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White-browed Scrub-Wren (Sericornis frontalis) feeding a young Fan-tailed Cuckoo (Cacomantis flabelliformis).
[Photo.—*K. A. Hindwood.*

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VOL. IV, No. 2. April-June, 1930.

Seals on the Victorian Coast and their Feeding Habits

By F. Lewis,

Chief Inspector of Fisheries and Game, Victoria.

THERE are a good many seal colonies in Bass Strait, and close against the Victorian coast two very large herds have their headquarters, namely, on the Seal Rocks near Western Port and on Lady Julia Percy Island, off Port Fairy. There are also several smaller rookeries at the Glennie Group of Islands, off Wilson's Promontory, and on the Skerries, off Wingan Inlet, in the far eastern part of Victoria.

The two big colonies on the Seal Rocks and Lady Julia Percy Island, being comparatively near important fishing centres, have for many years been the subject of complaint on the part of fishermen living and working in the vicinity. The fishermen have alleged that the seals are a menace to the fishing industry in that they destroy large quantities of good edible fish, break up and drive away from the fishing grounds the shoals of migratory fish and interfere with fishing operations generally. The Victorian Government was repeatedly requested to take action to destroy or greatly reduce the number of seals, but this was strongly opposed by other sections in the community, who maintained that there was no evidence that seals were as serious a menace as was alleged.

In 1928 the Victorian Parliament voted funds so that a scientific investigation of the whole matter might be made. The Seal Rocks and Lady Julia Percy Island were selected as the places to be examined because these contained the largest numbers of seals and were adjacent to the fishing grounds of a good many fishermen. Reliable men, having a good knowledge of the locality, were chosen to visit the rookeries at frequent intervals, kill a number of animals of both sexes and different sizes and report on the stomach contents. These reports were received regularly from November, 1928, to June, 1929.

On the Seal Rocks fifty-seven seals in all were killed. The stomachs of forty-one of these were found to be either

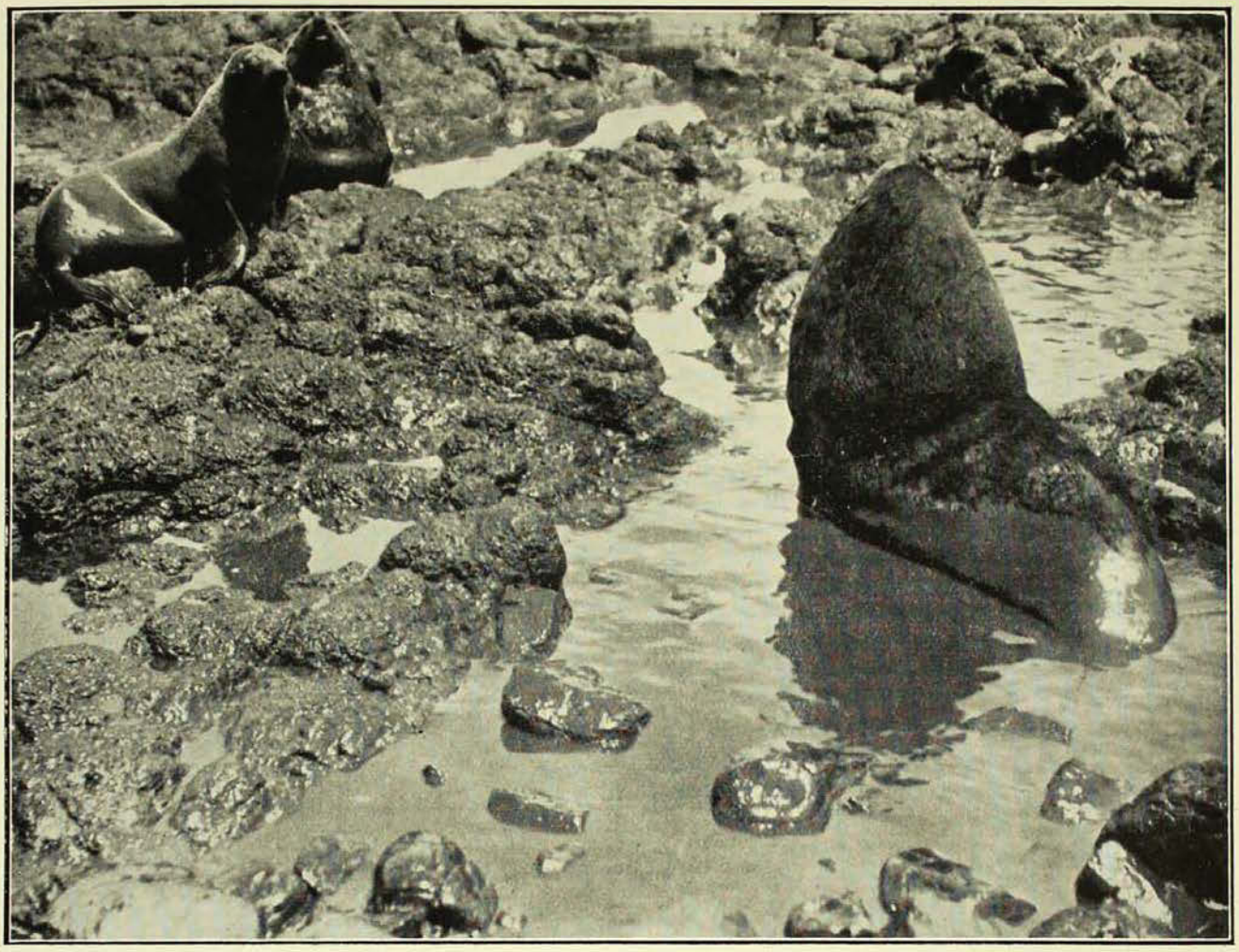
Eastern side of the Seal Rookery at the Seal Rocks, Western Port, Victoria.
[Photo.—*F. Lewis.*

quite empty or containing only a little liquid or a few pebbles. Four were found to be full of liquid and only twelve contained fish. Of the twelve containing fish, one contained gurnets and cuttlefish, four contained barracouta and cuttlefish, two contained crayfish, one contained barracouta, one contained barracouta bones, two contained barracouta bones and cuttlefish, one contained parrot fish.

On Lady Julia Percy Island twenty seals were killed and fourteen of the stomachs were found to be empty, except for a little liquid. Six contained fish, and in four cases these were barracouta, and in two salmon trout, which is the fishermen's term for the immature Australian salmon (*Arripis*).

The large number of seals having absolutely empty stomachs is remarkable. It is well known that the adult male fur seal of the Pribilof Islands, Alaska, once he comes on to the rocks at the beginning of the breeding season does not leave them again to feed until the breeding season is quite over. This may mean a total abstinence from food for two months or more, during which time this seal lives on his fat, and at the end of the breeding season he is naturally in a very poor condition. Whether this applies to the same extent to the adult males on our coast is doubtful. In any case, both males and females are often found to be empty.

Fishermen crayfishing in the vicinity of the rocks have reported to me that they frequently see in the early morning large herds of seals making away together in a south or south-easterly direction straight out to sea. Barracouta are very plentiful in these southern waters during most times of the year, and it would appear that the seals know of these good feeding



Back view of an adult male showing the mane.

[Photo.—*F. Lewis.*

grounds and do most of their fishing in waters well away from the Seal Rocks, only coming back to these places for rest or breeding purposes.

Quite close to the Seal Rocks parrot fish are extremely abundant. The rocky nature of the bottom, however, seems to afford these fish protection from the seals, as in only one case were remains of these found in the stomachs.

Crayfish are also very plentiful around the Rocks, and I have seen crayfish pots picked up within a few yards of the Rocks full of good crayfish. As a matter of fact, one fisherman makes the bulk of his living, so far as crayfishing is concerned, by fishing with pots around the rocks.

Western Port, which is very close to the Seal Rocks, is an excellent fishing ground for whiting, snapper, pike and many other choice fish, yet in all the seals killed there was not one of these fish ever found. On the rocks themselves there are huge heaps of the vertebræ of the barracouta, and these, together with the stomach contents which could be identified, seem to show that the seals feed principally on this type of fish, which is so abundant in Bass Strait. Cuttle-fish and squid are also very common in the vicinity and the seals must feed largely on these.

When the complaints of the fishermen are closely examined it is found that they refer to only a very small number of seals which cause annoyance at infrequent intervals. Men out fishing for barracouta sometimes find a seal following the boat and taking the barracouta from the hooks. Sometimes a man with a net set in Western Port will suffer annoyance from a seal taking fish from his net. On other occasions I have had complaints from

Two old bulls having an argument regarding territorial rights. [Photo.—*F. Lewis.*

men who were hooking snapper or whiting. A seal comes around and the fish immediately go off the bite. But these are isolated instances, and the fishermen have authority to destroy seals which are thus causing them annoyance.

A close investigation of the problem seems to show that it is probably the young males who cause most of the annoyance. These are not yet sufficiently developed to have a harem of their own, and are probably prevented from landing on the rocks by the big old bulls. On the Pribilof Islands it is the young males of three years old that are killed regularly each year for their furs. If the fishermen were to be granted absolute immunity from seals it would be necessary to kill every seal in Bass Strait. To merely reduce the numbers of the various colonies would be quite useless as a means of preventing interference with fishing operations, because, while there are any seals in the vicinity, there will always be the risk of a few interfering with the fishermen.

Seals are polygamous animals and gather on the various rookeries for breeding in November. A single young one is born between the middle of November and the middle of December. On my visit to the Seal Rocks on December 11, 1928, young seals of a week or two old were to be found in hundreds all over the rookery. At this period they seem to spend most of their time sleeping on the rocks. A few (perhaps the older ones) were found amusing themselves by scrambling about in the pools left by the tide. Young seals cannot swim when born, but have to be instructed by their mothers. They apparently stay with their mothers for some considerable time, as some of the pups born early in December were still

Young seals from one to two weeks old.

[Photo.—*F. Lewis.*

being suckled by their mothers at the end of June.

It is difficult to ascertain the average size of the harem of each bull seal, but, from my own personal observations, there would appear to be one bull to about six or seven cows.

One hundred years or so ago seals must have been very plentiful in Bass Strait. In 1798 Bass and Flinders are reported to have taken a cargo of 6,000 skins and several tuns of oil, and it is said that in 1805 ten vessels and 180 sealers were scattered in small groups among the islands employed in catching seals.

The seals are found on their rookeries all the year round, but in the greatest number at the breeding time in early summer.

It is estimated that fully 5,000 seals live on the Seal Rocks in November, and practically a similar number on Lady Julia Percy Island. At the Glennies and the Skerries the colonies are much smaller, probably aggregating not more than 400 or 500 at each.

The intense hunting which took place in the early history of the colony must have greatly reduced the herds, because sixty years ago, so an old fishermen informed me, there were not more than twenty or thirty seals on the Seal Rocks. Close protection in recent years, however, has resulted in the seals increasing in numbers, till now the various rookeries on the Victorian coast at least are practically fully occupied.

The seal on our coast is the Australian fur seal (*Arctocephalus doriferus*). Apparently it is the same seal that occupies all the rookeries on our coast. It is called a fur seal because there is a layer of very fine soft fur against the skin, but overlaid and covered with a coarse, harsh growth of

guard hair. The Alaskan seal, which provides the sealskins of commerce, is of the same type. In the process of manufacture the skins are not tanned as are other hides, but are cured with the oil obtained from the blubber of the seal. They then go through machines which remove the coarse hair from the pelt, leaving exposed the soft fur, which is then dyed either brown or black.

The Seal Rocks lie in a very exposed position, and it is only at rare intervals that a landing can be made thereon. If such a visit can be managed, however, one feels well repaid by the facilities for a close examination of the seals and of the bird life which is so plentiful on the rocks. On my visit in December the ordinary silver gull was breeding there in hundreds. Crested terns also had a rookery with their single egg lying out on the open ground without the semblance of a nest. The Sooty Oyster Catcher was also fairly plentiful, with its nest of stones and pebbles amongst the pig-face.

The place certainly cannot be recommended as a rest-cure for anyone with jangled nerves, because the seals keep up a constant clamour, bulls, cows, and young ones contributing to the bedlam. The sea-birds also distrust the intruder, and are constantly wheeling about shrieking their objections. The seals look so bulky and heavy that one is tempted to approach closely, but they are extremely agile and on a slope towards the sea can travel over the rough rocky ground as fast as a man can run. At the breeding time they are particularly ferocious, and strongly resent anyone attempting to move them from the particular domain they have taken up. Each male has a certain definite territory from which he excludes other males. Cases of trespass, of course, are common, and serious fighting then results, the old bulls tearing and biting one another, at the same time roaring their defiance. The females are much more timid, and move off into the sea if closely approached. The baby seals, however, are absolutely indifferent to the human intruder until they are a month or two old, when they also move away if approached too closely.

The result of the inquiry into the feeding habits of the seals demonstrated that, so far as choice fish are concerned, the seals do practically no damage. Their principal food is the pelagic shoal fish, such as salmon and barracouta, also squid. A few seals certainly interfere with fishing operations, but these should be dealt with by the fishermen themselves, who have authority to kill them under these conditions. No evidence was obtained which would justify the wholesale slaughter of these interesting animals, which may some day prove a valuable asset to the State.

Notes and News

On February 19, Mr. E. Le G. Troughton, Zoologist in charge of Mammals and Osteology, entered on long service leave, having completed over twenty years' service in the Museum. Mr. Troughton will visit some of the principal Museums in Europe and America, where he will study methods of storage and display, and examine the collections of Australian mammals. He will devote special attention to the types of Australian species housed in Museums abroad, and has taken with him a small collection of specimens for comparison.

During February, Mr. W. W. Thorpe, Ethnologist, lectured to the Sydney Practical Psychology Club on "Life and Customs of the Aborigines," and to the Legacy Club on "Aboriginal Stone Implements."

* * * *

A recent visitor was Dr. D. S. Davidson, of the University Museum, Philadelphia, U.S.A., who proposes to make sociological investigations among the aborigines of the Victoria Downs District, North Australia.

Shell Ornamentation

By Joyce K. Allan.

THE quaintness of shape, and beauty of design and colour of shells render them almost unsurpassable for ornamental purposes. There are few homes which have not sometime boasted either a clam or melon shell in the garden or a richly coloured cowry or pearl shell displaying its beauty within the house.

