin is found in tropical waters and it is plentiful on the Great Barrier Reef, but occasional specimens are taken in the northern waters of New South Wales, as for instance at Angourie, near the mouth of the Clarence River, so it is as well to be on the lookout for it.



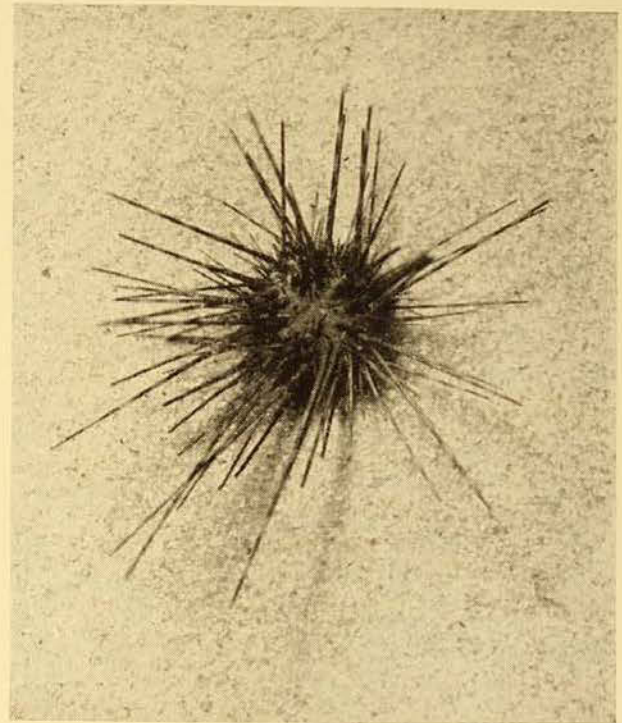


Head of the giant reef-worm, *Eunice aphrodito*, which lurks among rocks on the open coast. Numerous cruel jaws can be extruded through the mouth to bite an unwary finger.

Photo—Howard Hughes.

One of the sea squirts also has peculiar little spicules in its outer coat which can irritate the skin in the same manner as those of the worm *Eurythoe*, but these are only encountered when the animal is cut apart or broken open to get at the flesh. However, the species, *Microcosmus draschii*, is not the common one (the *Cunjevoi*) used for bait and it is not likely to come into the sphere of the amateur collector, for it lives under boulders near low water mark. It is a large form with a generally yellowish body covering and slightly darker yellow-brown markings in places.

The creatures mentioned here are not by any means all those which cause trouble and pain to the marine collector, but they are the ones most frequently met with. However, as their number is not great it is quite easy to remember them. The collector of marine animals can, however, be as safe as a bank if he is reasonably careful and his worst danger is a big wave or something unexpected like that.



A tiny needle-spined urchin from the coast of New South Wales. The fine, sharp spines should be avoided for they can cause painful wounds. The banding of the spines is present only in young specimens.

Photo—Howard Hughes.

In the article "Rhina, the Shark Ray", on page 111 of the last issue of this MAGAZINE, it was stated that this ray "was caught by Mr. Frank Walz in Mr. Charles Wells's fish trap at McEwan's Beach, Mackay". Mr. Walz has advised us that the fish trap was his, not Mr.

Wells's. The inadvertent error is regretted, but we are pleased to make this correction at Mr. Walz's request. At the same time we reaffirm our appreciation of Mr. Wells's action in ensuring that the specimen was made available for this Museum.



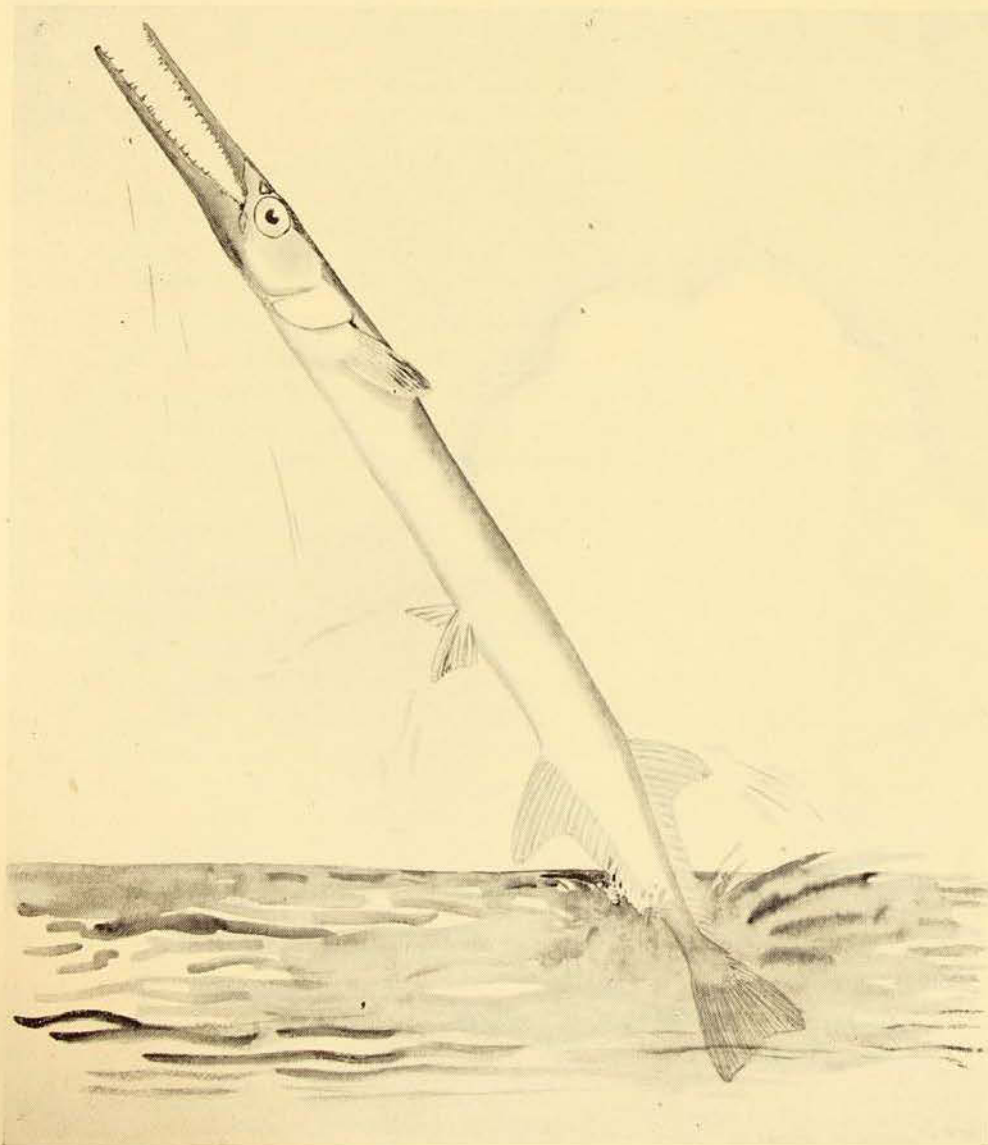
# Long Toms

By GILBERT WHITLEY.

