The AUSTRALIAN MUSEUM MAGAZINE

Vol. XI, No. 1 Price—TWO SHILLINGS

Sugar Glider eating a cicada.

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THE AUSTRALIAN MUSEUM

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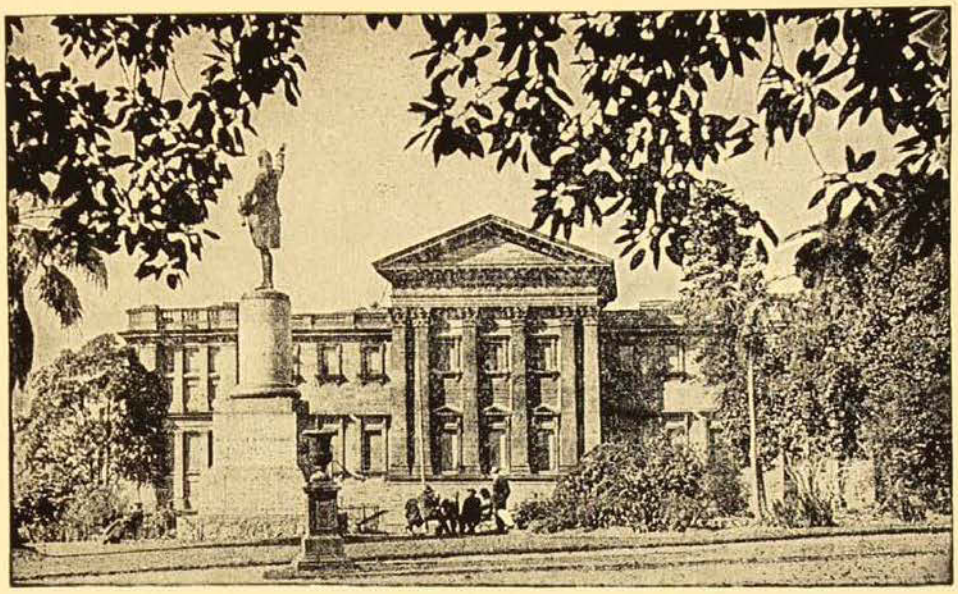
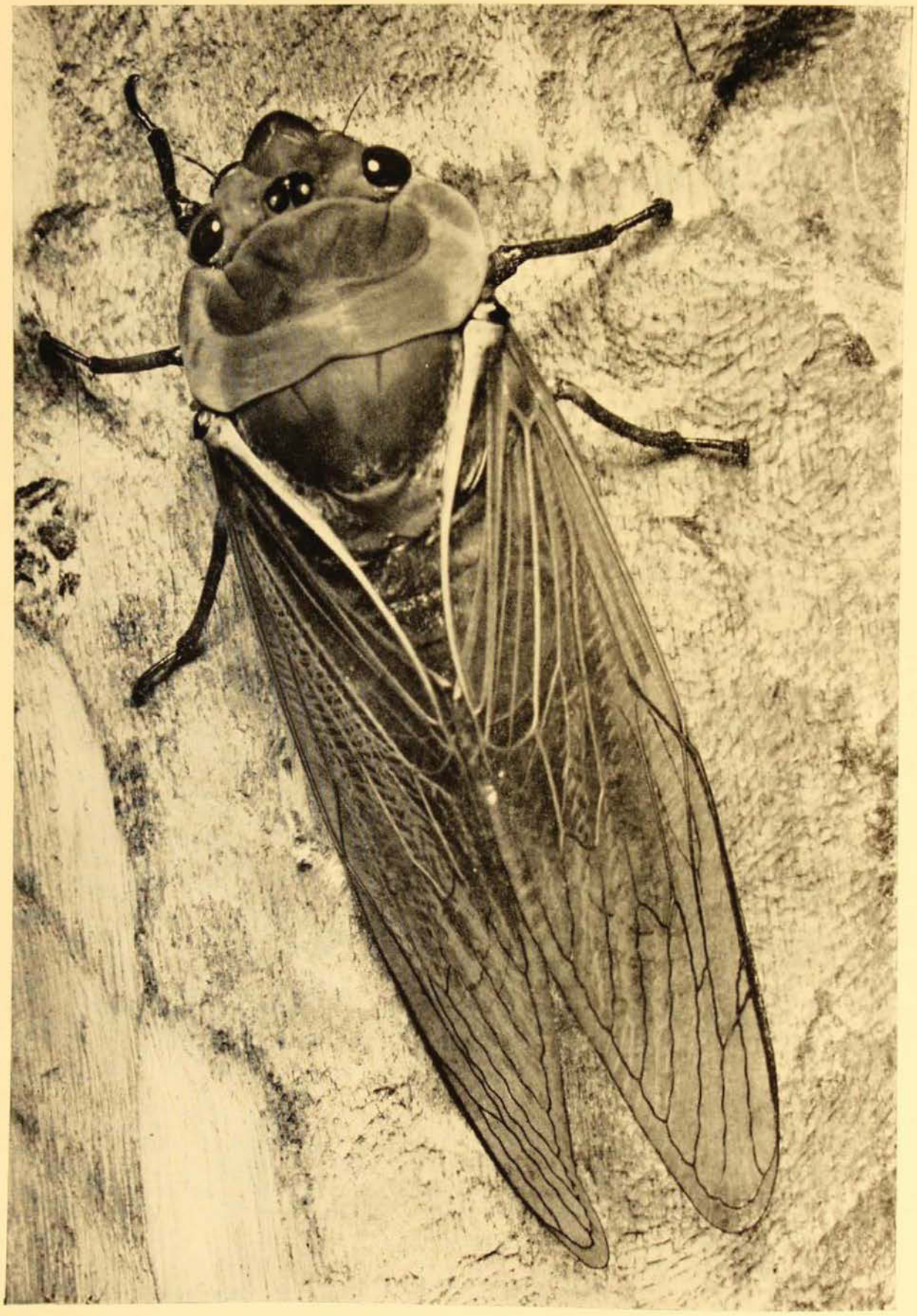


THE AUSTRALIAN MUSEUM MAGAZINE

(Photography, unless otherwise stated, is by Howard Hughes, A.R.P.S.)

● OUR FRONT COVER. The Sugar Glider (*Petaurus breviceps*), shown eating a cicada, is the second smallest of the Australian possum or phalanger family capable of gliding flight by means of skin-webs developed between its limbs. Because of likeness to foreign squirrels, and fondness for jam and other sweets, the first settlers called it "Sugar Squirrel". Nectar from blossoms and wattle-gum provide the natural sweetening of its insect food. It inhabits the scrub and forests of eastern Australia.

VOLUME XI, NUMBER 1. MARCH 15, 1953.



The "Yellow Monday" Cicada (*Cyclochila australasiae*). See article on page 10.

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Vol. XI, No. 1. March 15, 1953.

We Visit the Forrest River

By ALLEN KEAST, B.Sc.*

AN hour after dark we joined the mission launch. It was lying against the wharf, rising steadily as the muddy incoming tide swelled up Cambridge Gulf. We were en route to the Forrest River Mission, some fifty miles up the meandering stream from Wyndham. It was to be our next collecting area and one towards which, after hearing accounts of its animal life from the Superintendent, Rev. Keith Coaldrake, we were looking forward with considerable excitement.