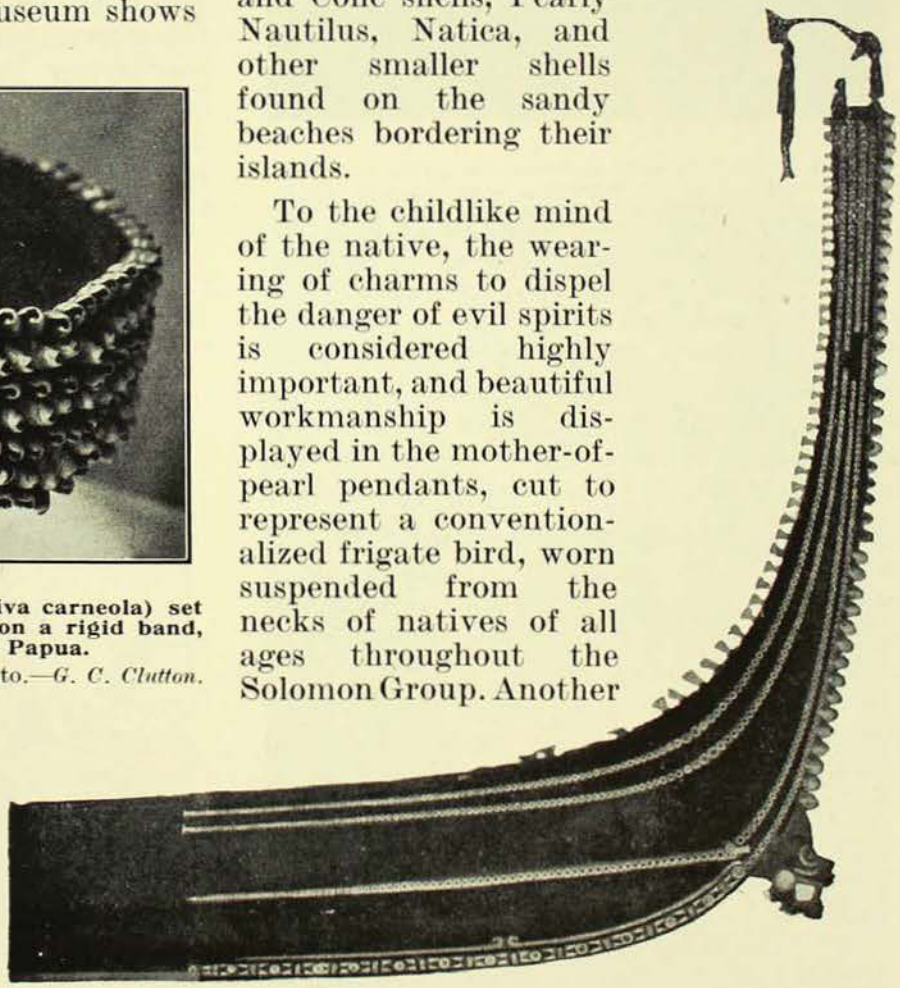
Apart from their utility, material found in caves of Europe proves that shell ornamentation played a very large part in the lives of the early inhabitants of those regions, and a stroll through the ethnological gallery of this Museum shows how extensively the South Sea natives use this form of expression for decorating their sacred enclosures and canoes, for personal adornment, and as insignia of office.

Seven rows of small olive shells (Oliva carneola) set in alternate directions, and mounted on a rigid band, form this shell necklet from Papua.

[Photo.—*G. C. Clutton.*

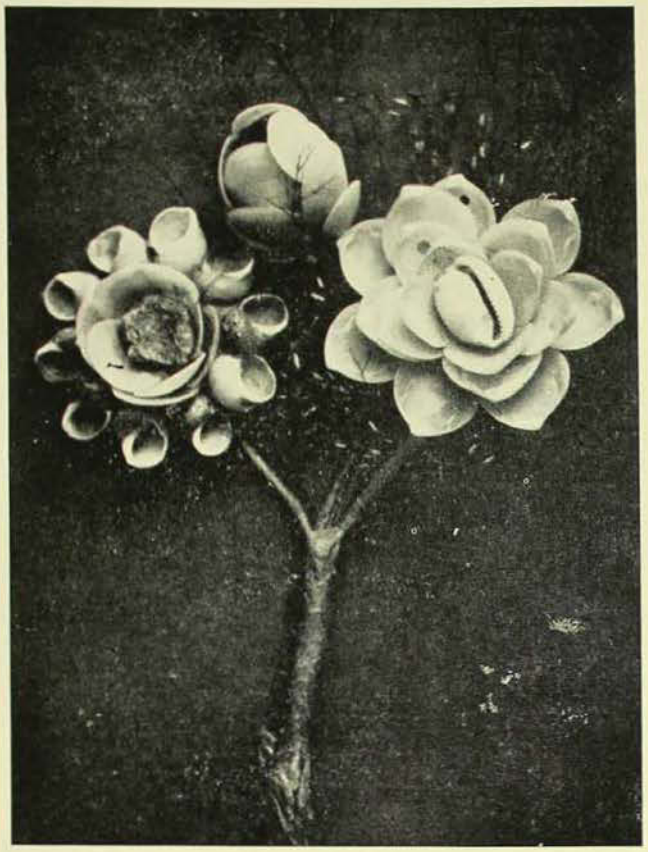
Amongst these people wonderful ingenuity is displayed in the fashioning of their dress regalia, consisting of waist and dance girdles, collars, head wreaths, bracelets, bangles, breast ornaments, ear and nose drops, and rattles, variation in these adornments being obtained by employing different species and sizes of shells, even the tiniest particles being used in the arrangement of the patterns. At the same time it is noticeable and surprising that, considering the great variety of shells at their disposal, they should restrict themselves to so few species, repeatedly using the large white Egg-Cowry, the Orange Cowry, Pearl, Turbo, Trochus, and Cone shells, Pearly Nautilus, Natica, and other smaller shells found on the sandy beaches bordering their islands.

To the childlike mind of the native, the wearing of charms to dispel the danger of evil spirits is considered highly important, and beautiful workmanship is displayed in the mother-of-pearl pendants, cut to represent a conventionalized frigate bird, worn suspended from the necks of natives of all ages throughout the Solomon Group. Another



The prow of this head-hunter's canoe from the Solomon Islands is ornamented with shells (Ovulum ovum) and inlaid with toothed sections of the Giant Clam (Tridacna gigas). Natica shells (Polinices mammila) similarly extend along the inner margin of the stern. The sides of the prow and stern are elaborately decorated with hundreds of inlaid sections of pearl or nautilus.

[Photo.—*G. C. Clutton.*



Sprays of shell flowers mounted on card, made by the aborigines at La Perouse, near Sydney, from shells collected locally (Phasianella ventricosa and Diplodonta adamsi) with small cowry as centre.

[Photo.—*G. C. Clutton.*

quaint charm, portion of a coral-boring mollusc, is worn on the left middle finger of Mandated Territory natives when planting yams. By rubbing the base of the plant with the charm prior to setting, the wearer hopes to ensure a good crop.

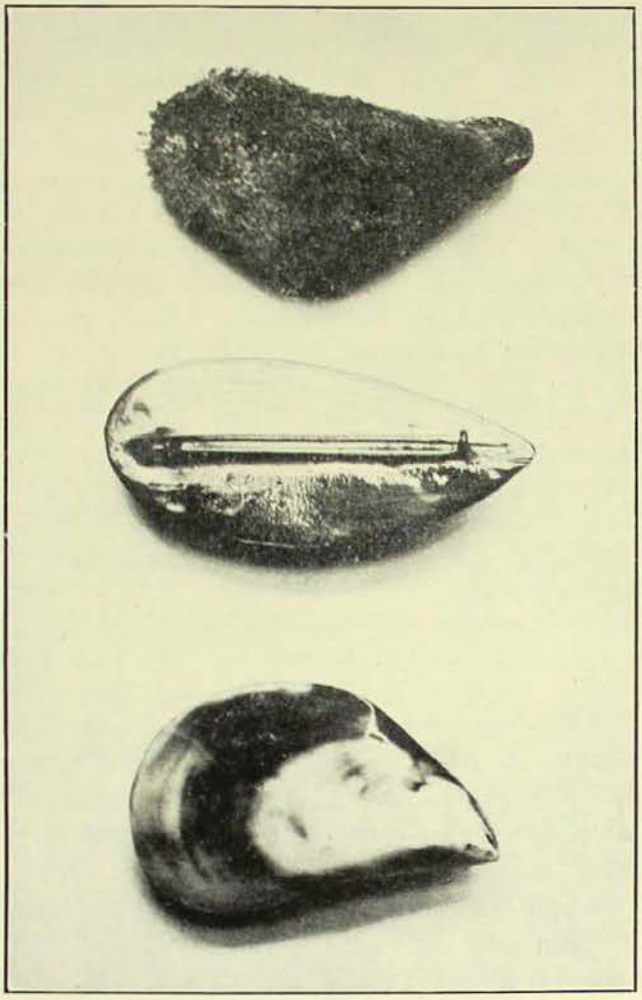
The various adornments comprising their dress regalia are made by attaching either one or more rows of shells and portions of shells to bands and strings of native fibre, varying the rigidity of the adornment to suit the purpose. A dance belt of a Murray Islander on view in the Museum consists of a flat plaited girdle with two rows of white Natica shells, and the small yellow and white Olive shell (*Oliva carneola* Linn.) set in alternate directions row by row and mounted on rigid fibre makes a handsome collar for a New Guinea dandy. Small Ear-shells (*Haliotis asinina* L.) suspended together and worn on the wrist or knee or held in the hand, are used as dance rattles by Murray Islanders, and in Papua freshwater mussels are attached to the dress while dancing. Even the wee piccaninny is catered for in this respect; the rattle belonging to one from Cape York Peninsula is formed of small cockle shells (*Arca pilula* Reeve) perforated and strung together with native cord.

The beautiful Orange Cowry (*Cypræa aurantium* Linn.), so treasured by shell collectors, is certainly worthy of the purpose it serves in the Fijian Islands, where it is worn by the chiefs as a badge of rank. The large spider shell decorates the interior of sacred enclosures on Murray Island, and large white cowries placed along the outsides of canoes lend quite a festive air to them.

With the advance of civilization much of the native ornamentation and dress regalia shows the influence of the white man. This is noticed in our own aboriginal camp at La Perouse, where day by day the aborigines may be seen by the roadside displaying their cleverly designed wares, fashioned from small shells collected on adjacent beaches, in the hope of catching the eye and better still the purse of the passer-by. Their income is no doubt augmented in a small way by the disposal of these little sprays of flowers, work-boxes, pairs of tiny slippers and boomerangs encrusted with shells.

Delicately tinted pink, yellow and cream Jingle shells (Anomia walteri) are utilized for this spray of flowers and buds, similar to those sold in Sydney shops.

[Photo.—*G. C. Clutton.*



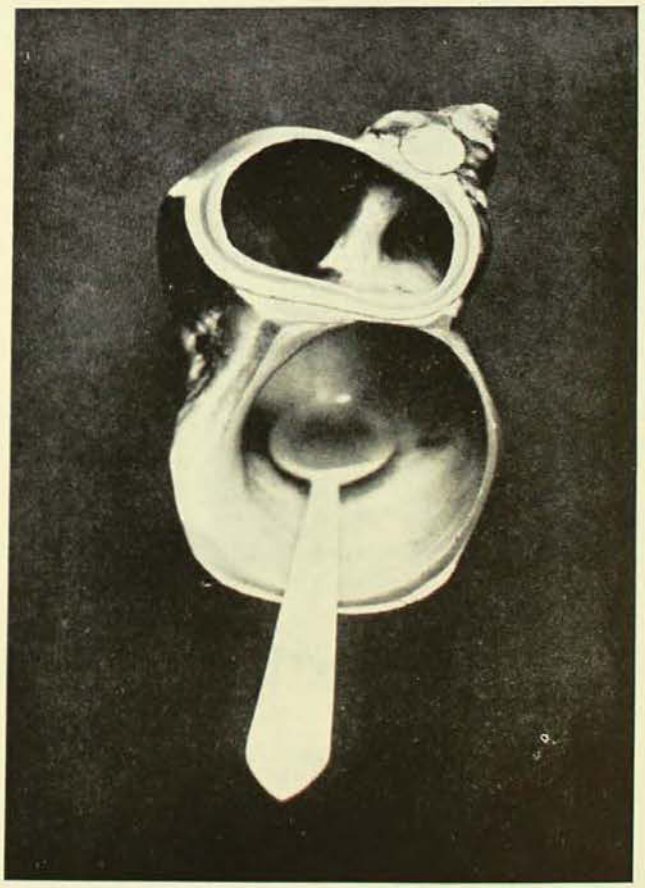
The common Sydney mussel (Brachyodontes hirsutus) before and after the hairy outer covering has been removed. A fine brooch results when mounted on gold and finished with a clasp pin.

[Photo.—*G. C. Clutton.*

This extraordinary affection for shells exists amongst civilized races in no less degree and many and varied are the uses to which they are put. Perhaps the most beautiful, and at the same time profitable fashion is that of shell flowers. Their exquisite and permanent colouring, their frailty and easy accessibility render them very popular for posies, table decorations, and for other purposes where hitherto paper or cloth flowers have been used. Sprays of these flowers presented to the Museum by Mrs. R. K. Robinson show how artistically the shells found on the Sydney beaches, especially the pink, yellow, and cream valves of the Jingle shell, the Star Limpet and the "Pipi" shell, may be employed for portrayal of roses, Iceland poppies and other flowers.

In the making of these, bivalve shells seem the most suitable, probably because they resemble more closely the shape of petals, but the small univalves are handy for centres and for buds. For some time the shell flowers have been fashionable on the Continent, but to my mind much of the beauty and delicacy is lost by the custom there of artificially dyeing them, a habit which is liable to weaken their nacre. With her clever workmanship Mrs. Robinson has been able largely to cope with the increasing demand for these articles in Sydney, where they find a ready market. Should the reader wish to see other examples of shell flowers, a pleasant hour could be spent in Mrs. Windsor's Museum at Cronulla, south of Sydney. Outstanding amongst a wonderful assortment of light shades, purses, table covers, milk jug covers, photo-frames, work-boxes, and jewel cases, are many sprays and single flowers to delight the eye.

Quite the most effective are the large sprays of Wistaria, which, suspended from the walls, lack only the sweet perfume of



Salt-cellar and spoon made from a small Turban shell (Turbo marmoratus). The pearly nacre and shape of this shell render it most suitable for such purposes.

[Photo.—*G. C. Clutton.*

that flower. These are made from the little violet snail, *Janthina violacea* Bolten, so often found washed up on our beaches after gales. With such a supply of material almost at the door it is not surprising that there should be so many articles of ornamentation, and here again the Jingle shell (*Anomia walteri* Hector), the colouring of which is more vivid in Australia than in any part of the world, is used constantly for the roses, of which there are many examples.

The beautiful tints and iridescent surface underlying the rough outer coat of shells serve to make them more appreciated for ornamentation, and, when this is exposed through the removal of the outer surface usually by an acid process, many artistic as well as useful articles can be made. The electric light shades so often seen in the windows of jewellers' shops in the city are the large abalone or Ear-shell (*Haliotis nævosa* Martyn) with the rough surface removed, leaving the beautiful mother-of-pearl nacre exposed. Well known to visitors to Tasmania are the necklaces made from the little kelp shell (*Cantharidus irisodontes* Q. & G.). These shells are collected about March, when they are in their best condition, and are shaken from kelp and small algæ dragged from below low water-mark. After they have been thoroughly cleaned they are treated with an acid process and the rainbow-tinted underlying surface is exposed. They are strung into necklaces about a yard in length, and are either dyed in bright colours or left in their natural state.