**T**HOUGH sometimes called Garfish by early authors, the Long Toms, subject of this article, are really different fishes, known at times as Needle fishes, Orphies, or even Houndfish, Alligator Gar, and Gar Pike. In our true Garfishes the upper jaw is short and triangular and only the lower jaw forms a "beak", but in the Long Toms, both jaws are long and beak-like and provided with many fine pointed teeth, giving a slightly crocodilian appearance. The general colouring is greenish, with three

thin dark lines down the back as in garfishes; the lower parts are silvery and there is much iridescence.

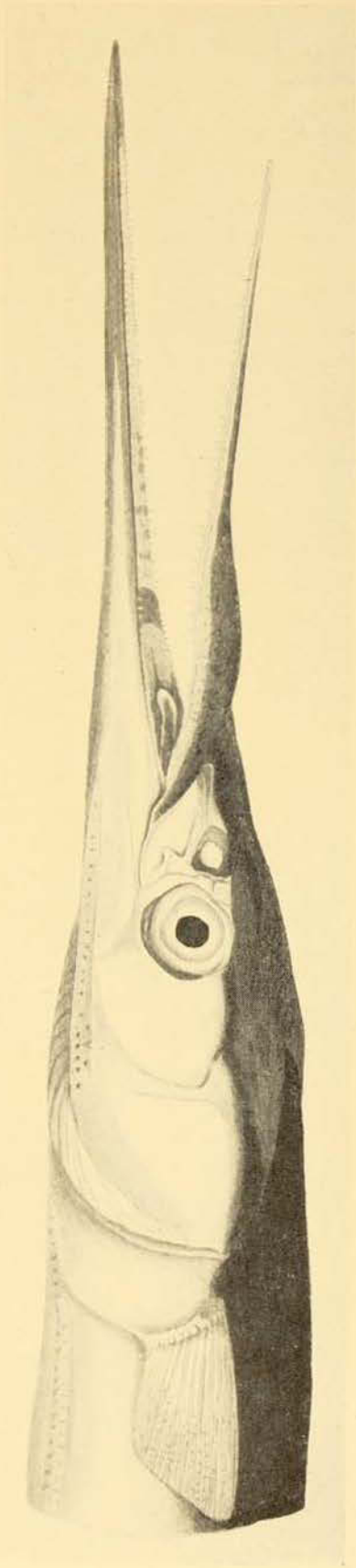
The bodies of Long Toms are covered with small scales. Some kinds enter or reside in fresh water but practically nothing is known of the Australian fluviatile species. The head of one may have been used in the strange concoction named *Ompar spatuloides* (see *Australian Museum Magazine*, vii, 4, March, 1940, p. 139) which made Count Castelnau wonder if we had the counterparts of the



**The Stout Long Tom**  
(*Lhotskia macleayana*) "skittering" at  
the water - surface  
off Hayman Island,  
Queensland.

G. P. Whitley, del.





Open jaws of a Long Tom, showing the numerous teeth. Note also the conspicuous nostril to the left of the eye. From an original painting in the possession of the Linnean Society of New South Wales.

James Stuart, del.

American Garpikes in our rivers. We have not.

Mostly inhabitants of tropical waters, the Long Toms are not found very far away from land and it is pleasant to watch them from a boat as they leap from the water, their greenish snake-like bodies supported by the tail as they "skitter" over the surface, often for surprising distances.

In 1676, Dampier wrote, evidently concerning the Long Toms of the Campeachy region, Mexico:

Garr-fish are round . . . they have long bony Snouts, like the Sword-fish, only as the Sword-fishes Snout is flat, and indented like a Saw on each side; so on the contrary these have their Snouts like a spear, round, smooth and sharp at the end, and about a foot long. These are a sort of floaty or Flying Fish: for they skip along a foot or two above the Water, for the length of twenty or thirty Yards: then they just touch the edge of the Water, and spring forward so much farther, and then touch the Water, and spring forward again, a great many times before they cease. They dart themselves with such a force, that they strike their Snout through the sides of a Cotton-Tree Canoa; and we often fear that they will strike quite through our very Bodies—They are extraordinary sweet Fish.

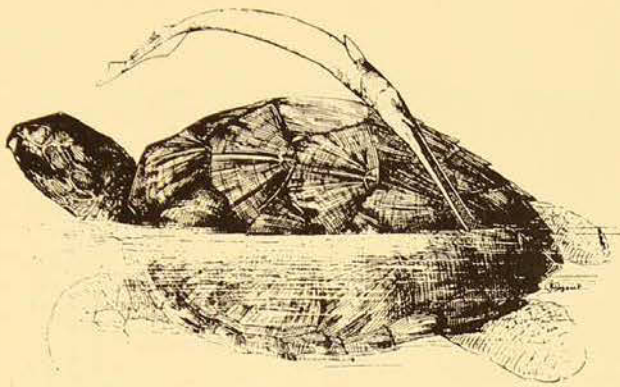
Years later, when he was approaching Western Australia and keeping a sharp lookout for signs of proximity of land, and in particular for the dangerous Abrolhos reefs, Dampier noted, on July 25, 1699,

being in Lat. 26 deg. 14 min. S. and Longitude E. from the C. of G. Hope 85 deg. 52 min. we saw a large Garfish leap 4 times by us, which seemed to be as big as a Porpoise.

Banks seems to have seen similar leaping "garfish" in July, 1770, on Cook's visit to what is now Queensland, and it is from Queensland that another note on the Long Tom's skittering may be quoted, this time from the modern author, Dr. C. M. Yonge (*A Year on the Great Barrier Reef*, 1930, p. 95):

The alligator pike or "long tom" . . . comes out of the water with a rush, its long stout body as stiff as a ramrod and inclined forward at an angle of about 60°, and maintains this position while propelled over the surface of the water at great speed by a series of convulsive movements of the tail. It is rather like a high-speed motor boat.





**A Long Tom playing leapfrog over a sleeping turtle at Tortugas, Florida.**  
From Gudger, after Holder.

with the propeller digging into the water and the bows of the boat high out of it. The long tom can continue in this way for 100 yards or more, and then, quite exhausted, disappears as suddenly as it first appeared.

Long Toms are savage fishes, and the long upper and lower jaws, bristling with needle-sharp teeth, open very wide and can damage the hardened hands of a fisherman, or cause a good deal of trouble when meshed in his nets, the jaws often being broken and having to be removed tediously afterwards. Long Toms are active by night and day, preying on smaller fishes near the surface or over sandy shallows. They grow to about three or four feet in length.

They are themselves very palatable to us, although some people are afraid to eat them because they have green bones. This verdancy is not a sign of poisonous properties, and occurs in the living fish, although some of the old authors thought

is was due to cooking or smoking. The heads and jaws are often found on sea-eagles' nests in the tropics and Long Toms are also preyed upon by sharks.