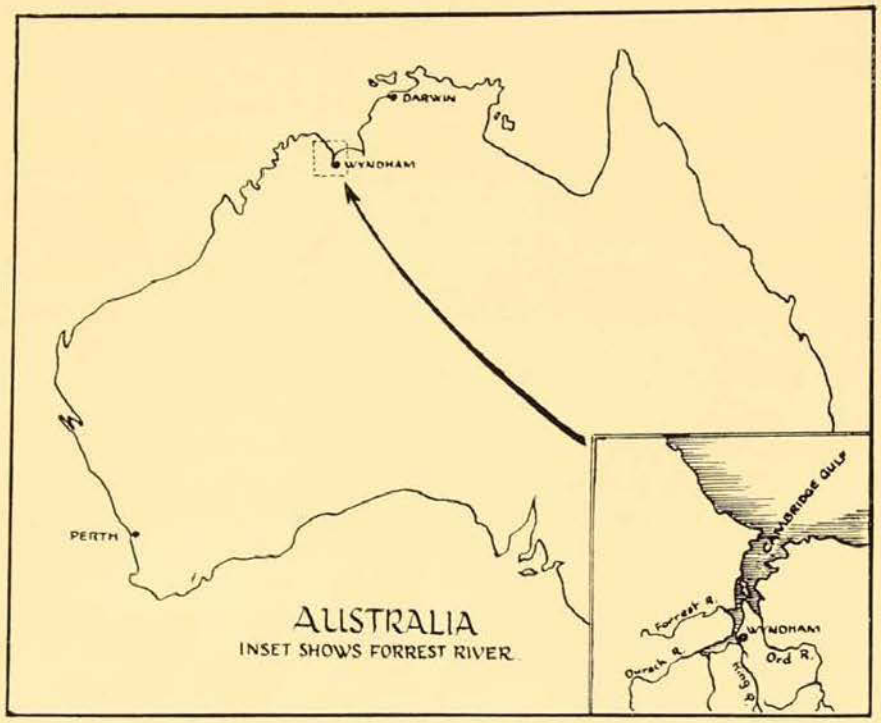
The launch was a trim craft, 30 feet in length. Her skipper was Gerrard and his crewman, James, educated and well-spoken natives who had an intimate knowledge of the waterways they negotiated. At high water the launch moved into midstream, a steady breeze bringing quick relief from the sweltering humidity that had been our lot for the previous few days. The night was dark, there was neither moon nor clouds and the stars reflected plainly on the stirring waters. Gerrard held the course directly outwards from the shore, away from the twinkling lights of the town and towards the mangroves of the far shore, dimly outlined against the skyline. Then the launch turned towards the mouth of the Gulf, seeking the break in the mangroves that would be the mouth of the Forrest River. The water journey was extremely pleasant after so much overland travel and one soon fell to reminiscing about the previous few days. Overnight camps in drying riverbeds, daylong drives along shallow Kimberleyan valleys, rugged mountains, yellow-flowering kapok trees silhouetted against the sky, and acres of pink everlastings where chance rain had fallen, had been features of the journey from Hall's Creek. And there had been the delight of coming on to the bitumen road a few miles out of Wyndham and then, finally, the picking up of mail, having an iced beer, and a full day of hotel accommodation.

We anchored at midnight a short distance up from the mouth of the Forrest River, Gerrard explaining that it was necessary to await the dawn tide before proceeding up to the Mission. A cup of primus-made tea formed our nightcap and we turned in for the night, lulled to sleep by the breeze and the gentle lapping of the wavelets on the side of the boat.

Gerrard was abroad again before daylight. One heard the anchor being raised and the engine start up and we clambered on to the deck, not wishing to miss any of the journey upstream. The first light of dawn revealed the stream to be wide and its banks lined by mangroves, broken here and there by a small creek draining the extensive forests beyond. Then the river

* Photographs by the author.

narrowed and passed through the hills. The launch followed the channel, now being in midstream, then sweeping close in to a towering cliff. A few miles further on we emerged on to broad flats. The stream now became wide and shallow, its banks muddy and ill-defined, and taking wide, sweeping bends that doubled back on themselves. Water birds were abundant. Groups of migratory waders fed on the still partly-exposed flats—Bar-tailed Godwits, Sea Curlews, Large Sand Dotterels, and others—species that by now (May) should have left on their long migratory journey to their breeding grounds in Siberia. Here and there a stately Jabiru preened its



Left—Sketch map of Forrest River area.

Below—Part of the Forrest River Gorge, upper reaches of the river. The pools are fresh, lily-strewn, the home of the little Johnson's Crocodile, barramundi and flocks of large Magpie Geese. The rare White-quilled Rock Pigeon and Woodward Shrike-thrush frequent the stony plateau and valley floor and about the cliffs the Little Wood Swallow flutters and glides.

The nocturnal curlew which, dazzled by the light, fluttered into the hut one evening.

feathers on the bank and Gerrard pointed out an island where the birds had nested earlier in the year. White-headed Stilts and White Egrets fed along the bank and, on rounding a bend, we put a small group of Pelicans to flight. The Forrest River is a haunt of the big estuarine crocodiles and we were constantly on the alert for them—but it was not until the return journey that we were rewarded.

At 8.30 a.m. the landing place came into sight—a group of bottle-trees and a wooden cross, the latter marking the site of the first landing in the area. It was at a point where the channel swept in right against the bank and we stepped ashore to be greeted by the Rev. Coaldrake and a large group of natives. With so many helping hands we were soon loaded onto an old thirty hundredweight truck and en route to the Mission. The buildings lay a quarter of a mile ahead, a group of perhaps twenty interspersed with bottle trees. Over a cup of tea we met the members of the

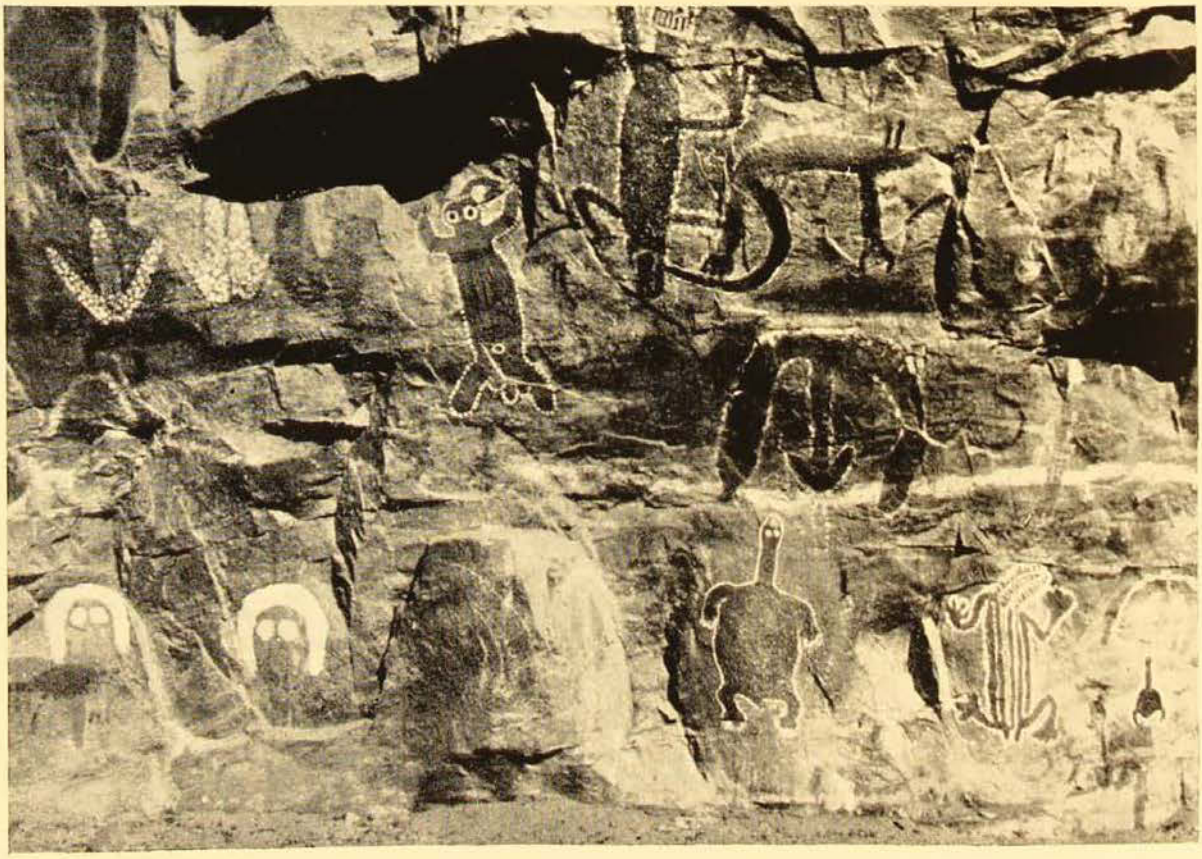
Head of the White-quilled Rock Pigeon.