The small Trigonia, sometimes known as the brooch shell, a bivalve with a particularly pearly nacreous interior, is most suitable for the brooches, sugar-tongs, and spoons, which are commonly offered for sale in jewellers' and curio shops in Tasmania.

No one viewing the common Sydney mussel clinging to the wharf piles would suspect the combination of wonderful colouring underlying its dull hairy surface, but a number of brooches displayed in the Museum show how by simple treatment a really beautiful piece of jewellery can be made from it. The polished shell, with its glossy surface of light and dark shades of purple, is mounted on gold and finished with a neat pin, and, besides being an attractive ornament, it is firm and strong. Cat's-eyes, the circular green and white opercula of the Turbo shells, have for many years been made into brooches, rings, and bracelets, and it is not generally known that cameos, the cutting of which is a very ancient and very beautiful art, are cut from the rosy outer layer of the helmet shell. An excellent article on the cameo shell, written by Mr. T. Iredale, appeared in a previous part of this MAGAZINE.[1]

An uncommon article on view in the Museum is a salt-cellar cut from a small Turbo shell. Only portion of the rough exterior has been removed in this case, partly to form a pattern on the utensil and to make a firmer base for it to stand on. Accompanying it is a well-made mother-of-pearl salt-spoon.

Single valves of pearl shells make satisfactory ash and pin trays, and quite recently at afternoon tea in a well-appointed home, I was agreeably surprised to see slices of bread and butter on a valve of a large golden-lipped pearl shell. In the same home I saw a fine collection of shell ornaments consisting of beautifully carved pearl and nautilus shells, but I was told they had been made abroad, mostly in Venice.

Commercially, our greatest assets for ornamentation are the pearl and trochus shells, evidences of which confront us daily in the form of pearl buttons, knife handles, and mother-of-pearl trinkets. The late Charles Hedley[2] dealt thoroughly with the usage of these two shells, and the reader is referred to this for further details.

[1] Iredale.—The Cameo Shell. THE AUSTRALIAN MUSEUM MAGAZINE, Vol. II, No. 12, October–December, 1926, pp. 415–417, illustrated.

[2] Hedley.—Australian Pearl Fisheries. THE AUSTRALIAN MUSEUM MAGAZINE, Vol. II, No. 1, January, 1924, pp. 5–11, illustrated.

Some Australian Cuckoos

By K. A. Hindwood, R.A.O.U.

AMONG the many unique and wonderful birds inhabiting different parts of the world, cuckoos are, perhaps, the most singular. Their diversity in form and colour, their wide distribution as a family, their plaintive call notes, and, finally, their astounding parasitic habits, have caused them to appear so frequently in literature and folklore that few of us do not know something of them. So it is that the expression "cuckoo" as an allusion, and in a more serious mood, signifies much to mankind. An instance of its application industrially is the cuckoo clock, and in the sphere of nature it is of interest to know that in certain European countries a froth-like secretion, found on plants and formed by the larva of an insect, is known as cuckoo spittle.

Throughout the world approximately two hundred species of cuckoos occur, and, while their distribution is extensive, it is in tropical and sub-tropical regions that they are most numerous. Of this number seven genera, comprising thirteen parasitic species, are found in Australia, and the contrasts in size and coloration are indeed marked. The largest species, and probably the greatest parasitic cuckoo in the world, is the Channel-Bill (*Scythrops novæ-hollandiæ*), some twenty-four inches in length, and the smallest the Rufous-breasted Bronze Cuckoo (*Lamprococcyx russatus*). The length of this beautifully marked bird is scarcely six inches.

In the County of Cumberland, that is within a radius of about twenty to thirty miles of Sydney, four species of cuckoos are commonly observed. These are the Pallid, the Fan-tailed, the Square-tailed, and the Horsfield or Narrow-billed Bronze. A fifth species, the Golden-bronze Cuckoo, is but occasionally seen, whilst the Black-eared Cuckoo and the Koel are rare. Thus at one time or another of the year seven kinds of cuckoos frequent the neighbourhood of Sydney. The remaining six species are mostly confined to northern Australia, ranging into Malaysia, and seldom or never wander southwards.

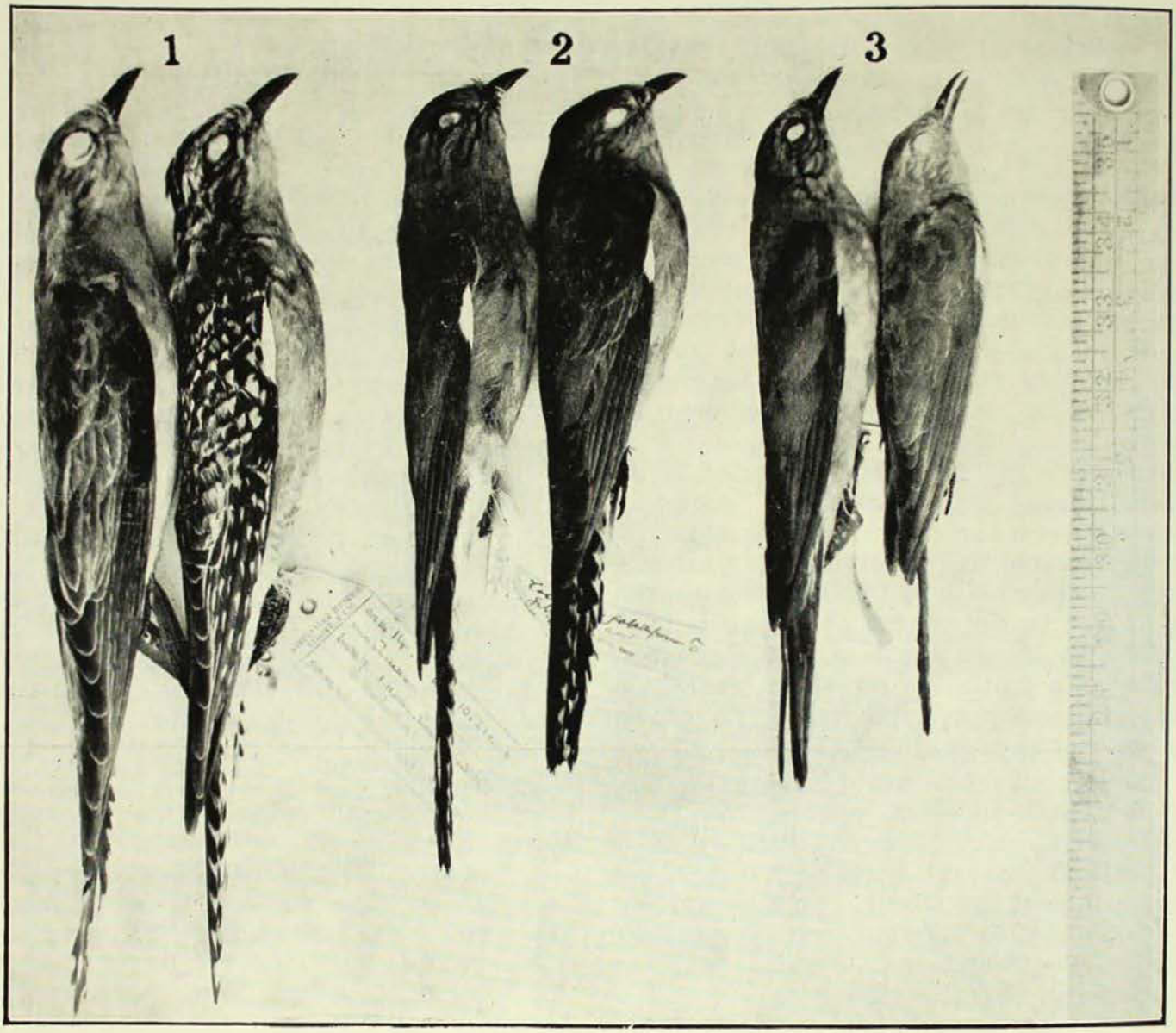
THE PALLID CUCKOO.

The Pallid Cuckoo (*Cuculus pallidus*) is probably the commonest of the Sydney cuckoos. Who, in the crisp days of joyous September, has not listened to the harsh cry or the insistent mounting call of this inconspicuously coloured bird, a bird of browns and greys, of tail and wing feathers notched with white, and drooping wings?

Much interest centres about the "Harbinger of Spring"; it happens to be the only Australian cuckoo that has been observed to feed a fledgling of its own kind. Such an unusual occurrence, whilst rare, is obviously an expression of the parental instinct, now dormant or non-existent in most cuckoos.

The courtship of the Pallid Cuckoo is exceedingly interesting, for during the long love flights of spring and early summer the male will sometimes feed the hen cuckoo, readily identified by the mottled feathers on her back. I recall the actions of a pair of these birds in some open forest country at Gundamaian, National Park, last November. The female would fly some distance and then perch on a stump or the sloping side of a rough barked tree, repeatedly uttering an insistent "tweet tweet"; always on alighting she drooped her wings and spread her tail. The male, in close attendance, would occasionally give a single harsh note, apart from a continuous reiteration of his usual scale-like call of some eight to fifteen notes. After I had been watching them for some time I noticed the male fly to the ground for a few moments and then rise and alight beside the hen to feed her on a large insect, perhaps a grasshopper. Subsequently I observed a similar incident in the same locality. The giving of food to the female is purely an act of courtship and in no way associated with the feeding of young cuckoos by their parents.

In all probability only male cuckoos have pronounced and sustained song, the purpose of which would be to announce



1. Pallid Cuckoo (Cuculus pallidus). 2. Fan-tailed Cuckoo (Cacomantis flabelliformis). 3. Square-tailed or Brush Cuckoo (C. pyrrhophanus). Male and female of each species are illustrated.
[Australian Museum collection.
[Photo.—*K. A. Hindwood.*

their presence to the female; also it seems that with but very few exceptions the duration of song corresponds roughly with the courting season and laying period of the female. So persistently do most cuckoos sing at this time of the year that their wistful voices are frequently heard throughout the night.

The nests selected by the Pallid Cuckoo are, for the most part, cup-shaped structures, by far the greatest number being those of honey-eaters. No particular situation is chosen by the female. The delicately woven homes of some of the smaller honey-eaters among the outer branches of tall eucalypts are just as readily used as nests closer to the ground. The egg of the Pallid Cuckoo bears a strong resemblance to many honey-eaters' eggs; it is of a pale flesh colour, often touched with a few reddish-brown spots. Young Pallid Cuckoos are customarily many times larger than their fosterers, and it is an odd and rather grotesque sight to watch the fussing, anxious foster-parents strenuously engaged in feeding a hulking greedy giant with an insatiable appetite.

After they leave the nest the tail feathers of young cuckoos grow rapidly, though some months elapse before young birds assume the adult plumage. Immature Pallid Cuckoos are conspicuously mottled with black and buff above, and striped

beneath, having much white on the feathers generally.

THE FAN-TAILED CUCKOO.

Scarcely less common than the Pallid Cuckoo and of a similar distribution, the whole of Australia and Tasmania, is the Fan-tailed Cuckoo (*Cacomantis flabelliformis*). In colour it is blue-grey above, rust-red beneath, and some ten inches in length. Many of our cuckoos are regular in their movements; a few may be considered strictly migratory, others are nomadic and seldom wander far from old haunts. To the latter category belongs the Fan-tailed Cuckoo, whose mournful trill of some five or six notes, uttered so quickly that they almost form a single note, is often heard throughout the autumn and winter months. Another call of two notes, habitually used during the breeding season, conveys an impression that the songster is attempting to justify the actions of its kind, for it can be readily likened to the words "why-work."

An unusual study of a White-shafted Fantail sitting on its foster-child, a well-grown Square-tailed Cuckoo whose bill is directly underneath that of its fosterer.

[Photo.—*K. A. Hindwood.*

Little more than a cursory study of the parasitic habits of the various Australian cuckoos will disclose the fact that, along somewhat broad lines and exclusive of chance and casual combinations, each species favours certain types of nests in which to place its eggs; a more detailed examination inclines one to the belief that in restricted areas a particular female cuckoo will endeavour to parasitize year after year one kind of fosterer.

In the environs of Sydney the two most frequent foster-parents of the Fan-tailed Cuckoo appear to be the Rock-Warbler (*Origma rubricata*) and the White-browed Scrub-Wren (*Sericornis frontalis*). The late A. J. North's [1] observations on this cuckoo indicate how frequently *Origma* is duped. Herein are records of fifteen nests containing either an egg or young of the Fan-tailed Cuckoo. Many similar instances have since been recorded by other naturalists.

From the frequency of the Rock-Warbler being duped at Middle Harbour, where North's records were made, we may infer that cuckoos, whether migratory or nomadic, return to the same locality to lay, just as other birds do to nest; also it is obvious that young cuckoos, either by instinct or association, are prompted to dupe the same species by which they were themselves reared, or a closely related one. Indeed this must be so, how else can we regard the fact that within limitations certain kinds of birds are constantly the hosts of distinctive cuckoos?

[1] North.—Nests and Eggs of Birds found Breeding in Australia and Tasmania, I, 1904, p. 311 *et seq.*

A noteworthy point about the association of the Fan-tailed Cuckoo with the Rock-Warbler is that the well-concealed nests of *Origma*, so often in dim rock-shelters or situations almost devoid of light, are, apparently, readily found by the cuckoos.

Considerable intelligence and watchfulness must be exercised by female cuckoos in discovering well-hidden nests. In this respect I recall an instance where a pair of Rock-Warblers built their pendant nest in a boathouse at Roseville, near Sydney. As the shed was invariably closed, the birds apparently gained access through some small opening in the boards. Soon after completion the nest contained a Fan-tailed Cuckoo's egg which the Rock-Warblers successfully hatched. The finding of this nest could only have been accomplished by watching the intended foster-parents building, followed by constant observation by the cuckoo until the nest contained eggs, for it is scarcely possible that the cuckoo happened upon one of the birds going to the nest during the very limited period when it could have been, as it was, successfully parasitized.

The Square-tailed Cuckoo. The young cuckoo grows rapidly; when a week old the quills enclosing the feathers commence to break and it occupies a considerable portion of the nest.
[Photo.—*K. A. Hindwood.*

This tabulation and watching of several nests by the female cuckoo until conditions favourable for deposition proved to be the case with the English Cuckoo (*Cuculus canorus*),[1] and no doubt would apply to parasitic cuckoos elsewhere.

The White-browed Scrub-Wren, unlike the specialized Rock-Warbler, is adaptable to various types of country, consequently, having a general distribution it is more often duped. Likewise in the choice of this nest we observe in the Fan-tailed Cuckoo a predilection for a certain style of nest, a domed structure on or near the ground. A curious situation sometimes arises from the low position of such nests. It may happen that the cuckoo's egg hatches before other eggs in the nest, and these when cast out by the usurper would lodge at the entrance of the structure and stay there. On the two occasions I have seen this happen the foster-parents seemed oblivious to the presence of their own eggs. In one instance, that of a Brown Thornbill (*Acanthiza pusilla*), the hen bird was sitting on the young cuckoo, then about two days old, while her own eggs containing dead chicks were within an inch of her head.