The Long Tom rarely, if ever, uses its beak as a sword to ram its prey and probably does not use it to stir up the sandy bottom in search of food. All I have seen were evidently aggressive surface-feeders. They may be attracted by bright lights and some European ones have been found to have inserted their snouts in rubber bands in the sea.

Where fish have been killed or disabled by gelignite, Long Toms will soon arrive in shallow water, snaking along like green prehistoric reptiles.

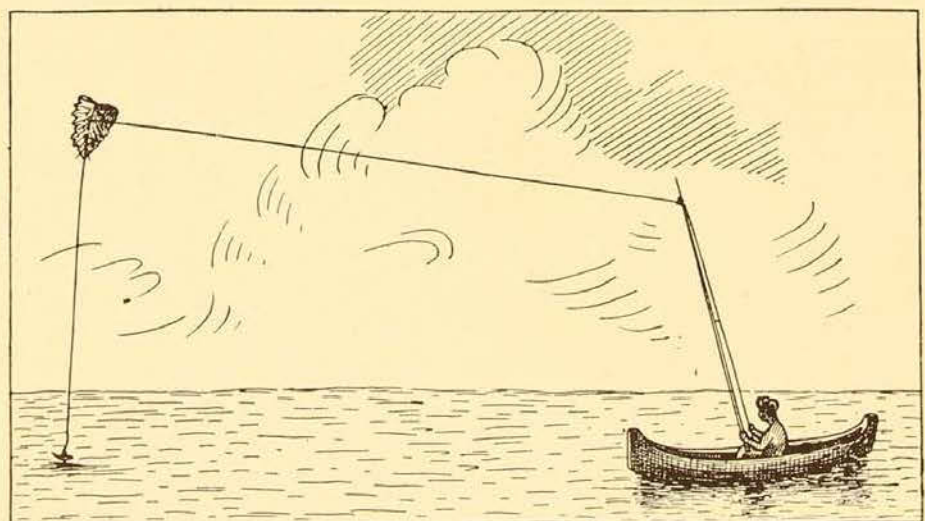
In Samoa, one was observed to leap from the water to seize a charge of dynamite in mid-air. One can only assume that it wasn't a Long Tom much longer!

In an account of the edible fishes of Queensland, Ogilby wrote

They delight in throwing themselves high into the air, and frequently skim along the surface of the water for a considerable distance with marvellous velocity. Such, indeed, is their reckless impetuosity that, in the case of the larger and weightier species, serious accidents, resulting even in death, have been caused to bathers from the impact of the dagger-like beak on the unprotected body.<sup>1</sup> Their partiality for leaping over any

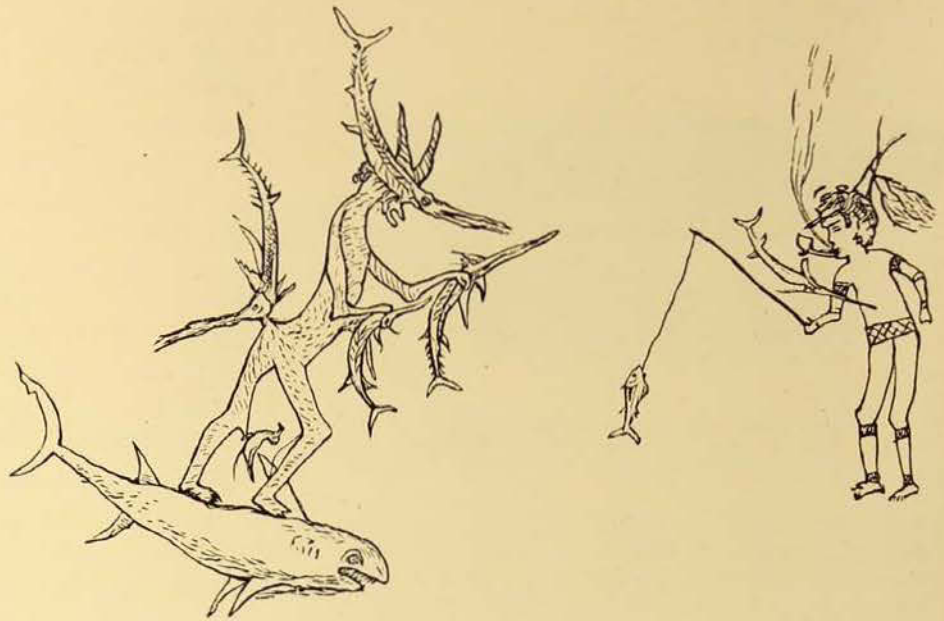
<sup>1</sup> A recent case of a bather having been stabbed in the face by a "garfish" at Scarborough, Western Australia, may enter this category. A surfer diving into a wave felt something violently strike his face: "a garfish had driven its snout through the bridge of his nose, missing his eyes only by a miracle". (*Sun* newspaper, April 2, 1947).

**Native method of fishing with a kite which jigs a surface bait of spider-web in which the Long Toms' teeth become entangled.**  
After Delsman and Hardenberg.





A dreaded Sea Ghost hurling Long Toms as darts at a fisherman. A native drawing from Saa, Solomon Islands. After Codrington.



small floating object, which may attract their attention, is another peculiar habit common to these volatile fishes;<sup>2</sup> in some countries this habit is ingeniously made use of for their capture, by the simple means of a wooden framework, which somewhat loosely supports a piece of fine netting. They may also be taken by hook and line from a moving boat in a strong tideway, so long as the lure, for which any small shining object will suffice, is kept near the surface. All the species are of good quality for the table, and though often rejected because of the greenish colour of their bones, this is natural and has no deleterious significance. The ova, which are large and consequently few in number, float on the surface when first shed; each ovum, however, is provided with several series of silky filaments, and is enabled, by means of these delicately barbed processes, to attach itself to any suitable object. When the little fish emerges from the egg both its jaws are short, but they soon begin to lengthen, and it is a remarkable fact that the lower increases so much more rapidly than the upper that, by the time the fry has attained a length of a couple of inches, it has all the appearance of a hemirhamphid (garfish) nor is it until considerably later in life that the beak assumes the normal adult form.

From his bathysphere, William Beebe reported "Rainbow Gars" of fantastic size and colours at a depth of 2,500 feet off Bermuda, and they have been very dubiously associated with the Needle fish or Long Tom family, Belonidae.

<sup>2</sup> Long Toms have been reliably reported as "playing leapfrog" over floating objects in Floridan waters; they sometimes cavort over sleeping turtles, and may even perform the difficult "somer-sault leapfrog", the ambition of many small schoolboys.