Mission staff and the Right Rev. the Bishop of North-west Australia, who was staying at the Mission. And here we really did live in luxury, being allocated a well-ventilated hut, comfortable beds, and electric light.

Later in the day, with Mr. Coaldrake, I made my first collecting excursion. It was to a tract of scrub at the foot of the plateau behind the mission and across a grassy plain to Thataway, a drying waterhole a mile to the west of the Mission. That Mr. Coaldrake was a fine naturalist we knew and he proved to have a very sound grip of the animal life of the area. In a thicket of *Pandanus* he introduced the White-gaped Honeyeater and the Great Bowerbird, the latter a large brown bird with nape of delicate pink. Twenty other bird species followed, including the Yellow Silvereye, Black-rumped Double-bar, Yellow-throated Miner, Red-breasted Babbler, and such familiar old friends as the Singing Honeyeater, Peewee, Wagtail, Rainbowbird, Jacky Winter, and Kestrel. A large flock of Pink-eared Duck and Grey Teal were seen on the waterhole, and the Brown Quail, Horsfield Bushlark, and Fantail Warbler, on the plain.

The second day of our stay was a momentous one for we visited a large freshwater pool on the upper reaches of the river known, because of its attractiveness, as "Camera Pool". The route lay along a prepared motor track, over some five miles of rocky plateau, and parallel to the recently-installed pipeline that brought the domestic water supply to the Mission. Immediately behind the Mission the track mounted a steep slope known as "The Jump-up". It then passed through savannah woodland with little undergrowth for the ground was covered with loose fragments of quartzite rock. A rare treat was in store for both the rare White-quilled Rock Pigeon and Red-plumed Pigeon were found to be inhabitants of these outcrops. A vantage point yielded a magnificent view of the river, stretching northwards towards Cambridge Gulf.[1] A few miles further on we arrived at Camera Pool, lying at the foot of a steep red cliff, its water clear, cold and deep. It was fringed with scrub, the home of Crimson Finches and Lovely Wrens, and large purple waterlilies were

[1] See last issue of the AUSTRALIAN MUSEUM MAGAZINE, X, 12, December, 1952, p. 382.



Below—Native lad with pet goshawk.

Above—Native boys go swimming in the waterhole among the flowering lillies.

scattered over its surface. It is a favourite swimming place of the native children and to see them diving and coming to the surface amongst the lilies was an attractive sight.

From Camera Pool we followed the river upstream. It was now a series of rocky pools, lying in the floor of a deep valley skirted by tall cliffs. Groups of Magpie Geese could be seen about the pools and here and there we flushed parties of Grey Teal, a Darter, or one of the herons. Robert, one of the native elders, explained that the little freshwater Johnson's Crocodiles were numerous here. The broken valley floor proved to be an excellent place for the Rock-pigeons and so inconspicuous were they that it was most difficult to see them before, with a clatter of wings, they took

Right—The pet dingo.

Opposite page—The native art gallery. Turtles, a crocodile, emu footprints and several symbolic human forms are represented.

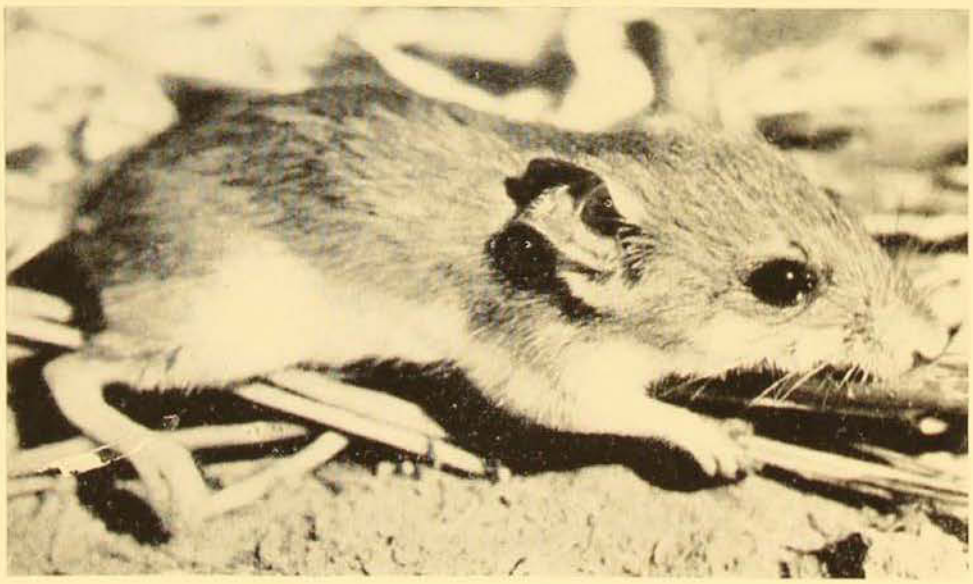
Left—Reggie, the pet brolga.

Below—Susie, one of the mission children.

flight. Another interesting inhabitant of these parts which we were able to collect for the Museum was the Woodward Shrike-Thrush, a rare bird confined to the north-west. It is about the size of the common Grey Thrush, but is shy, keeping well hidden amongst the scrub and stones. Its melodious single call-note echoes across the valley much more often than the bird is seen. Reptiles were plentiful in the valley, especially Agamid and skink lizards and occasionally a Brown Snake (*Demansia modesta*) and attractively patterned Water Snake (*Fordonia leucobalia*) were sighted.

Further up this valley is a splendid gallery of native paintings, animals and ceremonial figures in bright ochres that are in excellent condition and we paused to take a series of photographs. One can climb out of the valley just near here, up a broken talus slope, sighting an occasional rock wallaby, and with the pretty Little Wood Swallows wheeling and fluttering about one.

By the third day our collecting was well under way. The taxidermists had set up their working quarters on the verandah of the hut and soon had an admiring audience of natives lining the rail. The children in particular were a delight, full of fun, clean and bright-eyed, and every one with perfect teeth. They could speak



The little field mouse.

English well and never tired of our company at the Mission or in the field. And soon we had their co-operation in the collection of specimens: insects, frogs, snakes and lizards arriving in ever-increasing numbers.

On the succeeding days a wide coverage was made of the country around the Mission. Rock wallabies were collected on the riverside cliffs, the small boys and I went bird-shooting in the mangroves and on the plain, and there was frog collecting by torchlight. We traded tobacco with some of the old people for specimens of the plain goannas. And there was the humorous morning when a party, a dozen strong, sought native mice (*Pseudomys*) on the river bank. These little mice, which are about the size of the common domestic mice, but fawn-brown in colour, burrow into the sandy loam. The technique employed in catching them was for one of the older boys to wield a mattock, carefully turning over the soil so that the mice would not be injured, whilst the others stood around ready to pounce on the luckless animals. The sight of the quarry caused the greatest of excitement, the mouse usually biting two or three hands (and being dropped each time) before it was eventually secured in a bag.

The Mission people had several interesting pets. There was a tame dingo with a fine red coat that would have done justice to a pedigreed dog. One lad had a peewee, another a goshawk. But favourite of the whole village was Reggie, the Brolga. Reggie had been reared from a young chick, but had full freedom and was wont to come and go as the whim took him. He was said to be friendly with two wild Brolgas which would fly over periodically and call to Reggie who would immediately become very excited, finally leaping into the air and spiralling after them. Reggie was on "walkabout" when we first arrived. Then about the fifth day an excited cry rang out "Reggie is back". And there, at an altitude of perhaps 2,000 feet was the Brolga, neck and legs outstretched, wings rigid and slightly flexed, parachuting towards the ground in that fantastic manner that only Brolgas have. A minute or two later he was on the ground, making gentle trumpeting noises as he moved amongst the people in search of titbits.

One of the most interesting incidents towards the end of our stay was a visit, with Robert, to a drying waterhole across the plain from the Mission. I was armed with a small .410 gun for collecting birds and he with the typical three-pronged bamboo fish spear. I had a very successful day getting such interesting species as the Parson and Crimson Finches, Red-Collared Lorikeet, Silver-crowned Friarbird, Rufous-throated Honeyeater, and others.

Robert, one of the tribal elders, is a fish-spearing champion. This catch, barramundi and water goannas, came from a drying pool, 50 yards long and 15 inches deep, and was made in a couple of hours.