[1] Chance.—The Cuckoo's Secret, 1922.

The egg of the Fan-tailed Cuckoo seldom resembles those of its host; it is of a white ground, closely sprinkled all over with reddish and darker spots, which form a fairly distinct zone about the larger end, and its length is about $0 \cdot 86 \times 0 \cdot 6$ inch. Apparently the necessity for close resemblance does not operate here, and generally the birds duped are not unduly sensitive. Moreover, the fact that eggs are mostly placed in domed nests helps to conceal any incongruity in size and colour.

Immature Fan-tailed Cuckoos are dark brown above, with the feathers indistinctly barred. The underneath parts are lighter and more conspicuously marked.

THE SQUARE-TAILED OR BRUSH CUCKOO.

So similar is the Square-tailed or Brush Cuckoo (*Cacomantis pyrrhophanus*) to the preceding species that correct identification in the field is difficult. It is, however, slightly smaller and considerably paler in coloration; there is also a difference in the markings on the tail feathers, which when viewed from the back of the bird do not show the white toothed markings as in the Fan-tailed Cuckoo. In both species the tail feathers are tipped with white and the shoulders of the wing are similarly marked with a small patch of white. The surest way of distinguishing the Brush Cuckoo is by its unmistakable call notes, usually given from the topmost branch of some prominent tree. The predominant call is a series of from five to fourteen notes, each lower in tone than the previous note, though increasing in volume as they descend. The other call consists of either two or three series, each of three rising notes, with a final descending trill, as though the songster had suddenly lost the power of expression.

The name Brush Cuckoo was given by John Gould, who procured the first specimens in the cedar brushes of the Liverpool Range, New South Wales, on October 29, 1839. However, the bird is not confined to the thick coastal scrubs; excepting the central and south-western portions of the continent it ranges throughout Australia.

The majority of the nests used by the Brush Cuckoo are the beautiful cup-shaped

Young Square-tailed Cuckoo (C. pyrrhophanus). It is at this stage of its growth that it casts out the other occupants of the nest.
[Photo.—*K. A. Hindwood.*

homes of robins, and, to a marked extent around Sydney, those of the White-shafted and Rufous Fantails. It was from a nest of the latter species that I watched with fascination and, I must confess, with not a little pleasure, a recently hatched Brush Cuckoo casting out the rightful nestling. The cuckoo, about thirty hours old, blind, of a dark flesh colour and entirely devoid of feathers or down, struggled until the smaller and helpless fantail lodged partly on its back and partially against the wall of the nest, then, vigorously backing, the cuckoo gradually worked its way upwards with its back to the steep sloping side. During the early stages of the ejectment the neck of the cuckoo was stiffened so that its head rested against the bottom of the nest, thus giving the support necessary for attaining the initial position. Later, when nearing the rim of the nest, the neck and head hung limply downwards and in no way helped the cuckoo, whose body was now semi-upright but still pressed against the wall. The best illustration of the position can be gained by watching a duck partly rise out of the water and flap its wings, excepting, of course, the attitude of the neck and head.

Throughout the extraordinary act the wings of the cuckoo were constantly in motion and bent backwards to keep the hapless fantail in place, but it was not till the concluding movements that they became the paramount factor. Watching the cuckoo one almost felt that the wings, which were bent so far backwards that they frequently touched the wall of the nest, sensed all that was happening. Finally, with considerable exertion, and when the fantail rested on the rim of the nest, it was pushed over. After which the murderer, if such a term can be reasonably used, moved its wings about for a few seconds before reclining.

One marvels that at such an early stage of its development the cuckoo should have sufficient strength in its legs to accomplish its predestined task. Even the supposedly automatic actions, so vital to its future well-being, must forever be a source of wonderment.

The young cuckoo grows rapidly ; when a week old the quills enclosing the feathers commence to break and it occupies a considerable portion of the nest. Up to this age it has shown no resentment at interference, but from now until it leaves the nest in about another nine days it will viciously peck at an intruder, drawing its head back and striking sharply with its bill.

Statements to the effect that cuckoos possess the power of controlling the colour of their eggs so that they resemble those of their intended fosterers are misleading. Nothing could be further from the truth. Selection on the part of the foster-parent, by rejecting or deserting eggs unlike its own, is an important though not the only factor ; it would take hundreds, perhaps thousands of years to evolve a similarly coloured egg. It seems, also, that much depends upon the degree of specialization on the part of the cuckoo. The need for camouflage in open nests is generally greater than in domed structures. Thus in coloration the egg of the Brush Cuckoo resembles that of the White-shafted and also of the Rufous Fantail, two common fosterers. It is of a dull creamy-white ground colour, with a distinct band of purplish-brown spots round the larger end, and is smaller than the egg of its close ally, the Fan-tailed Cuckoo.

Fledgling Brush Cuckoos have buff tips to most of the upper feathers, with a slight bronze sheen to the darker parts. The under-surface is dull white, barred with brown.

Saving the Native Bear

In a previous number of this Magazine (Australian Museum Magazine, III, 4, 1927, p. 112) strict protection for the Koala was urged, on the ground that this quaint, interesting and harmless marsupial is becoming reduced in numbers, and is in fact threatened with extinction. We have now pleasure in directing attention to the praiseworthy efforts of Mr. Noel Burnet, who has been successful in establishing a sanctuary at West Pennant Hills, near Sydney.

For some years Mr. Burnet has made a close study of the habits and diet of the Native Bear, and at the present time he has a small colony of the animals at his home " Koala," Moir Avenue, West Ryde. Realizing that a fairly extensive piece of ground is necessary if success in saving the Koala from extinction is to be gained, he appealed for assistance to obtain an area of suitable wooded country which would provide a safe home for a Native Bear community, and, incidentally, a reserve for the protection of Australian birds, trees, shrubs and flowers.

To Mr. T. H. Kelly, who has generously assisted him to the realization of his wishes, is due the community's thanks.

C. A.

The Investigation of Ocean Waters

By T. C. Roughley and G. P. Whitley.

IN this, the third and last of a series of articles on the work of the *Dana* Deep Sea Exploring Expedition, the nature of the ocean waters will be considered.

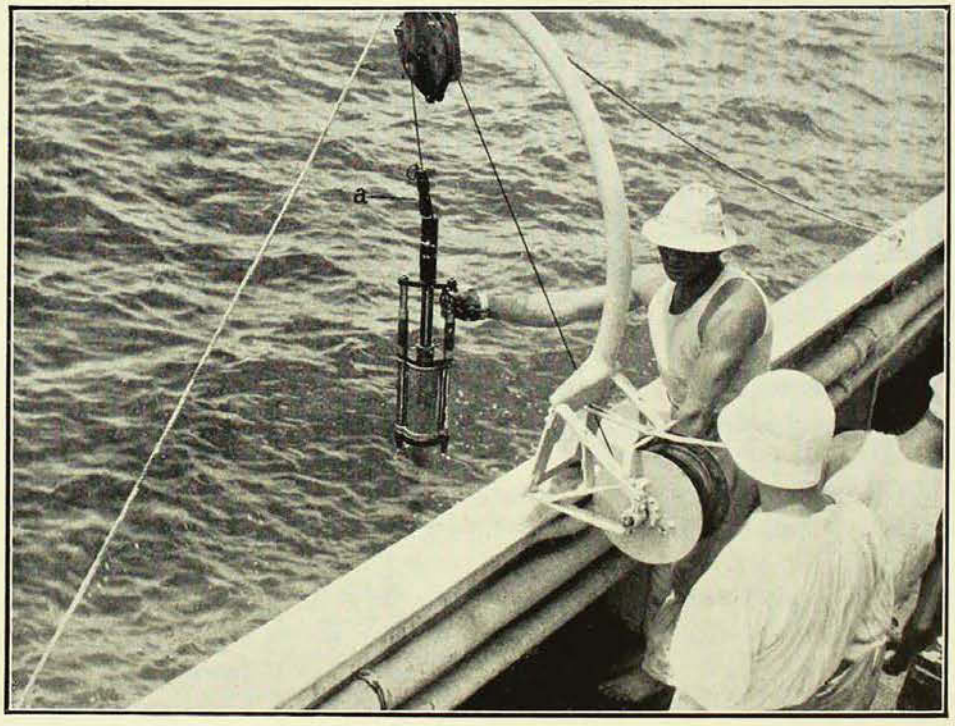
ANALYSING WATER FROM THE OCEAN.

When the last net is on board, the hydrographical work begins. For this work the boat is stopped. Water is procured in ingenious pieces of apparatus known as water-bottles, which are of two types—one for obtaining samples down to 150 metres, the other for use from a depth of 200 metres to the bottom. The former is attached, wide open, to a wire rope, and is lowered to the required depth, when a brass weight known as a "messenger" is dropped down the wire.

On hitting the top of the bottle a spring is released and the bottle securely closes. It is then hauled to the surface, and the temperature read in a well-insulated thermometer. The water is drawn off into glass bottles to await analysis. This type of bottle is not suitable for great depths, because, no matter how well insulated it may be, the temperature of the contained water is affected by the pressure. If water is compressed, its temperature is slightly raised.

For deep water a reversing bottle is used, and any number may be attached to the wire. If more than one is used it is necessary to attach a messenger to the base of each. The bottles are attached to the wire at both extremities.

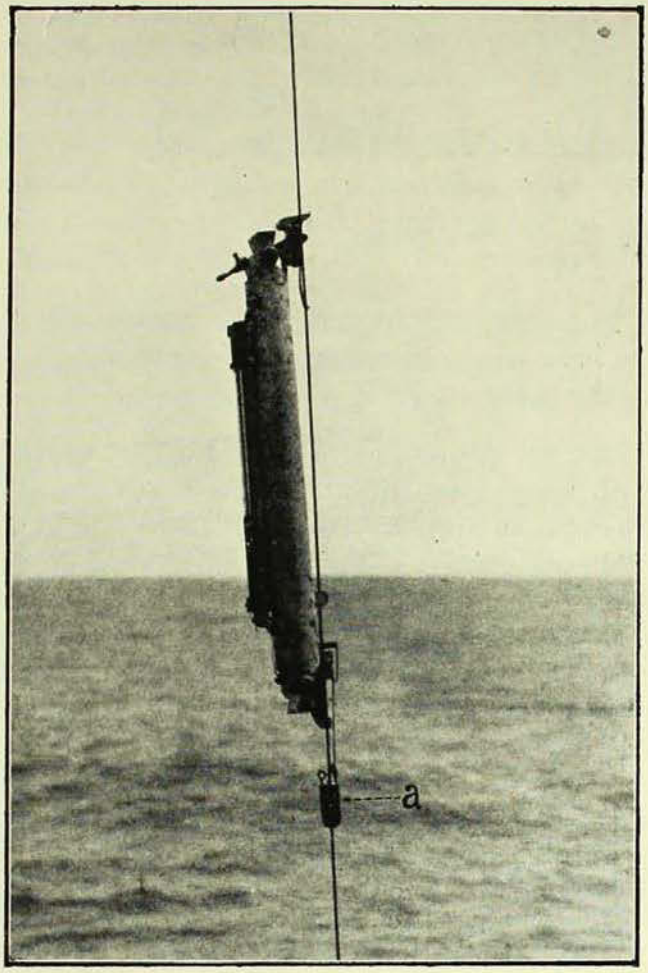
Let us suppose that six bottles of this type have been attached to the wire and lowered to depths ranging from 1,000 to 3,000 metres. A messenger is sent down the wire, and as soon as it strikes the uppermost bottle it releases the messenger attached to its base, which falls to the next bottle and releases its messenger, and so on to the lowest bottle.



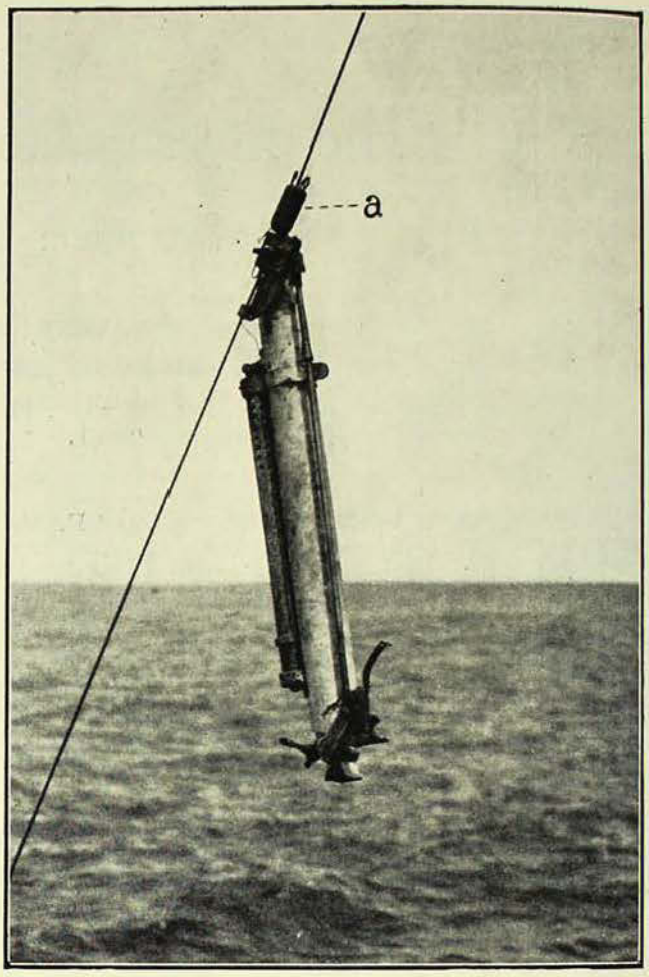
Hauling an insulated water-bottle on board. This type of bottle is used for obtaining samples of water at depths down to 150 metres. The metal messenger "a," which was sent down the wire, has released a spring and effectively closed the bottle.

[Photo.—*T. C. Roughley.*

When the messenger strikes a bottle it also disengages the upper extremity from the wire, causing it to fall over; in this way the column of mercury in the thermometer is broken, and, no matter what changes of temperature may occur



Reversing water-bottle, attached to the wire at both extremities, being lowered into the water. This type of bottle is used for recording the temperature and obtaining samples of water at great depths. Note the messenger " a " attached to the lower extremity.
[Photo.—*T. C. Roughley.*



Reversing water-bottle being hauled from the water. Note the messenger " a " which released the upper attachment of the bottle from the wire, causing it to close and turn upside down. By this action the column of mercury in the thermometer is broken and an accurate record of the temperature is obtained.
[Photo.—*T. C. Roughley.*

as it is hauled to the surface, the reading recorded at the appointed depth cannot be altered.