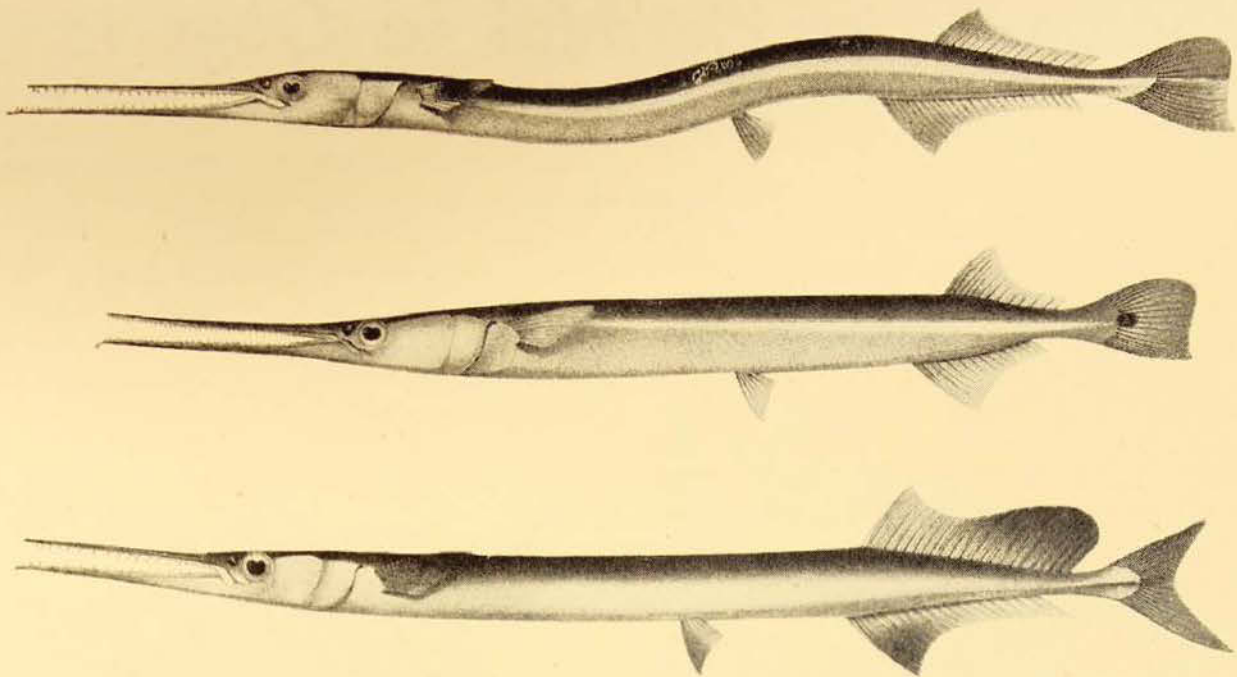
In the Solomon Islands, Long Toms are apparently caught by an ingenious method, for Dr. W. Ivens tells us (*Melanesians of the South-east Solomon Islands*, 1927, p. 386) :

Skipjacks, a large kind of garfish, are trolled for from the shore rocks with a long and flexible bamboo, the web of the silk-spinning spider being used as a bait. The teeth of the fish become fast in the web, which is wound round between two V-shaped ends of a string, knotted in three places. A kite of sago palm is also employed for this purpose, the web is fastened to the tail of the kite, and the fisherman paddles in his canoe against the wind, holding the string of the kite.

A sea spirit called Ngerieru in Solomon Islands' legend used Long Toms as weapons much as Jove employed thunderbolts. Canoe crews were careful not to disturb this deity lest they "be shot by one of his *mwanole*, skipjack, a giant garfish". (Ivens, *loc. cit.*, p. 200, and fig. on p. 201.)

Tropical Australia has about a dozen different species of Long Toms but little is recorded regarding their natural history. The most primitive is the Flat-tailed Long Tom (*Platybelone dorsalis*) which has a very flattened butt to its tail and still retains gill-rakers, which are lost or vestigial in all the others. The pelagic Barred Needle Fish (*Athlennes caeruleofasciatus*) has a very compressed, slab-sided body, adorned with dark bars. The Keel-jawed Long Tom (*Thalassosteus*





Marine Long Toms showing differences in dorsal and tail fins. Top to bottom: Hornpike Long Tom, *Strongylura leiurus*; Black-spot Long Tom, *Strongylura strongylura*; and Choram Long Tom, *Djulongius giganteus*.

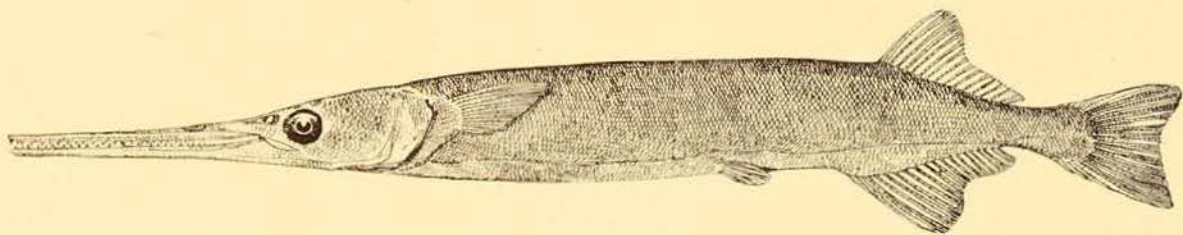
After Bleeker.

*appendiculatus*) has a bony keel below the end of the lower jaw. Other marine species are classified in the genera *Strongylura*, *Lewinichthys*, *Djulongius* and *Lhotskia* according to whether they have rounded or forked tails, and respecting the number of rays in their fins, and the shape and proportions of their heads and bodies.

In the rivers of tropical Australia and southern New Guinea is found the freshwater Long Tom or Fitzroy Garpike

(*Stenocaulus krefftii*), with its ventral fins further back than in its marine allies, which is misnamed "swordfish" by some of the river-folk. In the northern rivers of New Guinea occurs the beautiful *Stenocaulus perornatus* with a strikingly spotted head.

In habits, form, and physiognomy the Long Toms have strayed well away from the usual run of fishes and recall in some respects the savage reptiles which preyed so voraciously in prehistoric seas.



Often miscalled "Swordfish", this Fitzroy Gar-pike or freshwater Long Tom (*Stenocaulus krefftii*) is somewhat similar to a Pike in appearance. Shown here is a small specimen, one-fourth natural size, from the Lillesmere Lagoon, Queensland.

G. P. Whitley, del.



# Some Ticks Harmful to Dogs in Australia

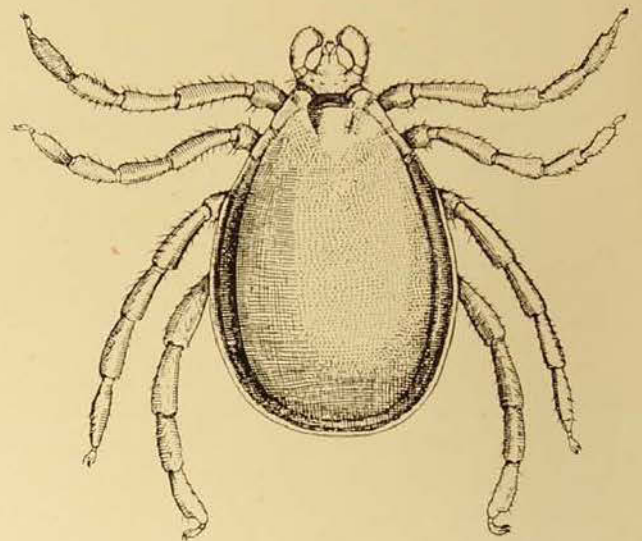
By A. MUSGRAVE

THE small parasitic creatures called "ticks" are, the world over, often the source of intense suffering and even death to man, from the poisonous nature of their bites or from certain diseases they convey. It is among the domestic animals, however, that ticks exact a greater toll and every year, about Sydney, dogs (particularly) and cats succumb from the effects of tick-bite poison (respiratory paralysis).