But my "catch" was dwarfed by the amazing collection of fish that Robert succeeded in spearing. The waterhole was perhaps fifty yards long, but was nowhere more than about fifteen inches deep. When he first waded into the water I remember thinking: "Isn't the standard of living of these people low—no fish of more than six inches in length could be living there." Then, before my amazed eyes, he pulled out a barramundi a foot in length followed by several others, two water goannas, and finally topping off the whole effort with a fish some twenty inches in length that must have weighed seven or eight pounds. I am still wondering how that fish managed to fit in so small a pool!

We were indeed sorry when the time came to leave Forrest River. One cannot be too grateful for all the trouble taken by Mr. Coaldrake and the staff to make our visit a successful one. And successful it was for we brought back a very comprehensive series of animals from the area. It was a revelation to find what fine people the Australian natives are when given a chance. To us they were most considerate and no effort was too great to help us collect things we sought. Young and old were splendid company and after listening so long to disparaging remarks on the cattle stations one felt badly about not acknowledging earlier that they have all the human qualities we treasure so much. Our final memory of Forrest River was the schoolchildren gathered on the riverbank singing, "Now is the Hour" as the launch pulled away from the shore. It was a wonderful farewell and left us with a keen longing to return.

Seasonal Occurrence of Cicadas

By A. MUSGRAVE.

IN the Sydney district every spring cicadas appear in greater or less numbers, giving rise to speculation as to the reason for their absence or their apparent superabundance.

The common cicada of the Sydney suburbs, though it occurs also in the city itself, is the Yellow Monday or Greengrocer, *Cyclochila australasiae*, which received its scientific name from Edward Donovan as far back as 1805. Though these cicadas are so common little is known of their habits. They are believed to be most abundant every third year, but it would seem that very wet conditions preceding their emergence may play a part in the diminution of their numbers causing a dislocation in their usual cycle.

How *Cyclochila australasiae* derives its popular name of "Yellow Monday" is not clear. Captain Watkin Tench, in his work, *A Complete Account of the Settlement at Port Jackson, In New South Wales*, &c., 1793, p. 121, relates meeting with an aboriginal named "Yèl-lo-mun-dee", but nowhere is it stated that this name was linked with that of the cicada.

As long ago as 1888 Dr. J. C. Cox, a well-known naturalist of his day, published in the *Abstract of the Proceedings of the Linnean Society of New South Wales*, for 31st October, 1888, p. vi, a statement,

"that he wished to place on record the regularity with which the large green cicada makes it appearance each year in the neighbourhood of Sydney. For the last 17 years he had noted the dates, which he found to range from October 14th to 30th."

This statement would, if checked, be found to agree with the times of emergence of the insect at the present era. What we are still not sure about is the time of life spent underground, or its full life cycle. From October to the end of January is the period spent above ground by the *adult* insects, or for those individuals who escape their many enemies.

Herewith are tabulated seasonal or phenological observations gleaned from press cuttings kept by me during the past few years:—

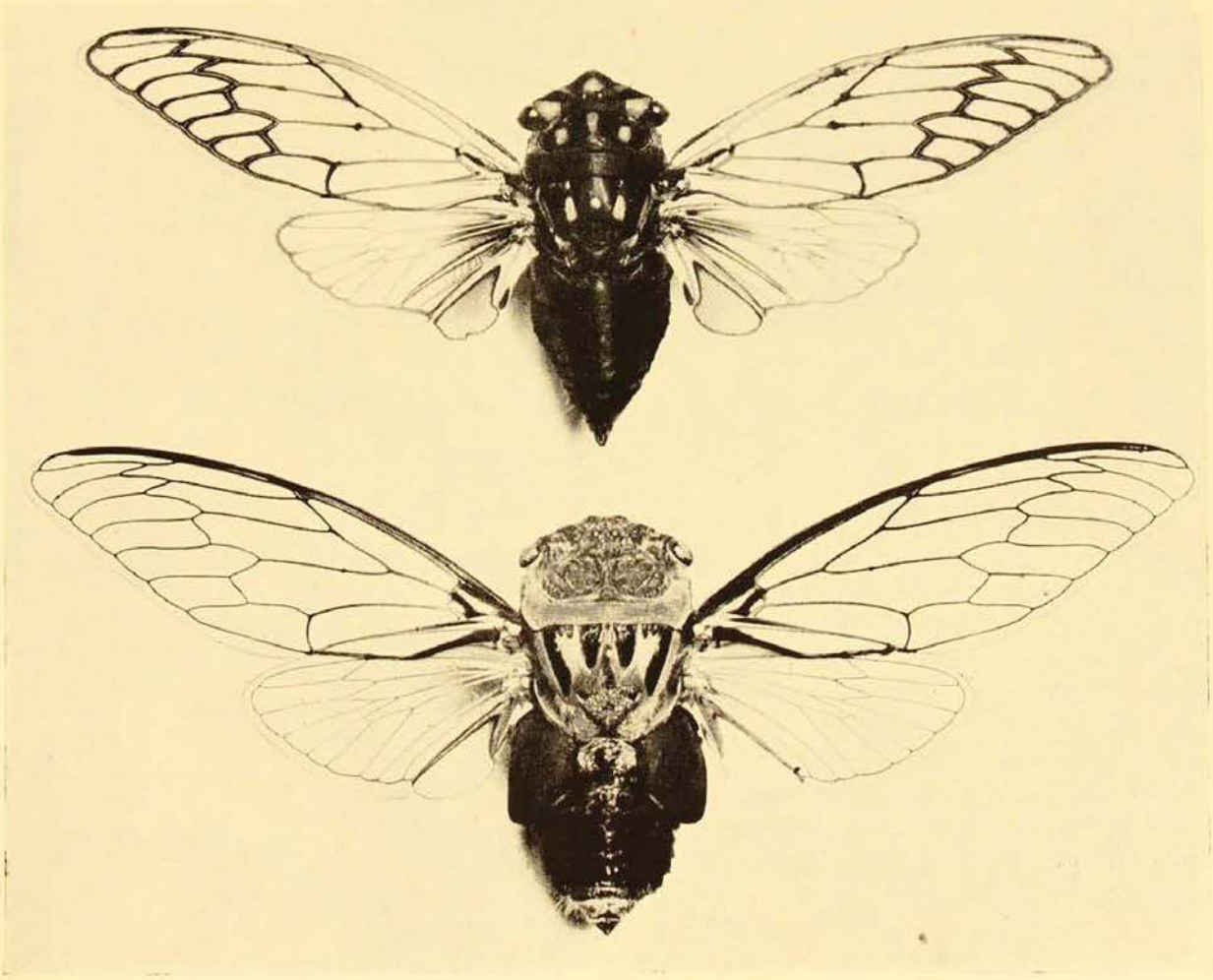
Season	Relative abundance	Source of information
1948–49	few	"Kanangra", *Sydney Morning Herald*, 30 December, 1948.
1949–50	many	"Waratah", *Sydney Morning Herald*, Thursday, 1 December, 1949.
	,,	W. H. Kinsela, *Sydney Morning Herald*, Saturday, 10 December, 1949.
1950–51	few	"Kanangra", *Sydney Morning Herald* Playtime.
1951–52	few	*The Sun*, Friday, 4 January, 1952.
1952–53	many	*Sunday Herald*, 2 November, 1952.

THE 1952-53 SEASON.

The last season of October, 1952-January, 1953, proved to be a "vintage" year for cicadas in the Sydney district and on the neighbouring Blue Mountains. About Wahroonga, on the North Shore line, where the author resides, some 14 miles from Sydney, cicadas were heard calling on the 16th October at 6.30 p.m., but the cicada orchestra was not at its full strength in the tree tops until November.

The English Oak, which grows well in the gardens and parks about Sydney, is highly favoured by this chief cicada songster of the Sydney district, the Yellow Monday or Greengrocer, and the late W. W. Froggatt in an article, Cicadas ("Locusts") and their Habits, published in two sections in the *Agricultural Gazette of New South Wales*,[1] refers to this predilection on the part of this insect. In the garden at Wahroonga is an English oak upon the butt of which I counted some dozen empty "pupal" shells one Sunday morning in October, while around about the foot of the tree and nearby drive were many exit holes from the tree's root system. In Hyde Park, opposite the Austra-

[1] xiv, April, 1903, pp. 335-341, figs.; May, 1903, pp. 418-425, 2 pls.