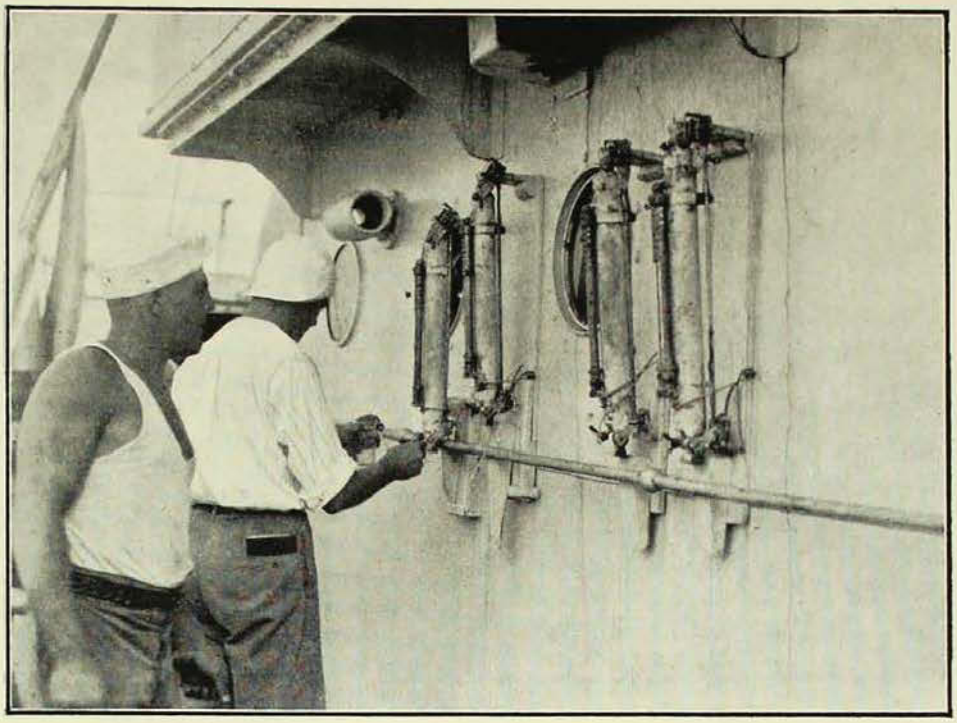
What is the effect of the pressure of water at great depths on the weight of an object? It is commonly supposed that if an object sinks into great depths it will reach a certain level when the pressure of the water will prevent it sinking further. This is entirely erroneous. Substances are practically as heavy in deep as in shallow water, and will sink as rapidly.

For instance, if a weight is run down a wire to close some apparatus, it will take just four times as long to reach its objective at 2,000 metres as it does to arrive at 500 metres. An object which sinks in a foot of water will go to the bottom no matter what the depth is. The most delicate shell, if it sinks beneath the surface, will ultimately reach the bottom, and the floor of the ocean is in many places coated with myriads of such shells.

The water obtained in the bottles is analysed for salinity, oxygen, phosphates and nitrates because on the amount of these constituents depend very largely the type and abundance of the organisms found in the water. The salinity is always greatest in the ocean, and decreases inshore, where fresh water is poured down by rivers. Oxygen is greatest at the surface and decreases generally to a depth of about 400 metres, below which it may again increase slightly. Of all the salts in solution in sea-water, phosphates and nitrates occur in least abundance, and the methods for their determination are extremely delicate. Their importance, however, cannot be over-estimated, for on their fluctuations the fate of many

organisms, particularly of Algæ such as diatoms, depends. An indication of the prevalence of plankton in the sea can frequently be obtained from the result of phosphate and nitrate analysis. In general, both increase in colder water and near the shore. There are also seasonal variations in any given locality.

In addition to serving as an index of the amount of plankton present in the water, chemical analysis will also frequently show the course taken by currents.



The hydrographer withdrawing samples of water from reversing water-bottles preparatory to analysing them.

[Photo.—*T. C. Roughley.*

PLANKTON.

On the completion of the hydrographical work samples of plankton are obtained. Plankton embraces the small animal and plant life, mostly microscopic, which is carried hither and thither by currents. It follows closely the phosphate and nitrate content of the water, and is more prevalent in cold water and inshore. The intense blueness and clearness of oceanic water well offshore is attributed to the relative paucity of plankton; in inshore waters the teeming myriads of plankton organisms render the water much more opaque, and give rise to the characteristic green colour so frequently observed in such situations.

Plankton forms the ultimate food of fishes, and a knowledge of its distribution and seasonal abundance is of prime importance in a study of the occurrence and migration of fishes. Two principal methods are used on the *Dana* for the capture of plankton; in the one case the net is towed behind the boat moving at slow speed; in the other the haul is a vertical one, with the boat stopped.

The latter method is used to determine the vertical distribution of the plankton. The net most frequently employed is of similar shape to, though much smaller than, those used for fishing, but the material used is fine silk, similar to that used by flour millers for sifting flour, with a mesh usually of 200 meshes to the lineal inch.

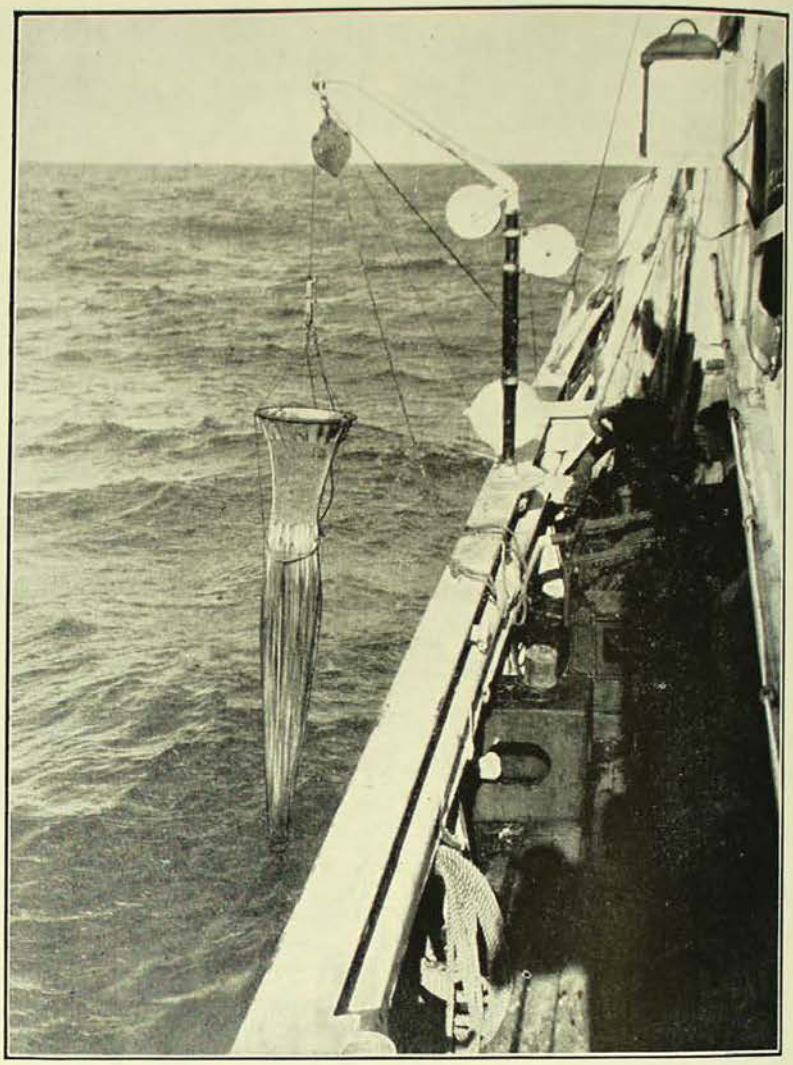
In order to recover organisms at any desired depth, the mouth of the net should be capable of being closed at will, otherwise many organisms would be captured while the net was being hauled to the surface, and a correct record of the types occurring at that particular depth would not be obtained. When the net has been hauled vertically for the required distance, a messenger is sent down the wire; this, on contact with the attachment of the net, liberates it, and the net is then held suspended, a little distance from the mouth, by a rope which effectively closes it.

The plankton is examined on board, but the great bulk of the work of classifying and counting the various organisms will be done in shore laboratories; then it will be possible to correlate the catches with the hydrographical conditions which obtained when they were captured.

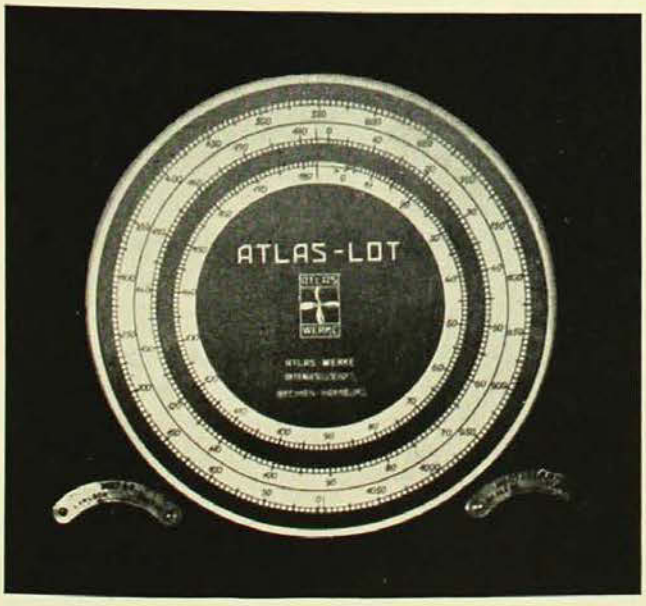
READING DEPTHS BY MEANS OF SOUND.

Perhaps the most intriguing piece of apparatus carried by the *Dana* is the echo sounder, by means of which soundings can be made from the shallowest water down to the greatest depths of the ocean in a few seconds with the boat going at full speed. The old method of sounding by means of wire was a lengthy business which necessitated the boat being hove to, and in sounding the greatest depths an hour or two would be required. The advantages of the echo sounder are therefore quite obvious.

Two pieces of apparatus are employed, one for sounding depths down to 180 metres, the other for use beyond that depth. In both cases use is made of a circular metal diaphragm let into the bottom of the boat. When making the shallower soundings a diaphragm about 12 inches in diameter is brought into play ; and when sounding below 180 metres a larger diaphragm with a diameter of 26 inches is used.



A plankton net, wide open at the mouth, being lowered into the water preparatory to making a vertical haul.
[Photo.—*T. C. Roughley.*



The dial of the " echo " sounder. By means of this apparatus the depth of water can be determined in a few seconds with the boat steaming at full speed.
[Photo.—*T. C. Roughley.*

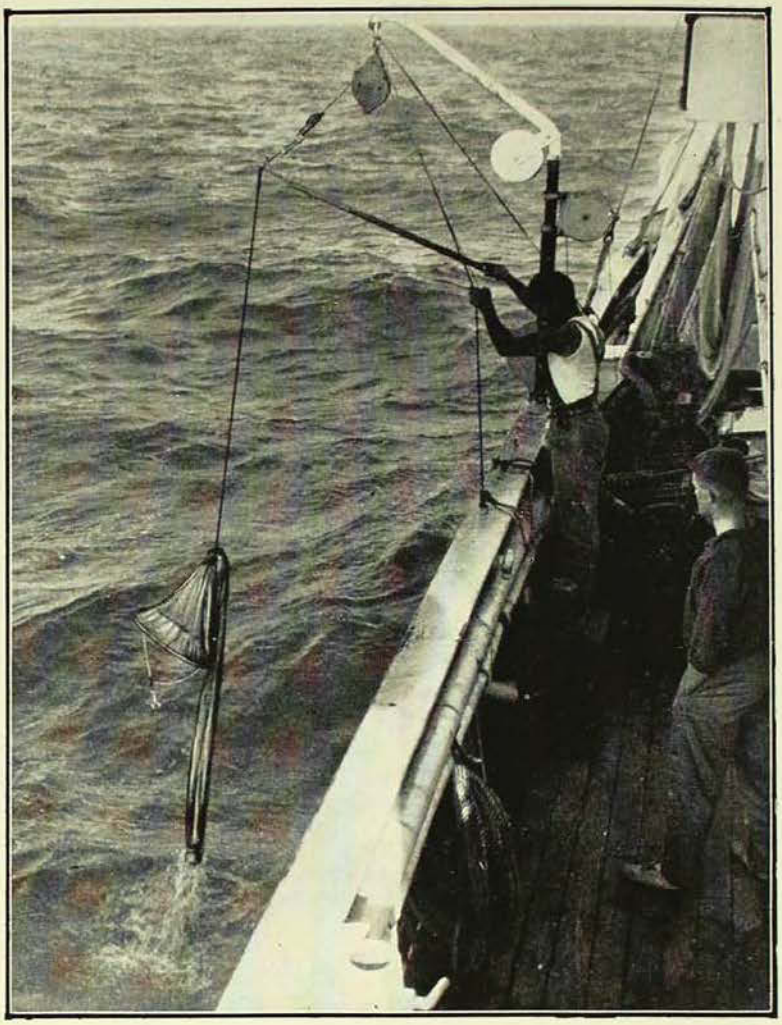
The principle governing the use of the instrument is the time taken for sound to reach the bottom and to return to the surface as an echo, hence the name " echo " sounder. The diaphragm is made to vibrate electrically at 1,050 vibrations per second, when it emits a musical note. By the time the echo reaches the surface it has become extremely faint, and it is necessary to amplify it very greatly by means of wireless valves. The average speed of sound through water is 1,500 metres per second, varying somewhat with the salinity and temperature.

The method of reading the depth varies according to whether it is below or above 180 metres. In both cases the depth is read off on a circular dial ; when shallower than 180 metres, a light flashes constantly opposite the figure recording the exact

depth; when a sounding is being made below 180 metres, a light revolves round the dial in a clockwise direction, and the operator uses earphones to catch the echo as it is received into the apparatus.

One revolution of the light indicates a depth of 1,100 metres. If the depth is, say, 3,370 metres, the light will have made three revolutions round the dial, and the echo will be heard as the light passes the figure 70. The depth then is $1,100 \times 3 + 70$, or 3,370 metres.

The installation of the echo sounder cost £3,000; this gives an idea of some of the expenses incurred by expeditions which have as their object the scientific exploration of the sea. Yet that this preliminary expenditure is justified is shown by results in the Northern Hemisphere. Here in Australia, we are only at the beginning of our oceanographical investigations, and much difficult work is ahead of us. For this, at least one investigation vessel and a shore marine biological station are absolutely necessary, but the expenses incurred in installing these should be more than repaid by the rich harvest which will be gathered in Australian seas.



The plankton net being hauled on board after the completion of the haul. Having been hauled the required depth a metal weight was dropped down the wire; this sealed the net and prevented any surface organisms from entering it.

[Photo.—*T. C. Roughley.*

Centipedes and Centipede Bites

By Keith C. McKeown.

YEARLY many inquiries are received at the Museum relative to centipedes and their bites, and these notes have been prepared in the hope that they will prove of value to those who are in any way interested in the effects of centipede bites.