In a previous article published in this MAGAZINE<sup>1</sup> I dealt with some of the ticks recorded from Australia, but since that time our knowledge has increased through the many articles written in scientific journals. These also compel us to unlearn some of the opinions held about these animals.

The animal responsible for the yearly toll among the local domestic animals, is placed zoologically in the class Arachnida, a large group including the spiders, scorpions, harvestmen and mites. Ticks and mites together form the order Acarina, but the ticks constitute the superfamily Ixodoidea, and the Dog Tick (*Ixodes holocyclus*), which is the chief subject of this article, is included in the family Ixodidae (the hard-bodied ticks). Well-known members of this family are the Cattle Tick (*Boophilus microplus*), a widely-spread pest of cattle, the Kangaroo Tick (*Amblyomma triguttatum*), not to be confused with another "Kangaroo Tick" cited below, the Brown Dog Tick (*Rhipicephalus sanguineus*), common in Queensland, while on snakes and goannas (*Varanus*) we find members of the genus *Aponomma*, though one species may often be met with on the black Passalid beetle, *Aulacocyclus kaupi*. All these Ixodid ticks are readily identified by the hard

scutum or shield situated at the anterior part of the body of the female, or covering the whole body of the male. In front of the scutum is the capitulum or head with the mouth-parts.



The adult male of the Dog Tick (*Ixodes holocyclus*) may measure 3 × 2 mm. The yellowish scutum covers the whole of the body. The male wanders over the body of its host but does not feed.

E. A. King, del.

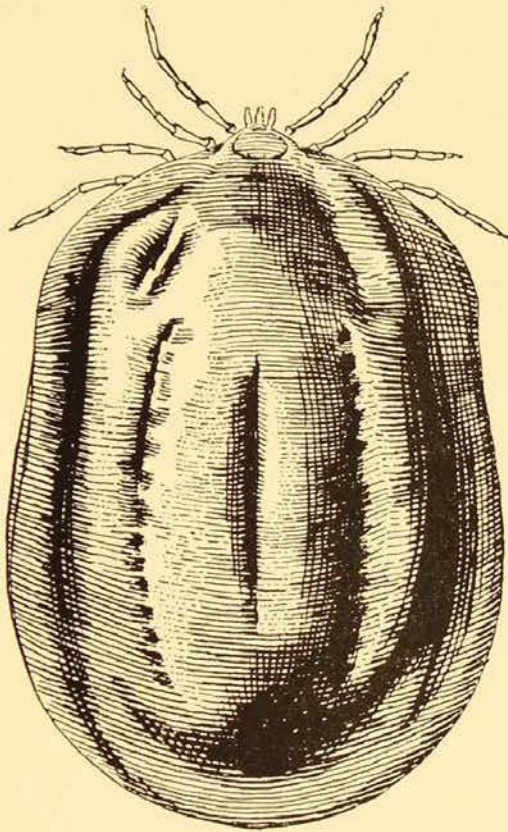
The Fowl Tick (*Argas persicus*), on the other hand, belongs to the family Argasidae (Soft Ticks), in this family the body is leathery and the mouth-parts are hidden from above; there is no shield as in the Ixodidae, and the females when gorged show only a slight dorso-ventral thickening. In the Ixodidae, however, the females when gorged swell enormously, so that the scutum or shield comes to form a small area anteriorly. The Argasidae attack birds, bats and man. The so-called "Kangaroo Tick" (*Ornithodoros gurneyi*) is included in this family. It occurs from south-western New South Wales to north-western Queensland and beyond, and so does not come into areas much frequented by man. Its "bite" is said to cause temporary blindness to man, and intense irritation.

<sup>1</sup> A. Musgrave: Some Australian Ticks, *The Australian Museum Magazine*, Vol. iv (9), Jan.-March, 1932: 316-323, illust.



## THE DOG TICK OF THE SYDNEY DISTRICT

The family Ixodidae contains the chief genera of our ticks and some eleven species are included in the genus *Ixodes*. Of these the best known is the Dog-Tick (*Ixodes holocyclus*), which occurs commonly along a narrow humid coastal belt of eastern Australia, a belt which may not extend more than ten miles in width in some places. Professor I. Clunies Ross has pointed out (1935) that the number of ticks in any year is largely



A "Bottle-tick" or gorged female of the Dog Tick (*Ixodes holocyclus*). Specimen from the author's garden at Gordon, near Sydney. Note the small area occupied by the scutum in relation to the rest of the body.

N. B. Adams, del.

determined by the rainfall in the preceding year; as we proceed inland from the coast the Dog-Tick is rarely met with, except in mountainous country where the rainfall may produce humid conditions. Most of our recent knowledge of this tick we owe to the researches of Dr. Clunies Ross,<sup>2</sup> though Dr. F. H. S.

<sup>2</sup>I. Clunies Ross: The Bionomics of *Ixodes holocyclus* Neumann, with a Redescription of the Adult and Nymphal Stages and a Description of the Larvae. *Parasitology*, xvi (4) Dec., 1924: 365-381, pl. v; 2 fts.

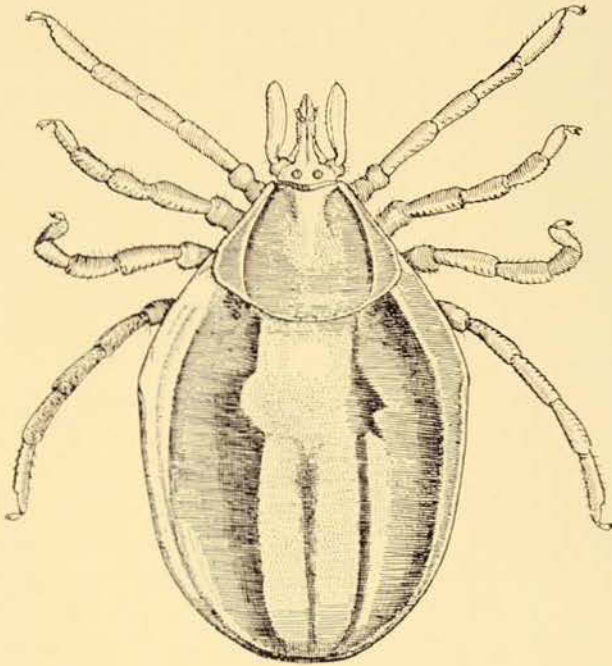
Roberts of the Queensland Department of Agriculture and others have contributed information about it. The tick is plentiful in the Sydney district, particularly on the northern shores of Port Jackson in such suburbs as Mosman, Manly to Pittwater, and along the North Shore Line. I have taken it on a dog in the Kurrajong. In Queensland it extends almost the full length of the coastal zone and, in the south, it extends as far west as the Bunya Mountains where it finds the temperature and humidity necessary for its existence. Here the tick proved a pest to the members of the Royal Australasian Ornithologists' Union in their camp-out in October, 1919. A doctor who had his time fully occupied extracting ticks from fellow-members was heard to remark that "he had a large practice but it was all on 'Tick'".