Above—Macrotristria angularis, "The Fiddler."
Below—Thopha saccata, "The Double Drummer."

lian Museum, the oak trees in November were full of the trilling insects when the temperature reached the desired peak. The cicadas remain mute when rains and cool winds lash the branches, for the Yellow Monday is essentially a lover of warmth. On hot, still nights the rasping, shrilling notes may be heard well into the night and would-be sleepers find relief only when a long-awaited southerly wind arrives to lower the temperature and still their song.

The Song.

The conditions of temperature and humidity requisite for the cicadas to begin their song have not been studied, but it is remarkable that soon after one songster has started off his initial opening cadence of "Gurk, gurk, gurk, cree-e-e-e", all the males in the trees adjoining take up the refrain and soon the whole neighbourhood is pulsating with their throbbing rhythm. The ornamental trees so favoured in Sydney streets, parks and gardens, such as camphor laurels, pepper trees, brush box (*Tristania*), as well as various species of *Eucalyptus* and *Angophora*, serve to shelter the green minstrels, and here they have been sought by the children of each generation who have taken them to their hands if not their hearts. Even when the cicadas are not calling, a sudden protesting squark and children's voices raised in triumph cause one to realize that another "Greengrocer" or "Yellow Monday" has joined the captive band. "Give us a shake of your locy", is a saying long current among Australian children and serves to remind us that among the vast majority of Australians these insects are termed "locusts". It is curious that this erroneous term should persist because in many parts of Australia (usually the dried inland areas) plague locust (grasshopper) swarms are of common occurrence. Maybe it is because the larger cicadas of the coastal regions do not occur inland and children of the coastal towns are unfamiliar with the devastation wrought by true locusts west of the main dividing range. Locusts and cicadas belong to two entirely different orders of insects, the first to the order Orthoptera (with biting mouth-parts) the second to the order Hemiptera (with a suctorial beak).

The male insect, when shaken in a hot hand or even in a box, will often give vent to a rattle of resentment. It is this noise which finds favour in the minds of the young, while school teachers find the cicada season adds to their worries in maintaining discipline, as the insects are often surreptitiously brought into class-rooms there to upset the gravity of the occasion by a sudden squark. Not only in the class-room may the monotony of life be relieved by the cicada's protests, for here at Wahroonga a cicada was the cause of an incident of a "gravity-removing" nature. The household cat, which seems to have acquired a liking for the harmless creatures, brought a live male one night into the bedroom of an occupant, who, hearing the insect's repeated squarks, captured it and threw it outside. There it was again seized by the cat and brought into the luckless man's room once more, but this time the insect succeeded in getting under the wardrobe where the cat could not reach it and here it was captured and enveloped in a boot rag which effectually silenced it.

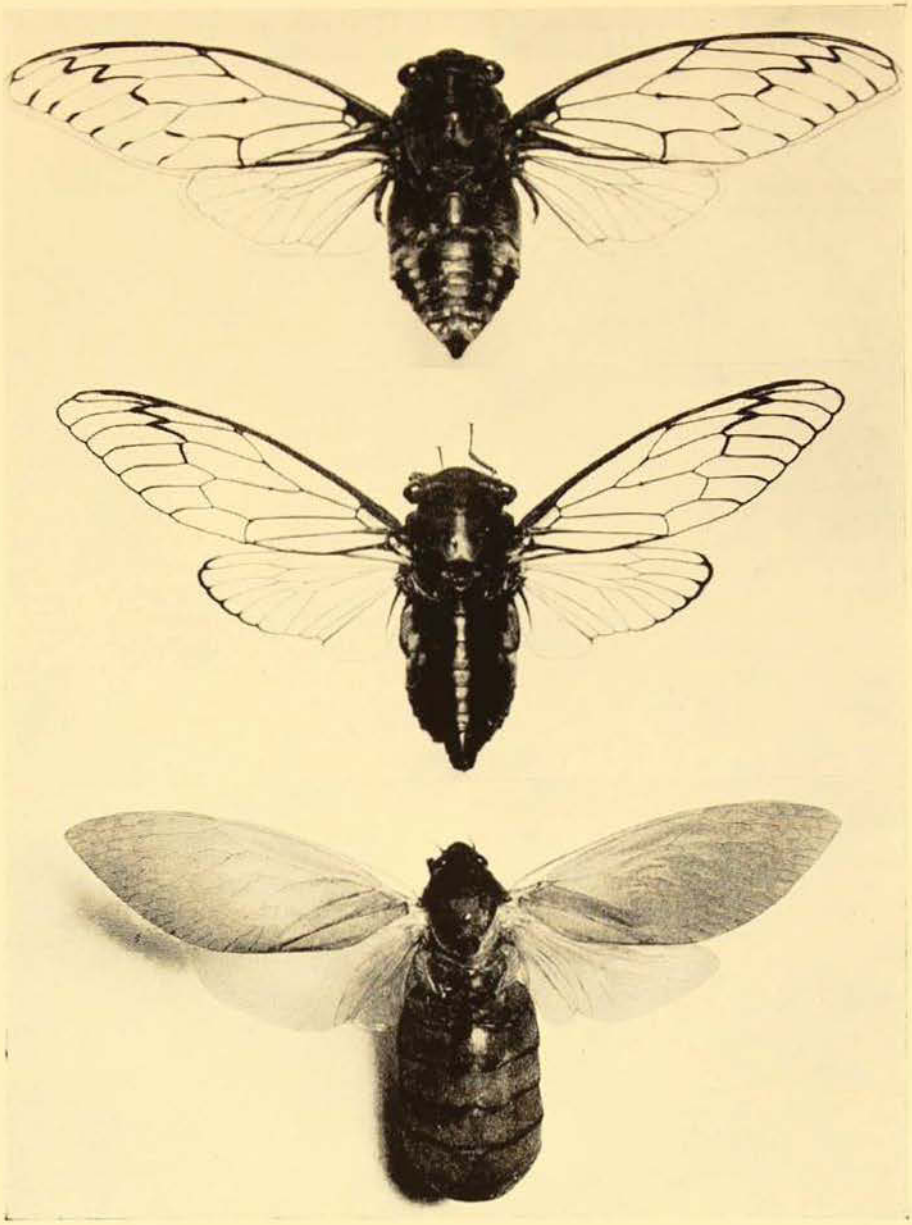
It is interesting to note the effect of our cicada orchestras upon visitors from other lands, and I am indebted to our former colleague, Mr. W. A. Rainbow, in drawing to my attention a work I had overlooked. It appears that when the ships of the United States Exploring Expedition under the command of C. Wilkes, U.S.N., visited Sydney from the 29th November to the 26th December, 1839, they arrived when the cicadas were at a seasonal optimum. In his work, *Narrative of the United States Exploring Expedition, during the years* 1838, 1839, 1840, 1841, 1842,[2] Charles Wilkes writes:

> "At the time of our arrival, the trees were infested with locusts (Cicada), which made a noise absolutely deafening. The sound this insect produces is the same as that made by the analogous species in the United States, but is continued here during the heat of the day, and ten times more deafening."

Appearance in the Blue Mountains.

Cicadas made their appearance during September, 1952, at Leura, Blue Mountains, but from a letter received at the

[2] Vol. i, 1852, p. 211.



Reading from the top—
Henicopsaltria eydouxi, "The Mottled Grey Cicada".
Psaltoda moerens, "The Black Cicada" or "Red Eye".
Cytosoma saundersii, "The Bladder Cicada", a species found in eastern N.S.W., extending south to Sydney.