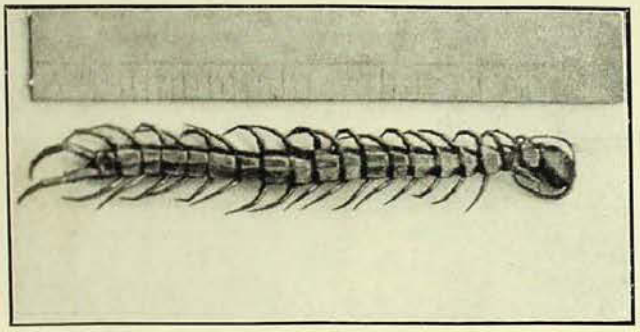
Centipedes belong to the class Chilopoda, and are widely distributed throughout the world. The giants of the family do not, however, occur in Australia, but are found in tropical countries, where they are generally feared by the inhabitants. Humboldt, the famous traveller, has related that the Indian children drag eighteen-inch centipedes from their holes in the ground and eat them with every

sign of enjoyment ; this, however, would appear to be an extreme case.

Contrary to popular belief, and although called centipedes, or hundred-legs, they only possess up to about twenty-four pairs of legs. In this connection it may be of interest to recall the old rhyme :

A centipede was happy quite
Until a toad in fun
Said " Pray, which leg moves after which ? "
This raised her doubts to such a pitch
She fell exhausted in a ditch,
Not knowing how to run.

Three species of centipedes are commonly sent to the Museum with requests for information as to their habits or for identification, namely, *Ethmostigmus rubripes*, *Scolopendra morsitans*, and *Allotheura maculata*.



A centipede, Ethmostigmus rubripes, which caused the death of a dog. The length is nearly six inches.
[Photo.—*K. C. McKeown.*

Ethmostigmus rubripes is the largest of the common species found in Australia ; it has also a wide distribution in other countries. It measures up to about eight inches in length, and may be distinguished by its cusped teeth, the teeth being three in number ; the stigmata, or openings along the sides of the body, are uncovered, and situated on the second and every alternate segment following to the end of the body.

Scolopendra morsitans is rather smaller than the previous species, and has four to five teeth on each side ; the stigmata are closed by means of valves. This centipede is cosmopolitan in its range. In coloration these centipedes are generally similar, and are of shades of brown, green and yellow ; they vary considerably however, so that colour does not prove a safe guide for identification.

The third common species is *Allotheura maculata*, the little " House Centipede," " Daddy-long-legs," or " Hairy Nanny," a curious little grey or brown creature, with very fine hair-like legs, which runs about upon the walls of houses, where it captures flies, small cockroaches and other insects. They have a curious habit of springing upon the fly so that it is surrounded by the palisade of legs, giving the captive rather the appearance of a hen in a coop. These small centipedes should be looked upon in the light of " friends " on account of the good work they do in the destruction of house or filth flies.

In spite of the almost universal dread in which centipedes are held there are few cases of bites on record, and, so far as I am aware, none have proved fatal to man in Australia. In several cases which came under my personal observation, the bite was accompanied by severe nerve pains, and, on recovery, the whole of the inflamed area surrounding the punctures gradually sloughed out like the core of a boil. These symptoms appear to be typical of those cases which have been placed on record.

In November 1929, Mr. J. Vlies, of Drummoyne, presented to the Museum a fine specimen of *Ethmostigmus rubripes*, measuring six inches in length ; he supplied the information that this centipede had been found coiled round the foot of a dog, a four-year-old bull terrier, and, although the wound was treated with permanganate of potash, the limb swelled, and the dog suffered great pain ; the following morning the dog was dead. This instance shows that, although a centipede bite may not usually be followed by fatal results in the case of a human being, yet it should not be taken lightly, and treatment similar to that for snake bite should be applied.

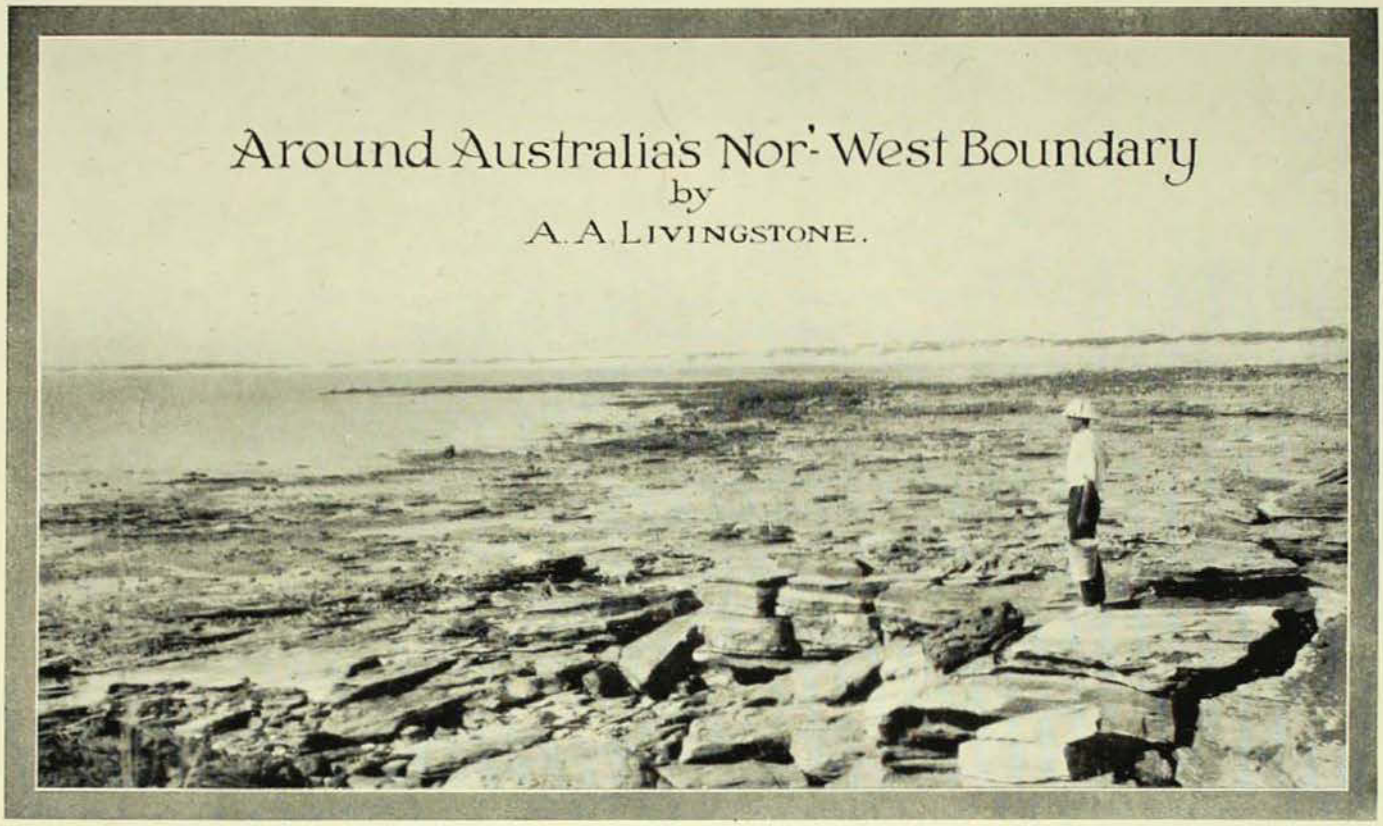
Although the long curved fangs are the weapons of aggression, the terminal claws are more or less poisonous, and leave a track of inflammation where they are allowed to come in contact with the naked skin.

Centipedes are carnivorous, but little is known with reference to their habits.

Around Australia's Nor'-West Boundary

by

A. A LIVINGSTONE.



The richest intertidal zone discovered by members of the expedition was at Gantheaume Point, Broome. Dr. Clark surveys the shore from the cliffs seeking a likely place to commence operations.
[Photo.—*A. A. Livingstone.*

THE coastline from Port Darwin to Broome is one of the wildest and most treacherous known. Huge tides and currents running around reefs and islands create mighty eddies which are capable of wreaking havoc to all small craft except the staunchest and best handled. Banks and jagged reefs of rock and coral combine with cyclonic storms to wreck the adventurous and add to the list of the perished along these little-known shores.

Wyndham, the first port of call after leaving Darwin, is situated near the head of the Cambridge Gulf in Western Australia. This vast expanse of muddy water is navigable for large steamers owing to the extensive rise and fall in the tide, and it is often a memorable sight to see at low water a huge steamer lying high and dry on the mud. The Gulf is bordered in places by low mangrove flats stretching for miles, while in other places the shore-line is made up of the northerly limits of the vast Kimberley Ranges. These mountain-like hills in the vicinity of Wyndham are remarkable for their almost complete cone-like shape, multi-coloured appearance and lack of substantial vegetation. In the wet season, or even in the dry, these hills are responsible to a considerable extent for the interception of any cooling breezes, with the result that the town has the reputation of having the highest average temperature in the world.

The town is an assemblage of small iron-roofed houses, occupied by Afghans, aborigines and a few whites. The meat-works, which take cattle from inland stations for canning and other uses, were the only active centre to be seen during our brief stay.

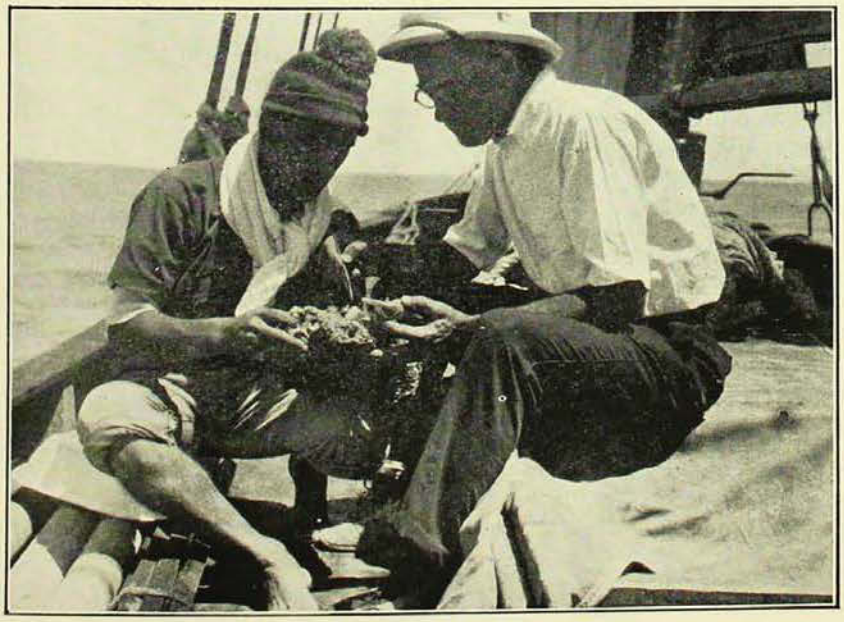
Derby, with its famed horse-tram and bottle trees, is situated at the end of King Sound. A vast plain, white in parts with caked salt, is warped and twisted by ever-changing mirages, and in the middle of this is Derby.

For the first article of this series see THE AUSTRALIAN MUSEUM MAGAZINE, IV, Part 1, 1930, pp. 6–11.

A hundred miles or so south-west across Dampier Land lies Broome, our home for some weeks to come. Roebuck Bay is the port of Broome, and stretches away like a sheet of shimmering cobalt blue southward from the town's snake-like jetty. At high tide the water approaches far up the sandy shore beaches, which are strewn with all sorts of debris brought in by the tide. Away on the horizon is the perpetual mirage, which alters the shape of the landscape and plays pranks with the white sails of pearling luggers. At low tide a change is wrought. No blue water, no beauty, simply a vast stretch of muddy sand stretching from the shore and terminating over a mile away. But here on this flat is a wealth of marine life that could not fail to delight the eye of any naturalist. Giant sea-anemones, sea-stars of handsome structure and pattern, and shellfish in abundance, all within easy reach and ready prey to unerring forceps. But haste has to be made for the tide comes in rapidly and hangs doggedly at one's heels as a reluctant retreat is in progress.

The waterfront at Wyndham, Western Australia. The township, which is composed mainly of an assemblage of galvanized iron huts, can be seen in the middle distance between the mangroves and the mountains.
[Photo.—*A. A. Livingstone.*

Our activities, however, must extend beyond the shore-line, and care must be taken to examine deep-water life as well as shallow-water material. With this in view a lugger was requisitioned and all the gear required for future trips deposited thereon. The owner-skipper of the craft had as his assistants two aborigines, Willie and Paddy. The first mentioned attracted our attention by his clothes. He was better clad than his dusky companion Paddy, but even this in no way qualified him as an exhibit in any respectable fashion parade. A hat, lacking most sadly both block and original colour and set at a somewhat rakish angle, covered a thatch of matted and tousled black hair. A jersey, obviously hand-knitted and possibly once cream in colour, hung like a large sack from his shoulders. The trousers, long past adequate repair and the despair of any tailor, were suspended from the waist and held there by two or three turns of clothes-line rope frayed at the ends. The knees of the trousers had gone, long gone, if the holes there were any criterion. But despite his taste

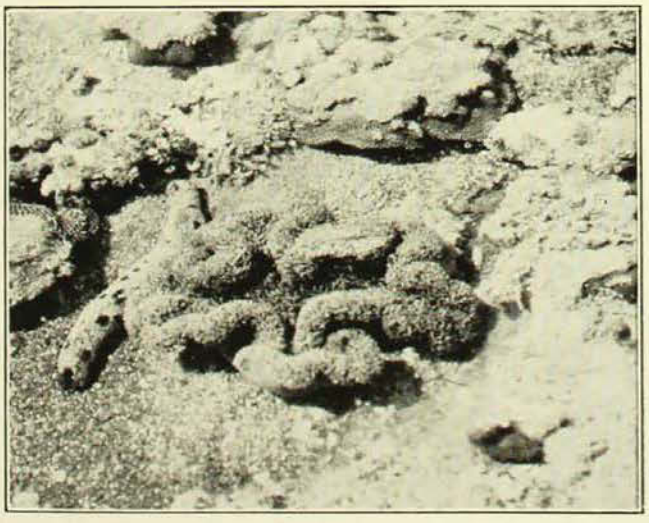


Dr. H. L. Clark (right) and the author examining a boulder brought up from the depths near Broome for minute forms of life.
[Photo.—*A. A. Livingstone.*

for clothes, and he had better ones to wear if he chose to, Willie was a sailor in a sort of a way, and knew his vessel in no uncertain manner when emergencies arose.