*Hosts.*—About Sydney the Long-nosed Bandicoot (*Perameles nasuta*) is the principal animal host of the Dog Tick, also known as the Bush Tick or Bottle Tick (this last name from the appearance of the engorged female), which accounts for the prevalence of the tick at the localities mentioned above as it doubtless follows the distribution of this marsupial. The range of this bandicoot, according to the book by my colleague Mr. Ellis Troughton,<sup>3</sup> is eastern Australia coastally from the Cairns district, north Queensland, to Victoria. This nocturnal rat-like animal lives during the day among blackberry vines, in open drain-pipes, and such shelter as it can find left by man in his rapidly-expanding towns, and at night it forsakes these hiding places and invades gardens for food. Here it causes the gardener concern by digging up lawns and flower beds in search of worms or grubs. The bandicoot is sometimes captured carrying a great number of ticks in various stages of engorgement, and it will be readily appreciated how the tick may thus be distributed during the nightly rambles of its host. The bandicoot is among those marsupials protected by law under the Birds and Animals' Protection Act, but many dog

<sup>3</sup>E. Troughton: *Furred Animals of Australia*, 1941, p. 64, pl. v, f. 3.



owners would like to see the little animal exterminated. Others see in any proposed lifting of the protection of the bandicoot, the thin end of the wedge for the exploitation and subsequent decimation of the scanty remnant of the Australian native marsupials. Between these two views the law has to tread a reasonably-balanced path.



The unengorged female of the Dog Tick (*Ixodes holocyclus*) may measure 3.2 × 1.7 mm. The relatively large reddish-yellow scutum occupies the anterior end of the body. When removed from dogs or humans this is the usual appearance of the tick.  
E. A. King, del.

The Dog Tick has also been recorded from a number of other native hosts: the Pouched Mouse (*Phascogale*), Kangaroo and Wallaby, the Common Opossum (*Trichosurus vulpecula*), the Sugar Squirrel (*Petaurus breviceps*), and even from birds such as a duck and the Ant-thrush (*Pitta*). It has been taken on the Black Rat (*Rattus rattus*) and on domestic animals as we shall see below. In coastal Queensland the Giant Brindled Bandicoot (*Isododon torosus*) is the chief host of the Dog Tick. In Queensland, Roberts points out, it attaches itself to the Native Bear (*Phascolarctos cinereus*) and to other native animals, as well as to the horse, cow, pig, sheep, dog, cat, chicken and man. In an earlier article (1934) he shows that at times it may

“be responsible for heavy losses among flocks in ticky areas”, and that dogs and cats are particularly susceptible.

It would seem that the native animals are largely immune to the toxic effects of the Dog Tick's poison, but Dr. D. J. W. Smith<sup>4</sup> has shown that under laboratory conditions larvae, nymphs and adults may produce tick paralysis, when present in sufficient numbers, upon bandicoots trapped in areas near Brisbane where the tick is rarely found.

*Life-history.*—The Dog Tick is a three-host tick, that is to say it has to spend part of its life on three hosts before reaching maturity. In this respect it differs from the Cattle Tick which is a one-host tick. The adult female is at first a small, flat, oval tick, yellowish in appearance, but as she finally engorges she swells enormously till she is somewhat larger than a large pea and becomes bluish or greenish in colour (the “blue-bottle” or “green-bottle” tick stage). The scutum, which is conspicuous in the unfed female, now comes to occupy a relatively small area at the anterior part of the body. After being attached for about 5-6 days she drops off her final host and crawls to shelter under leaves. In about 11-14 days she commences to lay her eggs and, in about a month's time, lays about 2,000-3,000 eggs, at the rate of about 200 per day, after which she dies. During the warm humid weather of spring or autumn the larval or “seed” ticks emerge in about seven weeks.

The three stages of the life-history of the Dog Tick may be better understood from the accompanying table.

*Toxic Qualities.*—The Dog Tick has long been known to be toxic to dogs and, as far back as 1827, P. Cunningham, in his two-volume work entitled *Two Years in New South Wales*, London, p. 331, wrote:

There is a wood-tick found in brushy places near the coast, that burrows and breeds under the skin of the kangaroos, dogs, and similar animals, and which in general eventually kills them if means are

<sup>4</sup>Dr. D. J. W. Smith: Studies in the Epidemiology of Q Fever. 10. The Transmission of Q Fever by the Tick *Ixodes holocyclus* (with notes on Tick-Paralysis in Bandicoots). *Aust. J. Exper. Biol. Med. Sci.*, xx (3), Dept., 1942, 213-217.



## LIFE HISTORY OF THE DOG TICK

<i>First Stage</i>	<i>Second Stage</i>	<i>Third Stage</i>
From the eggs, which develop in about seven weeks, the <i>larva</i> or "seed" tick emerges. It is minute and six-legged. Spends 4-5 days to harden the integument.	In this <i>nymph</i> stage the tick has now eight legs like the adult.	Again there is a short period before awaiting the arrival of the third host.
It climbs up the grass and awaits first animal host.	Waits 4-5 days to harden and ascends herbage to await the second host.	Males wander over body of host but do not engorge.
Remains attached to host 5-6 days.	On completion of engorgement it is about the size of a large pin's head.	Female at first small, but as engorgements proceeds swells rapidly. Remains attached for 5-6 days, then drops off, crawls away and hides. The body is very swollen in this last stage—the "bottle" tick. After 11-14 days lays eggs and dies.
Drops off and, after 30 days, moults and enters upon second stage.	Drops off and after another 30 days moults, to emerge as adult male or female.	<i>Effect of Bite</i>
<i>Effect of Bite</i>	<i>Effect of Bite</i>	Very toxic to dogs and man.
May cause intense irritation, especially to man.	May cause mild form of paralysis in dogs.	

not taken to check it. It also burrows in the same way under a man's skin, and so quickly and quietly does it nibble its way that a friend of mine compelled to sleep for a night in a brushy place, was induced to examine an itchy spot on his side in the morning and there found a tick already burrowed head and shoulders into it.

Similarly another writer, C. H. Horsley, in an article entitled "Miscellaneous Facts in the Natural History of New South Wales", *The Zoologist*, London, iv, 1846, pp. 1422-1431, wrote:

We have a pest in this country of the Tick kind; it entirely frequents thick, scrubby country, and is most annoying and fatal, if not discovered. It is, therefore, essential to look well over your dog's coat after you have been shooting in these brushes, otherwise you may lose him, for this tick has the power to destroy life. The symptoms in the dog are first excessive drowsiness, and as the insect sucks, weakness of the loins and spine, and finally death. In man, as I know, it is sufficiently disagreeable, though of course, seldom or never fatal.