Museum from the Rev. Colin Burgess of that town, dated 2nd October, we glean the following information:—

"Something appears to be wrong with the 'instinct' of this cicada. It appears in large numbers every three years but, owing perhaps to both excessive rain and (last year) dryness, has not appeared in large numbers for five years. Now the curious fact is that the cicada emerges in September on the mountains, when the temperature is, with few exceptions, in the 60's or even lower. In consequence almost all of them die, many before properly emerging from the shell or drying, and few are lucky enough to reach a stage when they are able to feed, 'sing', mate, &c. So we have the spectacle of the fences and trees littered with many thousands of shells, often one upon another, and the ground littered with the bodies of the dead insects often maimed and deformed because there was insufficient warmth for the creatures to harden properly. This has been so this past week or so—countless dead insects and not a single cicada song from the trees. Now every season when there is a *large* influx of cicadas this thing happens—they emerge too early and die, apparently of cold, immediately. Can you throw any light upon this?"

Accompanying the letter were specimens of *Cyclochila australasiae* var. *spreta* Goding and Froggatt, 1904, a variety represented in the Museum collection from Roseville and Gordon, North Shore line, and from Katoomba (October), Blackheath (November), Kurrajong Heights (October) and Mt. Wilson (3,276 feet) and also a specimen from Upwey, Victoria, taken in October.

In a letter dated 2nd January, 1953, the Rev. C. Burgess writes:—

"Re my remarks on the cicada *Cyclochila australasiae* var. *spreta*. I have had the opportunity during convalescence to observe this variety at Leura, together with the common Sydney species *australasiae* at Northbridge and note the following:—The var. *spreta* is, in every way—sight, flight, song—much less vigorous than the Sydney insect. The contrast is most marked."

Mr. G. H. Hardy, of Katoomba, who has had considerable experience as a professional entomologist in Australia and Tasmania, writes as follows:—

"On the 30th September, 1952, at Katoomba, came from the ground quite a number of those cicadas with a black abdomen known as variety *spreta*. As the days passed throughout two weeks these emerging creatures progressively increased their numbers, leaving behind a trail of numerous holes in the lawns, on beds, paths and even between the stones of a crazy pavement, and their cast pupal skins littered everywhere the tree-trunks, foliage of garden plants and even the walls of my laboratory. In their greatest numbers these residues of metamorphosis occurred by the hundred, over 30 being counted on the trunk of one pussy-willow alone, and they were numerous on a large pine-tree. Ten days passed before the call of the cicada was heard (i.e. on the 9th October) and on the 2nd November, the call has passed its peak ear-splitting volume, though still remaining considerable. Right from the beginning of this influx of cicadas, their dead carcases began to litter the ground and indeed, the absence of sufficient ants to remove them, these remains accumulated making the dead almost appear as many as the living. However, as these carcases dried out, the wind removed many just as it did the nymphal cases and the fallen leaves. The cause of early death amongst cicadas may be due in part to a constitutional weakness whereby they have difficulty in, and even failure in casting their nymphal casing, and those that succeed may fail to harden their cuticle properly, this affecting their muscular action and making flight impossible. Also cicadas have to meet the normal accidents of insect life thus failing effectively to carry out their regular habits. Amongst such accidental happenings is the falling to predatory creatures such as a certain wasp which, in the present case, happened to be absent, but birds were plentiful and on this occasion I saw only one sparrow capture a cicada. When offered a cicada, the domestic fowls gathered around, critically surveyed this offering of food, then turned their backs and walked away, and these fowls are quite used to being given insects to eat, eagerly eating all offered, along with slugs and snails. As I sit writing this, the cicadas are loudly calling in my garden and surrounding bush and I remember two years ago they occurred in normal numbers arriving at the normal time of the year. Last year they were not in evidence, and none was heard calling, but this year they excelled in numbers and came in the month before expected. Now, having reached November, they show signs of reaching more moderate proportions in numbers and voice, though new emergences are occurring each day, and new carcases are daily to be observed on lawns, beds and paths, but these are lessening in their numbers."

FAILURE TO EMERGE.

It has been remarked upon by the two residents in the Blue Mountains how often individual cicadas failed to emerge completely from the nymphal ("pupal") shell. At Wahroonga some of the cicadas failed to complete their transformation into the perfect insect and clung to the bark of the oak tree a prey to ants. What is the cause of this *malaise* among the metamorphosing insects? The only reason the author can advance is that sudden climatic changes in temperature and humidity have upset the insect's metabolism, which at this critical period of transference from nymph to adult is probably sensitive to such changes.

Reading from the top—

Melampsalta abdominalis, a Squeaker, common in N.S.W.

Psaltoda harrisii, "The Razor-grinders".

Abricta curvicosta, "The Floury Miller" or "Baker".

Why the varietal form *spreta* should appear in the colder Blue Mountains area before the more typical forms of the warmer coastal belt, is a problem which is difficult of solution.

January, 1953.

In January of this year when this article was being written, the cicada host was still maintaining its song even far into the night when conditions were hot and sultry. On Christmas night (1952) at Gordon, near Wahroonga, the cicadas were "going their hardest" at about 10 p.m. The increase of temperature and humidity during this month of the year would appear to make the cicadas almost indifferent to thunderstorms and winds which in the earlier part of the season would cause them to lapse into silence. In the early part of January, they kept up their persistent rhythmic trilling in the trees at Wahroonga (and elsewhere) though a slight diminution in the volume of their song was perceptible. Adjoining the golf links at Gordon, upon which I relax during the week-ends, is a bush-filled valley and it is interesting to note the change in the cadence of the song of the cicadas as one approaches a fairway bordering the Eucalyptus forest. On the cleared slopes above, where a variety of trees, *Eucalyptus*, *Angophora*, and introduced forms occur, the Yellow Monday, *Cyclochila australasiae*, is the dominant cicada. In the bush near the golf course it would appear that the Double Drummer cicada, *Thopha saccata*, is the chief form and the noise here is one long continuous trilling note, not in the pulsating rhythm of the *Cyclochila*. Even when some distance away from the forest areas the noise made by the insects can be heard above the screech of the Yellow Mondays in nearby trees. As the end of January approaches few Yellow Monday cicadas are to be heard, though some smaller forms are in evidence about Sydney.

Other Local Forms.

It might be appropriate here to mention some of the species most commonly brought in to the Museum together with their vernacular names. In 1903 the late W. W. Froggatt, in the work previously cited, mentioned the names of the cicadas current among the youth of Sydney at that time and these would still appear to be in vogue though some seem to have fallen into disuse. It would appear from conversations I have held with lads who have brought cicadas to the Museum for identification that some popular names are applied loosely to various species.

Cyclochila australasiae. Its yellow, green, and rarely, black colour phases are known as: Yellow Monday, Greengrocer, and Black Prince.

Cyclochila australasiae var. *spreta*. This variety has a black abdomen and black marks on the head and thorax. No popular name.

Thopha saccata. The male has large swollen opercula and the species is generally known as The Double Drummer, though Froggatt states that they are also known as the "Union Jack" and the "Washerwoman".

Macrotristria angularis. The Cherry Nose, Whisky Drinker, Fiddler and Union Jack.

Psaltoda moerens. The Black Cicada or Red Eye. Is noted for its preference for the trunks of the Smooth-barked Apple, *Angophora lanceolata*.

Abricta curvicosta. The Floury Miller or Baker.

Arunta perulata. This species is larger than the preceding and the whitish operculа in the males are swollen as in *Thopha saccata*. It is sometimes submitted to the Museum in the belief that it is a "Floury Miller".

Psaltoda harrisii. This is the cicada which in the past has been called the "Razor-grinder" on account of the curious whirring note of the male. This species was captured on the trunks of *Banksia integrifolia* at Trial Bay, N.S.W.[3] The silver patch at the side of the abdomen serves to identify it.

Psaltoda plaga (= *argentata*). This is common on the trunks of the river oaks, *Casuarina*, on the Nepean River, and it also occurs by the sea.

[3] See A. Musgrave and G. P. Whitley, Australian Museum Magazine, ix. (5), Jan.-March, 1931, pp. 153-154.

Sea Lice or Jellyfish?

By ELIZABETH C. POPE, M.Sc.

IN mid-January of 1953 an unusual number of people were stung by invisible agents while bathing off the surf beaches of the central New South Wales coast. One victim—a beach inspector—told us how he had sprinted down the beach and plunged into the surf to cool off but the second his body contacted the water he was stung all over in a most painful manner. In fact he could not bear to stay in the water even for a minute and had to leave to seek first-aid without swimming another stroke. He remarked especially on the searing pains felt where the water had got in his eyes. Where he had been bitten the flesh was covered with little raised, urticated lumps which oozed and wept from the centre if not treated with sal volatile or an ointment like Ung Vita. The accompanying photograph shows the kind of lesion associated with a bad case of the so-called sea lice stings. It was taken several days after the attack.