Out on the pearling grounds for which Broome is renowned the process of diving was made known to us, but a word first about the diver's spoils before telling of the methods adopted to get it. The young pearl shell before migrating to deep water lives under stones in rock-pools between tide marks. It is invariably attached to its rocky shelter by a fibre-like mass called a byssus. When the shell has reached a stage when it measures about five inches across, the anchoring byssus breaks down and liberates it, thus allowing a passage through the agency of the tide and currents to deeper water. When in deep water the shell lies on its side with the curved half buried in the mud or sand. The flat half of the shell is then uppermost, and by raising this the animal is able to communicate with the exterior and gather for itself the necessities of life. Matured shells often reach as much as ten inches across, perhaps more, and it is these that the divers risk their lives daily to secure. The pearl shell is used mainly for the ornamentation of such things as knives and other cutlery, besides a host of other things that lend themselves to beautification by the addition of beautifully polished mother-of-pearl shell.[1]

Willie on the left smokes and strikes a characteristic attitude while his black companion and boss work upon a load of sandal wood secured near the Ninety Mile Beach, Western Australia.
[Photo.—*A. A. Livingstone.*



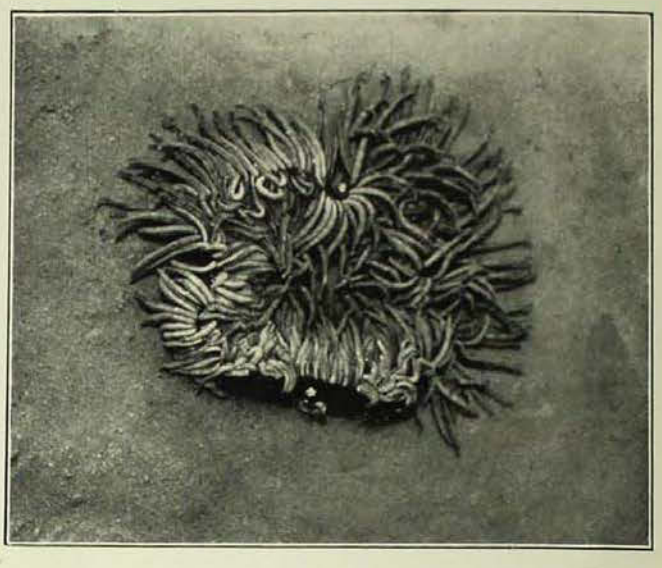
A characteristic anemone of the tidal pools. This green species often measures as much as fourteen inches across its tentacle-laden folds. Alongside is the common sea-cucumber, Holothuria sp.
[Photo.—*A. A. Livingstone.*

Our diver, with his diving suit fully adjusted and inflated with air to partially counteract the water pressure, and helmet securely in position, was ready to descend. His life-line was tested as well as his air-pipe, so that tangles which would endanger his life would be prevented. Making his way to the ship's side, laden with a necklace of lead weights and ponderous leaden-soled boots, he slid down a short ladder and fell backwards into the sea and gradually sank like a huge inflated sack. By adjusting an air-tap on the side of his huge brass helmet a descent is made possible and the air escaping from his dress in the form of bubbles indicates his position at all times. As the diver sinks the vessel sets sail and moves gently forward, dragging him along over the sea floor in search of shell. By dragging the diver along the bottom a greater area is covered in the exploration of shell than if he were left to walk. A tug on the life-line signals

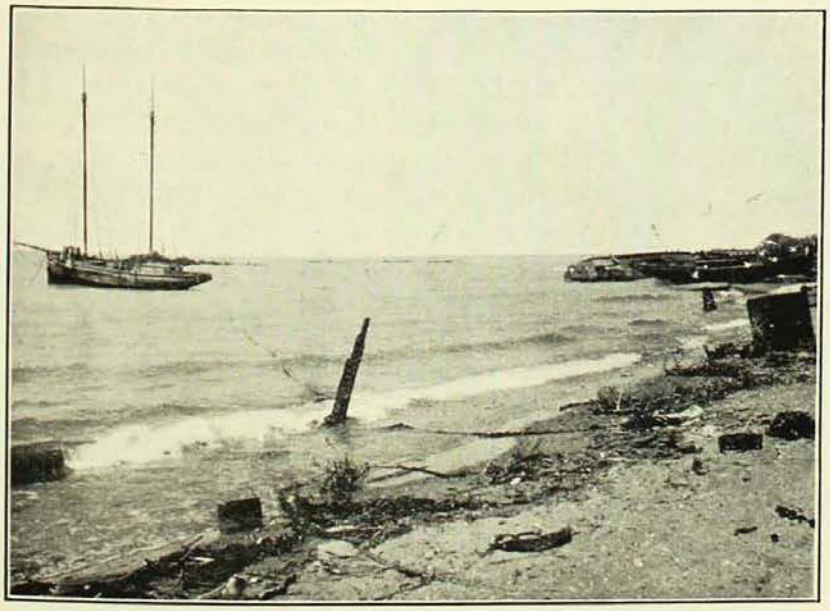
[1] An account of Australian Pearl Fisheries, by C. Hedley, will be found in this MAGAZINE, Vol. II, p. 5, 1924.

the discovery of a shell, when the lugger is brought into the wind and the diver given time to secure his find. When his small cane basket is full he is hauled inboard for a "breather." The basket never failed to attract us the instant it was brought to light, for, besides the shells, it contained small quaint crabs, giant sea-stars of great rarity, and wonderfully branched sea-ferns and coral. On forcing open the large halves or valves of the pearl shell and looking between the inside layer of nacre and the mantle of the animal we sometimes find small irregularly shaped free objects. These are pearls. In size, shape, lustre and colour, pearls show a most remarkable range of variation. A valuable pearl is one of good colour, lustre, and symmetry, either round, ovate, pear-shaped, or some such pleasing shape. Round pearls are in greatest demand because of their use for stringing into necklaces. Good pearls, however, are scarce, and the vast majority secured are of little value because they lack some essential quality. Low-quality pearls are called barique (pronounced barrick), and are used mainly for mounts in mediocre jewellery. This term is apparently a degenerate usage of baroque, which was originally applied to all pearls of irregular shape even if of great value.

A pearl is formed by a foreign body entering the valves of the shell and causing irritation. As the mollusc is, in most cases, unable to eject the body, it must deal with it in another manner to reduce the discomfort caused by its presence. To do this it is necessary for the animal to deposit about the foreign body layer upon layer of material called nacre, which ordinarily is used to line the inner surface of the shell. This has the effect of smoothing off the rough edges and so allaying discomfort and irritation. Sometimes boring worms assail the shell from the outside, and by steady and persistent work reach the inside edge. To combat the worm's invasion the pearl-shell animal concentrates its effort upon piling on the point of entry a considerable amount of nacre, which ultimately looks like a mound or blister. These blisters are sometimes round, and not infrequently many are found together like a bunch of grapes. Good pearl blisters are valuable, and the use to which they can be put depends upon their structure and size. Sometimes blisters are carved for mounting in the form of bunches of grapes, sometimes shaped like butterflies or baskets of fruit, but no matter how they are dealt with their beauty



Sea anemones occur in great abundance on the flats at Broome. The present example is typical of many found anchored in the sand.
[Photo.—*A. A. Livingstone.*



A portion of the beach at Broome, where the tide falls as much as thirty feet. The black patches in the distance are the tips of mangrove trees which are fully exposed at low tide.
[Photo.—*A. A. Livingstone.*

always remains to gladden the eye of a modern aphrodite.

Towards evening sail was set for home with a good haul and a better knowledge of the mysteries of the deep. Willie was at the tiller crooning some childhood song with his mind seemingly divided between his proper task and his stolen enjoyment. His feet were tangled in loose rope ends and his eyes half closed. Still crooning, he untangled his feet and commenced to strum with his fingers on the deck ; then his feet took up the time of his song. Mumbled words entered the chant, louder grew the strumming, louder grew the pounding of feet, and the babble of words louder than anything else. In a few seconds he was well into the throes of some tribal war song, shouting at imaginary companions or enemies in a deafening manner. The patience of our skipper was, at this stage, about exhausted, for he silenced the dusky Willie with words truly nor'-western in both tone and character. Willie stopped and stared, and, in forsaking this (his favourite pastime we came in time to learn), gave his entire attention to bringing the craft safely home to her anchorage.

A typical scene on the nor'-west Australian coast. The hatless trio are half-castes, the children being almost pure white.
[Photo.—*A. A. Livingstone.*

Insects and Disease

SOME FURTHER ASPECTS OF APPLIED ENTOMOLOGY.

By Keith C. McKeown.

THE science of medicine, one of the oldest of all sciences, is, in some of its aspects, intimately connected with that of entomology, and to co-operation between the medical man and the entomologist the world owes the unlocking of the wealth of the tropics. No longer do ships stagger into port, or drift helpless derelicts, their crews dead or dying from "Yellow Jack" or yellow fever. The ports of South America, once hotbeds of disease, are now among the healthiest in the world, and open to ships of the seven seas. The Panama Canal is a great memorial to this union of the two sciences. During the attempt made by the French under De Lesseps to construct the Panama Canal, over 50,000 men perished from the ravages of malaria and yellow fever, but when the project was finally carried out by the United States, after its recommencement in 1904, the death-roll from disease was almost negligible, owing to the draining of swampy areas and the scientific methods

which were evolved to meet the mosquito menace.

Africa, the "Dark Continent," has been opened up, and slowly but surely the plague spots of the earth are becoming habitable for man, and the romance of the investigation of insect-borne diseases passes forward to further conquests and further fields in human endeavour in the subjugation of the powers of Nature.

In ancient myth and legend one can find glimpses of the truth of the relationship of insects to the spread of disease, but for many generations this truth was deeply buried beneath mountainous accumulations of prejudice and superstition. It is only within recent years that the human race has begun to awaken to the true interpretation of the facts, and, as a result, our outlook upon many insects as the enemies of man has undergone an almost complete reversal, for in the early records we find insects looked upon, not as enemies, but as important contributions to the pharmacopœia; for instance, millepedes steeped in wine was considered to be a certain cure for a number of ills to which the flesh is heir.

LEGEND AND EARLY HISTORY.

The theory has been advanced, with some considerable degree of probability, that the decay of the Greek, and later the fall of the Roman civilization, came about owing to depopulation and the de-energizing effects brought about by malaria.

The ancient Greeks seem to have been aware of the prevalence of malaria in the vicinity of swamps. Homer (say about 1100 B.C.) mentions what was very likely malaria (*Iliad* XXI, 31). The old story of Empedocles of Agrigentum (say 550 B.C.) recounts that he delivered Selinus, in Sicily, from a plague by draining its marshes or, for accounts vary, by turning two rivers into them. This sounds remarkably like modern methods in mosquito control. In Italy, the Roman legend of Hercules and the Hydra is supposed to symbolize the draining of the Lernian Marshes. The Roman Campagna remained until recent years a fever-infested swamp where malaria was rife, but, instead of realizing the true cause, the people closed their doors in the vain belief that the fever was due to the night mists, or bad air, from which the name malaria is derived.

In olden times life in the marshy areas must have been rendered almost unbearable by the myriads of mosquitoes which arose from them. Herodotus first mentions the use of mosquito nets in Egypt, and frequent references are to be found in the literature of ancient Rome, where, however, their use was looked upon with scorn as a sign of extreme effeminacy. Columella, writing about the first century B.C., says that the bogs bred insects armed with stings and pestilent swimming and creeping things from which came obscure diseases; while in the writings of the hermits who lived on islands in the English Fens, many of their visions and their encounters with fiends are obviously pictures conjured up by fever-disordered brains.

In 1494 there was great mortality from yellow fever among the followers of Columbus, and the chronicles of the Elizabethan adventurers and their voyages on the Spanish Main are full of pictures of the ravages of yellow and other tropical fevers.

THE USE OF INSECTS IN PHARMACY.

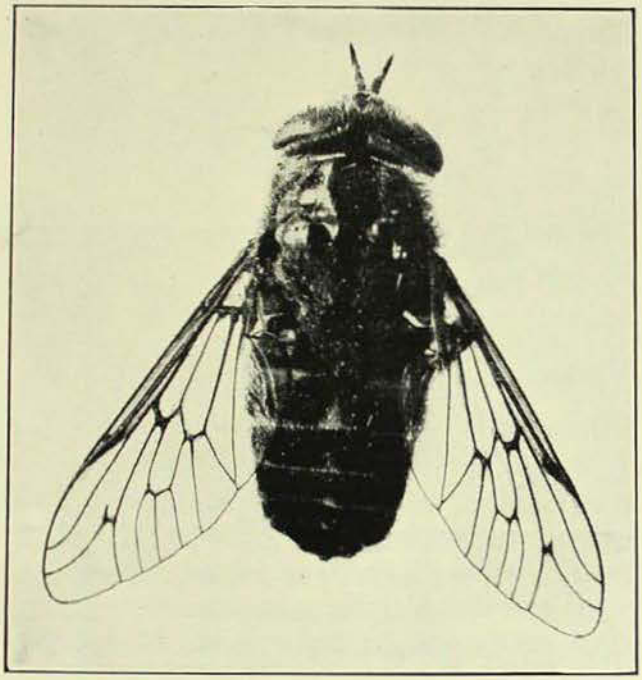
In the Middle Ages and later, the insect comes into its own, for a while, in its use in medicine. In ancient pharmacy ladybird beetles were considered an infallible specific for toothache, colic, and measles; the dose unfortunately is left to the imagination. The egg-capsules of the mantis were given as a cure for toothache and chilblains, and this superstition still survives in Southern France, now however, more as a charm against, rather than as a "cure" for the complaints.

Almost the sole survival of insects used as drugs at the present day, with, perhaps, the exception of cochineal as a colouring matter, is the blister beetle, or Spanish fly (*Cantharides*); this was first employed in healing at a very early date. Hippocrates is said to have administered it internally as a cure for dropsy, apoplexy, and jaundice. Aretaeus, a Roman physician, who lived in the first century, is supposed to have been the first to use it in creating blisters.

THE MODERN VIEW OF INSECTS AND DISEASE.

Flies and Mosquitoes.

The majority of the insect enemies of man are included in the order Diptera, or two-winged flies, which includes many blood-sucking forms, and, by virtue of this propensity, these insects are of great importance to medical science, since



A typical March fly (Tabanus froggatti). March flies are inveterate blood-suckers and are under suspicion of being carriers of disease. About four times natural size.

[Photo.—*G. C. Clutton.*

the pathogenic organisms of some of the most deadly diseases are transmitted to man and his domestic animals by the agency of these involuntary carriers. Economically mosquitoes are of the utmost significance owing to their acting as vectors, or carriers, and intermediary hosts of malaria, yellow fever, dengue, filariasis, and a number of other diseases—an awe-inspiring catalogue of diseases in wait for those whose ways lie in tropical and sub-tropical lands.

The researches of Sir Ronald Ross on the *Plasmodium* of malaria has all the fascination of a romance. It is impossible to go fully into his work here, but the bare facts are these : after a long period of investigation, attended by many disappointments and at best varying success, Ross, in 1897, made the great discovery, which was to revolutionize the world, that the Anopheline mosquito was definitely the carrier of malaria, and he was able to infect mosquitoes with the disease. The next link in the chain followed in 1898, namely, the successful infection of healthy sparrows by mosquitoes previously fed on diseased birds, proving definitely that the mosquito was capable of transferring the malarial organism from one patient to another.