The above quotations are interesting, since they show that the poisonous qualities of the bite of the Dog Tick was well known long before the arachnid received its scientific name of *Ixodes holocyclus* from Neumann in 1899. The life-history of the animal does not appear to have been satisfactorily dealt with until Dr. Ian Clunies Ross<sup>5</sup> described it more than

twenty years ago. The clinical aspect of tick-bite had, however, been touched upon by Dr. Sydney Dodd<sup>6</sup> (1921) and by Dr. E. W. Ferguson<sup>7</sup> (1926). Dr. Ian Clunies Ross has also shown that the tick produces a poison, the product of its salivary glands, whose function it is to prevent coagulation of the blood. As indicated earlier, the female feeding on her final host increases greatly in size during the five to six days of engorgement, and the salivary glands correspondingly increase in size as they pour their products into the blood stream of the host. The tick in all stages becomes merely attached to the host by the mouth-parts and does *not* "burrow" beneath the skin.

*Respiratory paralysis* is said to occur after a *female* tick has adhered to a dog for four days (though many dog owners would insist that symptoms appear much earlier than this), but experiments conducted by Dr. I. Clunies Ross showed that the *first* symptoms of tick paralysis appear during the last twenty-four to thirty-six hours of engorgement. The symptoms of tick paralysis in the dog may be divided roughly into five periods.

<sup>6</sup> Dr. Sydney Dodd: Tick Paralysis. *Agric. Gaz. N.S.W.*, xxxii, April 2, 1921, 265-272; May 2, 1921, 331-337.

<sup>7</sup> Dr. E. W. Ferguson: Deaths from Tick Paralysis in Human Beings. *The Medical Journal of Australia*, Vol. ii, 11th year, No. 14, October 4, 1924, 346-348.

<sup>5</sup> I. Clunies Ross: An Experimental Study of Tick Paralysis in Australia. *Parasitology*, xviii, December, 1926, 410-429. 2 text-figures.



1. Slight lack of control in the hind limbs; the dog, while running, lifting the legs higher than under normal conditions, or the legs may swing while the animal is turning.  
Search should now be made for the tick.  
Synchronizing with the lack of co-ordination vomiting after taking food may occur.
2. In two to three hours the dog may be so under the effects of the poison that the hind limbs give way even when attempting only to walk.
3. In another three to four hours the animal may not be able to raise itself on its hind legs and vomiting follows any attempts to give it food or drink.
4. After ten to twelve hours, as paralysis grips the body, the dog can no longer raise itself on its forelegs and breathing too becomes difficult as the muscles which control respiration become affected.
5. Finally the muscles of the head and throat are affected by paralysis, making movement impossible and swallowing difficult.

The services of a trained veterinary surgeon should be enlisted when any of the above symptoms become apparent, though some dogs have shown amazing powers of recovery, and may pass through the ordeal described above without any treatment.

The effects of "tick-bite" on man seem to vary according to the age of the patient. In a recent work<sup>8</sup> by the late Frank H. Taylor and Dr. R. E. Murray, a table is given by the latter author of the fatal cases attributed to tick paralysis in man from 1904 to 1942 for New South Wales.

These deaths numbered nineteen, and while the ages of the patients varied from three months to seventy-five years, the majority, seventeen, were children from

one to three years. The symptoms of tick poisoning in man are usually not experienced until about twenty-four hours have elapsed, but in some persons the tick may be felt and removed long before that time has passed. Then perhaps nothing more serious than a swelling and itchininess in the vicinity of the bite may ensue, though this may persist for some days. When the tick has engorged for *more* than twenty-four hours, case histories show that a headache and slight malaise may be among the symptoms. As the tick seems to find the most inaccessible portions and crevices of the human anatomy, including the scalp and behind the ears, conditions here are probably more severe than in more remote regions of the body. Small children show a *weakness in the limbs*, which emphasizes the need for thinking in terms of tick paralysis and the necessity for a search for a tick or ticks. For the more detailed medical aspects of the disease as it affects man, readers are referred to the paper by Dr. Murray. Dr. D. J. W. Smith (1942) has shown that it is a potential vector of Q fever in Queensland.

*Treatment.*—Dogs in tick-infested areas (and doubtless young children also) should daily be searched for ticks. The vast majority of ticks will be found to attach themselves to the head, neck and shoulders, some are found on the posterior part of the body of the dog and even between the animal's toes.<sup>9</sup> As experiments show that tick paralysis appears *after* the fourth day of attachment of the adult female tick, Dr. I. Clunies Ross<sup>10</sup> states that, "if a dog owner is prepared to examine his dog daily and remove all ticks found, he has at least four chances of finding any one tick before it is able to cause paralysis". Ticks are removed by means of a small pair of forceps or tweezers, a sharp pull being all that is necessary to dislodge them. Sometimes the mouth-parts may be left in the wound.

<sup>8</sup> F. H. Taylor (the late), and R. E. Murray: Spiders, Ticks and Mites, Including the Species Harmful to Man in Australia and New Guinea. Section 1, Descriptive; By F. H. Taylor. Section 2, Clinical; by R. E. Murray, M.B., B.Sc., D.T.M. (Syd.). Commonwealth of Australia, Department of Health Service Publ. (School of Publ. Health and Tropical Med.), No. 6, September, 1946.

<sup>9</sup> H. R. Carne and I. Clunies Ross: How to Search for Ticks on Dogs, and How to Remove Them. Bull. Dog-tick Research Ass., Sydney, No. 2, April, 1933, 1-6, tfs. A-B.

<sup>10</sup> I. Clunies Ross: Tick Paralysis: A Fatal Disease of Dogs and Other Animals in Eastern Australia. Journ. Council Sci. and Ind. Research, viii (1), February, 1935, 8-13.



but these come out later of their own accord. In the past it was the fashion to put turpentine or kerosene on the tick, but this has been shown to be so much waste of time.

Derris dust is regarded as a satisfactory repellent, but this is not always available, and care must be taken to see that it does not get into the eyes of the animals when rubbing it into the fur.<sup>11</sup>

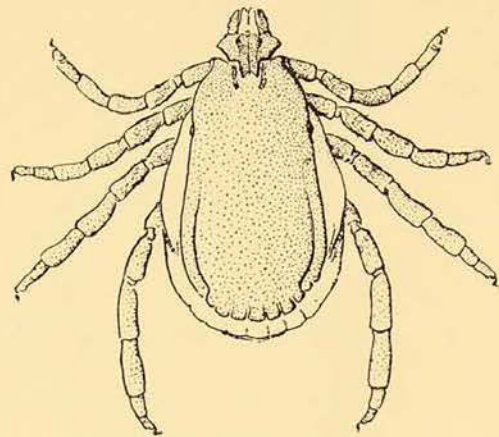
DDT does not appear to have been tried out experimentally to any extent on the Dog Tick of the Sydney suburbs but, as may be seen under the heading "Treatment" for the Brown Dog Tick, it has been successfully employed in the United States.