Many hundreds of people in places as far apart as Wollongong and Newcastle were stung in a similar way. Some suffered but little inconvenience. Others (among them many children) had a most painful and distressing experience lasting for several hours. While local surfers are accustomed to mass stingings during the summer months inflicted by Bluebottles (*Physalia*), in the present plagues it was at once recognised that the stings differed considerably in pattern from the *Physalia* stings and were not nearly so severe or lasting in their effects. Some other causal agent was looked for by the reporters and in the newspaper accounts the stings were attributed to sea lice.

This was a most unfortunate name to choose since the popular name "sea lice" has been used all over the world, for a very long time, for certain small, isopod crustaceans of the kind which, during certain stages of their life cycle are parasitic on fish. Some larger types, called fish doctors, are well known to anglers. These true sea lice live by sucking their host's blood (generally from the gills) and therefore might conceivably take a passing nip at a human. It is highly unlikely, however, that even the smaller species of fish lice would remain invisible especially if they were present in the surf in the enormous numbers necessary to produce the wholesale stingings in the present outbreak. Also the nature of the stings is characteristically of the jellyfish kind.

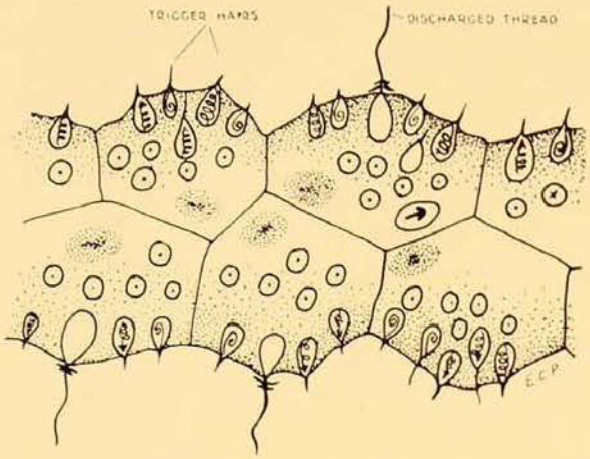
Stimulated by newspaper accounts and broadcasts popular interest in the stingings ran very high and nearly 200 inquiries were received at the Museum on the subject. These varied from requests from news reporters and broadcasters for scientific information to queries as to where to bathe so as to avoid stings. It will be a long time before the Museum officers concerned forget the hectic three days when the sea louse scare was at its worst. Useful information was supplied by one ambulance officer, a well-known deep sea angler, several surf-lifesavers and by a truck driver whose spare-time occupation was deep-sea fishing. Mr. Cuthbert, the truck driver, had for years used the large, brown jellyblubber of the estuaries (*Catostylus mosaicus*), for bait in leatherjacket traps and, like most professional fisherman, was well acquainted with their stinging properties. He informed us that he had had the stings from the so-called sea lice in the last few days and that they were characteristically the same as those from the large jellyblubbers. Moreover the waters out to sea were, at the time of the stinging, full of huge brown jellies which were, as he described it, "going mouldy and breaking up". Any fishing line which had trailed through the water in the vicinity of the blubbers caused severe stingings when handled and something which was not visible to the naked eye was in the water near the jellies and could inflict stings.

With one exception all the other evidence supports our theory that jellyfish caused the stings. That piece of evidence comes from a Mr. Hyam who found a small crustacean in his swimming trunks after he had been stung in the surf at Harbord. It was a Cumacean or Possum Shrimp and not a type of animal which could be expected to draw blood even though it was caught in compromising circumstances in the centre of an area of skin where there were three bites. Its red colour convinced Mr. Hyam that it was the culprit and that it had sucked his blood. It is more than likely that the stings came from invisible pieces of jellyfish and the Cumacean was there just by chance. However, this matter will be referred to an expert on this group of animals for his opinion.

An attempt was made by Museum officers to find out what animal was causing the stingings and a number of the major surf beaches were visited when stingings were reported. It was intended to make hauls with special fine nets used for catching the microscopic life of the sea at times when the stingings were going on, for it is not yet certain whether the stings are caused by fragments of adult blubbers or by their spawn or young stages. In most cases where stings were reported, keen observers had noticed large jellyblubbers in the vicinity which appeared to be broken up, but we have not yet been able to ascertain whether the breaking up is part of the breeding behaviour or whether the fragmentation is due to purely mechanical means like surf.

Unfortunately, at every beach visited the stings had stopped before we arrived and, although one of our party waded hundreds of yards through the surf, and even through accumulations of floating seaweed, offering himself as a decoy for the stingers, we still met with no success. However, at each beach visited our theory about the jellyfish stingers received confirmation for every beach inspector, without any prompting from us, said that he was sure it was jellies, because the water was always thick with them when the stings occurred, the stings they had experienced were similar to blubber stings, and also in parts of the beach where no jellyfish were

Marks left on a bather's arm by a mystery stinger in the surf. Photographed several days after the attack.



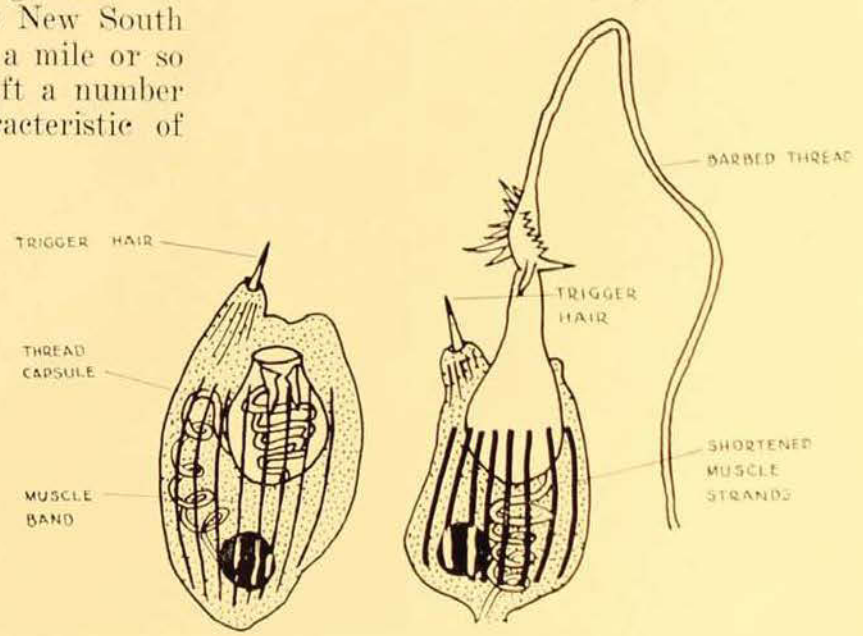
Portion of tentacle of a bluebottle (*Physalia*) showing the microscopic nettle cells in the tissues with the trigger hairs " at the ready ". Three of the stinging capsules have been " set off " and their barbed threads project from the walls of the tentacle.

drifting in there were no stings. In fact the manager of the Coogee surf sheds, whose experience extended back to 1918, stated categorically that whenever similar mass stingings had occurred in the past the sea had been infested with big brown jellyfish. This was interesting as it confirmed what we had believed, that is, that this was not a new phenomenon and all that was new was the publicity it received. However, such widespread mass stingings are sufficiently rare to need some explanation.