In 1899 an American commission sent to Cuba proved conclusively that yellow fever also was carried by a mosquito, *Aedes egypti*. In this work the names of Reed, Carroll, Agramonte, and Lazear will live in history, for, with great heroism, they faced the risks of infection, and some of them gave their lives in the cause of science to save their fellow men from the horrors of " Yellow Jack." *Aedes egypti* is also the carrier of dengue fever, which is well known to residents of Queensland and northern New South Wales.

Other workers have proved that the cosmopolitan *Culex fatigans*, the common house mosquito, together with other species, transmits *Filaria bancrofti*, which produces elephantiasis.

Sambon has advanced the theory that the disease known as pellagra, and found in certain districts in Italy, is transmitted by *Simulium*, another member of the order ; the disease appears to be confined to those areas where the insect is prevalent.

Another group of flies, which are of considerable economic interest and world-wide distribution, are the March flies (*Tabanidæ*) ; these insects are well known in the bush in the summer months for their vicious, blood-sucking habits, and the persistence with which they hover round their victim awaiting a favourable opportunity to alight and pierce the skin. They are under grave suspicion of carrying several diseases in human beings, and are definitely known to convey disease to horses and cattle.

In Africa one finds the notorious Tsetse flies, members of the genus *Glossinia*, which are vectors of the pathogenic organisms causing sleeping sickness. *Glossinia palpalis* transmits *Trypanosoma gambiense*, *G. morsitans* carries *T. rhodesiense*, the Rhodesian form of the disease, and also transmits *T. brucei*, which causes

a disease known as *ngana* among domestic animals. Considerable research has been carried out in South Africa relative to the disease, and appreciable success has been achieved in some areas.

Perhaps the best-known, and certainly amongst the foremost insect carriers of disease is the common house fly, or, as it is better described, the filth fly, which has an important bearing on the health of man as the carrier of diarrhœa, typhoid fever, and a number of other diseases, as well as being under suspicion as a vector of others, which are at present, however, obscure, and offer a wide field for research. The eggs of various intestinal worms are also conveyed to the food of man by these insects. The filth fly breeds in filth and excrement, and the bacteria, which teem in these sources of contamination, adhere to the feet and body-hairs of the fly, and when the insect walks over the porridge, or falls into the breakfast milk jug, it liberally infects these with the germs of disease. Screening of windows and doors, the destruction of breeding places, and proper sanitation are essential in the war against what is, perhaps, one of the deadliest mechanical disease carriers and enemies of man. The excrement of the flies, together with food which they regurgitate, are heavily charged with living bacteria.

Fleas.

The familiar flea is also to be numbered among the foes, for at least eleven species have proved capable of transmitting bubonic plague; in particular, the rat flea (*Xenopsylla cheopis*).[1] The rat and other rodents are particularly susceptible to the disease, and the flea becomes infected with the plague bacillus by feeding upon the diseased rat, from which it migrates to man. Excretory matter from the flea, in addition to infection by means of bites, is also capable of causing the disease if introduced beneath the skin by scratching. The chief factor in the control of bubonic plague is, of course, the destruction of rats, thereby cutting off the disease at the fountain head before it can be distributed by the fleas.

[1]Ferguson, THE AUSTRALIAN MUSEUM MAGAZINE Vol. I, No. 4, March, 1922.

The Rat Flea (Xenopsylla cheopis), the carrier of Bubonic Plague from rat to man.

[Photo.—*R. Grant.*

Lice and Disease.

Pediculus humanus, the common louse of man, is perhaps concerned with the transmission of more human diseases than any other insect, chief of which is typhus fever; this disease is transmitted direct from the insect by means of punctures made in the skin by the mouth-parts of the louse. During the Great War 1914–18, the complaint known as trench fever was proved to be transmitted indirectly by this insect, the crushed bodies of the lice and their excreta causing infection through abrasions of the skin.

The Cosmopolitan Bed-bug.

The ubiquitous bed-bug (*Cimex lectularius*), prevalent in dirty houses, is under the strongest suspicion as a carrier of diseases, including leprosy, while its near relative, *C. rotundatus*, is responsible for the dissemination of kala-azar in India.

In view of the recent birth of modern methods in medico-entomology one can only look upon the progress which has been made to date as wonderful, and the future holds the hope of the control of these insidious enemies of man in their rôle as carriers of disease, and the years to come will add yet more chapters to one of the most fascinating romances of modern science, the investigation and control of insect-borne diseases.

What is the Life Span of a Bird?

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

"Longest life is but a day."—*Wordsworth.*

ARE eagles exceptionally long-lived birds? How long will a canary live? Do large birds live longer than small ones? These and a host of such questions are being asked every day by "the man in the street," but are seldom answered correctly. When an answer is forthcoming it is only with a great deal of reservation, because it depends on whether the inquirer means a bird in captivity or one in the wild state. If the former a fairly correct answer can be given, provided, of course, that the bird's age was known when captured, but if the latter only a guess can be made.

There have been occasions when certain wild birds have been recognized from time to time by some peculiar marking, a white head, feather or patch on the wing, and there have been records of marked examples having been observed by several generations of people in the same district. Little reliance can be placed on observations relating to birds with peculiar markings, because almost identical abnormal markings may be common to several succeeding generations of the same species, and what might be taken for the original bird might be an offspring once or more times removed, with the result that ages exceeding one hundred years have been attributed to species which we are fairly certain do not live longer than thirty years at the outside. Furthermore, abnormal markings may come and go with moult and age, and the bird be lost or mistaken for another in this way.

It is obvious that wild birds cannot be compared with those kept in captivity, as they are exposed continually to many dangers, such as food shortage, vagaries of the elements, the ravages of birds and beasts of prey, and to man. On the other hand, some species may not live as long in captivity as they would under normal conditions in the wild state, while other species may not be able to adapt themselves to the environment of a confined space and the semi-domesticated conditions of a captive state. Some may die from over-attention, over-feeding, while others, among which are the majority, die from lack of attention.

It would appear that parrots and birds of prey live longer than others, and that, speaking generally, large birds live longer than small ones. This is quite reasonable, because the small species are not so well fitted to do battle with the elements, and, furthermore, many of them fall victims to the larger ones, and to mammals and reptiles. In regard to this I might say that the majority of large birds can hold out against hunger longer than the small ones can, and thus are able to avoid death from starvation when a temporary food shortage occurs. Eagles and allied birds of prey are noted in this respect, some species having been known to live without food for more than twenty consecutive days, a condition which would be fatal to the great majority, if not all, small species, such as wrens, robins, finches, flycatchers, and a host of others. It has been suggested by various authors that the period of incubation might have some bearing on the length of life, but such suggestions have never got beyond the stage of hypothesis, and I doubt very much if they ever will. Some naturalists have thought that those species which lay only one egg live longer than those which lay two or more, and in support of their arguments have stated that a census of different species in a given area over a number of years shows that the different species observed maintained a comparative uniformity in numbers. This statement deserves some consideration and investigation, and may help solve the problem,

or at least narrow it down, because the numbers of birds is governed by the abundance or scarcity of food, and this in turn has a marked influence on the duration of life. Though many theories have been put forward none have yet been fully tested, so we can say that we do not know the age to which a bird will live in its natural state. This means that, when making statements relating to the ages to which birds live, we must restrict our remarks, more or less, to birds in captivity and those which, while not being in aviaries, are living in a semi-domesticated state.

Turning our attention to aviary birds, we can find several records which show that goldfinches have lived for over twenty years, while the well-known English blackbird has been known to survive for over twenty years of life in a cage.

Though finches are tiny birds and not usually credited with long life, there are many which can boast to having lived, or should I say existed, for over eighteen years in aviaries. We should imagine that birds which are hatched and reared in a cage would produce, in time, offspring that would become so accustomed to the changed environment that their length of life would greatly exceed that of allied species which might be brought straight in from the bush, but such is not the case, for canaries are usually considered old at the early age of fourteen years.

There are one or two records of canaries having survived for about twenty years, but usually the little songster comes to a sudden end after a dozen or so years through bursting a blood vessel while in the middle of its early morning song.

Ravens and crows live to great ages, but while numbers of old-time stories tell of ravens over a hundred years of age, the average life span does not exceed thirty years. An occasional specimen reaches a grand old age, but the oldest on record is one which attained its sixty-ninth year. Parrots and cockatoos can claim pride of place, as there are at least two records of white cockatoos which exceeded the eighty mark, while the well-known Cocky Bennett, a bird which was practically naked in his latter years,

"Cocky Bennett," about 110 years old.
[Photo.—*Thompson and Wilkinson.*

and which used to scream out "One more . . . feather and I'll fly," was declared to be over one hundred and twenty years of age when he died, but, even though there is no authentic information available regarding his actual age, he must have been very near, if not more than, the century at the time of his death. He was a well-known identity at the Sea Breeze Hotel, Tom Ugly Point, near Sydney, belonging to Mrs. S. Bennett, the proprietress, who had him in her possession for about twenty-six years. He was given to her by Captain George Ellis, of Tanner's Island, who, at the age of nine years, was apprentice to a South Sea Island sailing ship, at which time the bird was owned by the captain of the vessel. Ellis eventually became captain of this ship, and he used to stay with Mrs. Bennett, then Mrs. Bowden, of Bowden's Hotel, Elizabeth Street, Sydney, when in port. Captain Ellis died in 1898, but left the cockatoo to Mrs. Bennett on condition that she would never part with it.

The Long-billed Cockatoo or Corella is credited with having survived for over forty years, though the only authentic records do not exceed twenty-nine years of captive life. Some Galahs have lived in cages for more than thirty years (what a prison life it must have been), and I know of one which lived with one family for twenty-nine years; its name was Bill, but when in its thirtieth year it laid an egg, the shock was too great and it died. A Galah which came into the possession of the Museum during the year 1924 was reputed to have lived in captivity for forty-seven years. The black-backed magpie, more commonly known as Maggie, is more often kept in a free, but semi-domesticated state than in captivity, and I have known of several which ate pests in suburban gardens for upwards of fifteen years, while the record, as far as I am aware, is twenty-eight years. I have record of a magpie called "Jacko" which built a nest at the age of fifteen years and laid an egg, after which its name was very quickly changed to "Maggie." Among the birds of prey several eagle owls (European birds) have been known to live in the wild state for about forty years, while one in particular, a captive bird, attained the great age of sixty-eight. While these ages are authentic there are several for which there is no confirmation which have been given as eighty years. On more than one occasion eagles have been credited with over forty years in captivity, while there are unconfirmed reports of two which reached the age of eighty and one hundred and four years. Australian wedge-tailed eagles (eagle hawks) probably live quite as long as other eagles, but, apart from one which lived for over twenty years in the London Zoological Gardens, I have no other record.

Condors and vultures might be classed with eagles, as there are several records of specimens having lived ages ranging from thirty to fifty-two years in a captive state. Cranes, herons, and storks also live to an old age, the average ranging from thirty to forty years, though a heron which was captured in Bavaria in the year 1878 had been ringed sixty years earlier. It might be noted here that the ringing of birds is the only method by which their ages in the wild state can be authentically recorded.

Ducks, swans, and fowls of the domestic class do not live particularly long lives, for obvious reasons, though there are records of over twenty years to their credit. There is one record of a domestic goose which lived in Great Britain for eighty years, and though it is not usual for the poultry farmer to allow so much time for his products to fatten, I have heard it stated at times that certain legs or wings served at table must have belonged to birds which came out of the Ark.

Regarding the many questions asked at times concerning the ages of birds, I cannot close without giving some which were published in the year 1899 by Mr. J. H. Gurney at the conclusion of his paper on "The Ages to which Birds Live," and they are as follows:

(1) Are birds of some families longer lived than others?

(2) Do female birds live longer than males?

(3) Are birds which are long in incubation therefore longer lived?

(4) Do large birds live longer than small ones?

(5) Do birds in general live longer than mammals?

(6) Do birds which lay only one egg live longer than birds which lay two?

Since Gurney's time quite a number of workers have been investigating the matter, but not very much progress has been made. One of the latest of these is Major S. S. Flower, who, in the *Proceedings of the Zoological Society of London*, 1925, wrote an extensive paper on the longevity of birds in captivity or restricted freedom, and he says: "Twenty years hence there should be real evidence available as to the length of life of birds in their wild, free state." He answers Gurney's questions as follows:

(1) We do not yet know. We only know that some birds live better than others in conditions of captivity. The birds that probably have the shortest lives in a state of nature are the small Passeres and the smaller members of the Gallinæ.

(2) We do not yet know.

(3) The available evidence does not suggest so.

(4) As a general rule, yes.

(5) A few species of mammals have a specific longevity exceeding that of any bird. Many species of mammals have a specific and potential longevity far lower than that of any bird of which we have records. In general, birds live longer than mammals.

(6) The available evidence does not suggest so.

As is evident the longer an individual bird lives the harder it is to prove the facts of its longevity. As far as our present knowledge goes, no species of bird has a specific longevity of thirty years. But many species of birds have a potential longevity of over thirty years.

For those readers who are interested enough to want to follow this subject, I can do no better than to advise them to read Major Flower's article, " Contributions to Our Knowledge of the Duration of Life in Vertebrate Animals—IV. Birds," and wherein they will find a fairly complete bibliography of the subject.

The Auckland War Memorial Museum

THE former Auckland Museum, situated in Princes Street, had long been inadequate for the proper housing of the valuable collections, and, before the Great War, the Curator, the late T. F. Cheeseman, had urged the erection of a new building. Early in 1918 the Auckland City Council offered a site in the Domain, and promises of financial assistance were readily obtained. A public meeting of Auckland citizens was held in October, 1920, to consider the question of providing a fitting memorial to those who had taken part in the War, and it was decided to erect a museum as being the most appropriate. The cost was estimated at £200,000, and a strong Committee of Citizens was formed to raise funds. The response was most gratifying, and in August, 1925, the foundation stone was laid. The building was completed in August 1929, and the opening ceremony, which was attended by Mr. W. W. Thorpe, of this Museum, took place on November 28.

The building, for which competitive designs were invited from all parts of the world, is designed on the lines of the Parthenon of Athens, and is a dignified and beautiful structure, simple in its contours and suggesting strength and solidity. The stone was obtained from the Portland quarries, England, which have furnished the material for St. Paul's Cathedral and many other historic buildings.

This magnificent Museum, with its spacious Court of Honour, midway in which stands the Cenotaph commemorating the deeds and sacrifices of New Zealand's soldiers, may be regarded as largely a gift from the people of the Province. A sum of no less than £231,614 was subscribed by the Government and people for the erection and equipment of this noble building, a proud memorial to the fighting forces of the Dominion and a museum worthy to house and display the rich treasures of the Auckland Institute. Of this amount the Auckland Savings Bank contributed £50,000, the New Zealand Government £37,500, the Auckland City Council £10,000, the Auckland Racing Club £5,065 18s. 10d., the Auckland Harbour Board £5,000. Various firms and private citizens subscribed £93,000, individual amounts ranging from £2,000 to one shilling. The separate Cenotaph Fund totalled £6,796 5s. 0d. The people of New Zealand, and, in particular, the citizens of Auckland, may well be proud of this fine achievement, which is both a lesson and an inspiration to other communities, including our own.

C. A.