For dogs in the throes of respiratory paralysis the serum prepared by the Commonwealth Serum Laboratories in Melbourne seems to be the only effective means of saving the lives of the animals, but this requires to be administered by a qualified person such as a veterinary surgeon. Moreover, the serum has not always been available in the past and owners of pets have been made fully alive to the inconvenience of having to get this product from a city 500 miles away and where no disease of the kind occurs.

THE BROWN DOG-TICK.

Another tick parasite of dogs in Australia is the Brown Dog-Tick (*Rhipicephalus sanguineus*). This cosmopolitan

<sup>11</sup> I. Clunies Ross: Report on the Investigation of Methods for the Prevention and Cure of Tick Paralysis in the Dog, for the year 1934. *Bull. Dog-tick Research Ass.*, Sydney, No. 3, December 18, 1934, 1-5, fig.



The Brown Dog Tick (*Rhipicephalus sanguineus*), male. From Allora, Queensland. Length about one-sixth of an inch. Specimen by courtesy of Department of Agriculture, New South Wales.

N. B. Adams, del.

species has been introduced into Australia. It occurs commonly everywhere in Queensland and in the Northern Rivers district of New South Wales. In addition to being the common dog tick of Queensland it has been recorded in that State from cats, sheep, cattle, horses and man. Specimens taken on a dog in Sydney were once brought to the Museum, but the species seems to be rare in these southern latitudes. It is a three-host tick, and its life-history has been given by Dr. Roberts<sup>12</sup> and the following table is based on his account.

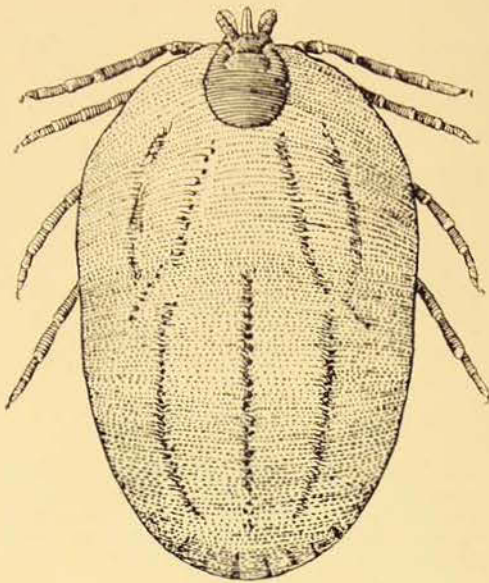
Beyond Australia, the Brown Dog-Tick has been shown to be the vector of certain

<sup>12</sup> F. H. S. Roberts: Ticks Infesting Domesticated Animals in Queensland. *Q'land Agric. J.*, xli (2), February, 1934: 188, pl. 28, f. 3-4; The Brown Dog Tick (*Rhipicephalus sanguineus*). *Q'land. Agric. J.*, lii (5), November, 1939, 529-530, pl. 233.

THE LIFE HISTORY OF THE BROWN DOG-TICK

First Stage	Second Stage	Third Stage
<p>Eggs hatch in from 19-60 days according to the season of the year.</p> <p>The larval or "seed" ticks are a little larger than a pin's head.</p> <p>They attach themselves to a dog, and are fully fed in from 3-7 days.</p> <p>They drop off the host, hide, and in from 6-23 days cast their skins.</p>	<p>This is the nymphal stage. In a few days they are ready to attach and feed on the first dog that comes into contact with them.</p> <p>In 4-9 days the nymphs drop off.</p> <p>They moult in from 12-29 days, emerging as adult males and females.</p>	<p>Young males and females fasten on to a dog.</p> <p>Each female attaches herself to the one spot and becomes engorged in from 6-30 days. Then she drops off, lays from 1,000-3,000 eggs, and dies.</p> <p>The males do not feed at one place for very long but wander about.</p>





**The Brown Dog Tick (*Rhipicephalus sanguineus*), female. From Allora, Queensland. Length one-quarter of an inch. Specimen by courtesy of the Department of Agriculture, New South Wales.**

N. B. Adams, del.

diseases to man as well as to dogs, and the pages of the *Journal of Applied Entomology* every year contain numerous references to the tick and the diseases it is known to transmit. Of these diseases specific mention may be made of the following: (1) the malady termed Canine piroplasmiasis whose causal agent is *Babesia canis* and which, as its name suggests, affects dogs; it has been recorded from India and Brazil and is an organism related to *Piroplasma bigeminum* (Tick Fever in Cattle); (2) Dog "typhus" fever, caused by *Rickettsia canis*, first described from Algeria in 1935 by Donatien and Lestoquard, but shown by them to occur also in dogs in the south of France; (3) Marseilles Fever, caused by *Rickettsia conori*, transmitted by the Brown Dog-Tick in such widely separated places as Kenya, Africa, and Spain; (4) Relapsing Fever, due to *Spirochaeta hispanica*, and recorded from man in Algeria following on a bite from this tick; (5) Rocky Mountain Spotted Fever in the United States of which it is a

potential vector; (6) in Queensland, this tick has been shown by Dr. D. J. W. Smith to be a potential vector of Q Fever, caused by *Rickettsia burneti*, one of the typhus diseases.

*Treatment and Control.*—Unlike the Dog Tick of the Sydney district, the Brown Dog-Tick, being an alien, has no native host, but is a domestic pest of dogs. Control is therefore directed to caring for (1) the dogs themselves, and (2) paying attention to the animals' sleeping quarters, for here we may expect to find the three stages: larvae, nymphs, and young adults. These stages are known to exist without feeding for considerable periods. Roberts in his article (1939) has advocated the use of *derris dust* used as a powder and shaken into the skin, or by making a wash of two ounces of derris powder to a gallon of water. This should stand overnight. Soap is then added to make a good lather. This wash is then allowed to dry on the coat. Care must be taken to keep the wash away from the dog's eyes so as to prevent inflammation. Young dogs require careful treatment with derris. In the United States the Brown Dog-Tick was subjected to experiments by Messrs. H. K. Gouck and C. N. Smith<sup>13</sup> and 5% DDT emulsion gave satisfactory control. Moreover, none of the dogs treated with DDT showed any ill effects from the treatment. In another article, Mr. C. H. Curran,<sup>14</sup> dealing with the ticks in the United States harmful to man and the domestic animals, cites the Brown Dog-Tick and gives a formula containing arsenic trioxide for keeping dogs free from ticks and fleas. This formula is said to be harmless to dogs when used in the recommended strength.

<sup>13</sup>H. K. Gouck and C. N. Smith: DDT in the Control of Ticks on Dogs. *J. Econ Ent.*, 37 (1), February, 1944, 130.

<sup>14</sup>C. H. Curran: Ticks—A Menace to Animal Life. *Natural History*, New York, liv (5), May, 1945, 212-215, illus.