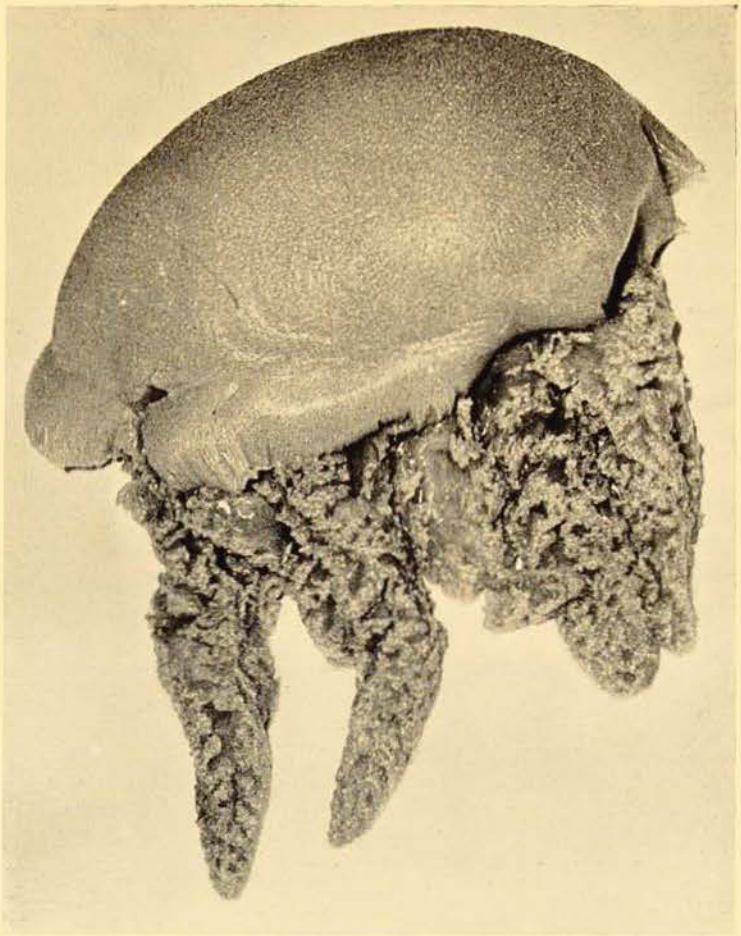
Firstly, we would remind the reader that in the summer time especially there is a marked warm current flowing from the tropics southwards down the New South Wales coast. It is generally a mile or so offshore. In this current drift a number of creatures which are characteristic of warmer seas. When a long period of easterly or north-easterly winds occurs these warmer waters and their drifting life from more tropical parts tend to blow inshore, towards the surf zone and generally some of the animals are cast up and stranded on the beaches. It is in this way that the visitations of bluebottles occur. Sometimes they will infest the surf for a day or even a week, but when the wind changes to a westerly or comes from some direction other than from the east the nuisances are blown out to sea again.

Among the animals that become stranded at such times are two brilliant blue Siphonophores in addition to the Bluebottle (*Physalia*). One is oval in outline and has a vertical, transparent sail set obliquely across its upper surface. This is the By-the-wind Sailor (*Velella*). More rarely the rounded *Porpita*, which has no sail, is found too. These are not stingers. Also stranded at such times are Violet Snails, worms, certain species of barnacles and large numbers of medusae or jellyfish of a variety of species, some of which have reputations as bad stingers in other parts of the world, for example the enormous *Cyanea annaskala* and even an occasional Carybdeid.* Among the jellyblubbers

*Refer to "Some Sea Animals That Sting and Bite," AUSTRALIAN MUSEUM MAGAZINE, IX, 5, and "A Large Medusa in Sydney Harbour," AUSTRALIAN MUSEUM MAGAZINE, X, 1.



Greatly enlarged diagrams of a stinging capsule before (left) and after discharge (right). When properly stimulated the trigger hair touches off the reaction which brings the mechanism into play. Shortening of the muscle bands contract the thread capsule and the pressure on its contained fluid shoots the barbed thread out.



The brown Man-of-War Blubber, *Catostylus mosaicus*, found in local harbours and estuaries.

Photo.—By courtesy of "The Telegraph".

causing bad stings is the large brown *Catostylus mosaicus*, known locally as The Man-of-War. This is an unfortunate popular name since it leads to confusion with *Physalia* which is known almost universally outside Australia as the Portugese Man-of-war. At times *Catostylus* swarms in tremendous numbers in the estuarine waters and anyone who has crossed the Hawkesbury River railway bridge on a day when the water is clear will have some idea of the numbers of this blubber which can be present in a given volume of water. The stinging powers of this jelly are well-known to fishermen and I have heard a friend of mine, who was a professional prawner, remark, "The blubbers are hot to-night", meaning that he felt a burning pain when he removed them by hand from his nets. However, this did not prevent him from handling them for the pain soon went. At other seasons the stings are barely noticeable. This increase in the potency of the sting seems to be correlated in some way with the animals' breeding cycle so that we feel that the outbreaks of "sea lice" stings may be caused by the minute larval jellies or by the spawn—rather than by the adults.

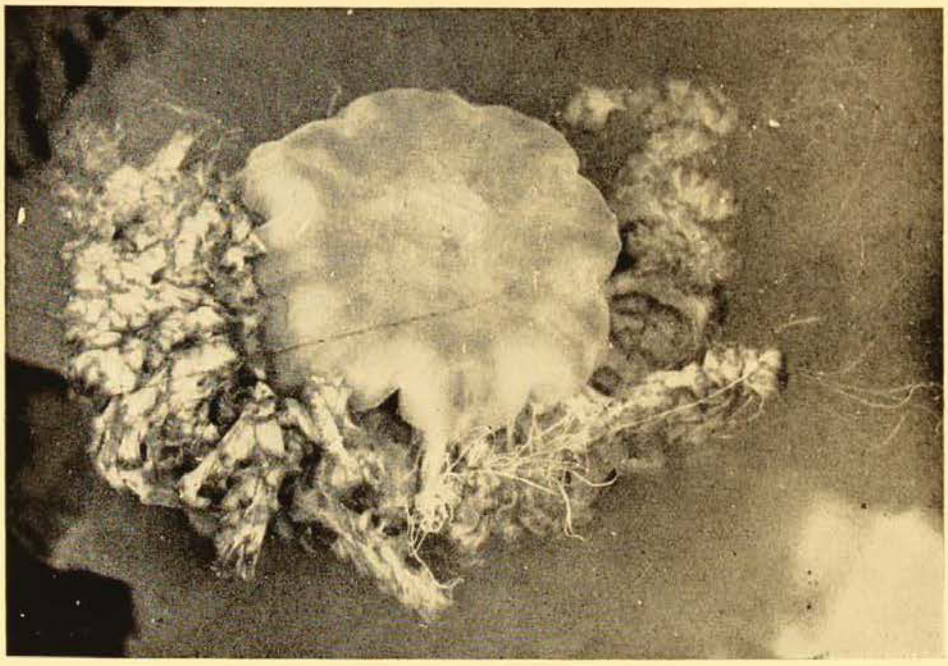
It becomes clear then that, only when all the many weather conditions necessary to float offshore jellyblubbers shorewards coincide with the exact stage when the jellies are in their most venomous state, will there be mass stingings of the type which occurred in January last. It must also be remembered that it is necessary for a large number of people to be surfing at such a time for the stingings to become "news". Such a concatenation of events occurs but rarely and when it does it is all the more remarkable to the man in the street.

All jellyfish and their allies like the anemones, bluebottles and corals possess a type of stinging mechanism that is unique and all work on essentially the same principle. They are popularly known as nettle cells and certain parts of the body like the tentacles and walls of the digestive cavity are armed with batteries of these stinging cells or nematocysts which are normally

used for catching the animal's prey. When properly stimulated the nematocyst contracts and shoots out with great force a minute, hollow, barbed thread which either stings or entangles the prey, according as to whether the thread is open or closed at its tip. Threads that are closed at the free end act merely like miniature lassos serving to hold and entangle smaller creatures, while the threads with open ends act like microscopic hypodermic needles and inject venom into the victim either to kill or narcotise it, so it can be digested at leisure.

While the exact nature of the venom in the nematocysts is not yet known, it is obvious that different species of jellyfish have poisons of differing potency. At all times the venom from the Bluebottle (*Physalia*) is worse than that of any other jellyfish in New South Wales waters from the point of view of the surf bather. A bad stinging from a bluebottle can produce difficulties in breathing and intense pain while that of the mystery jellyfish generally results only in an irritating pain in the skin or eyes. However, here again we meet a point of interest. Each human being reacts differently to stings from nematocysts and where one person might have exeruciating pain, vomiting and severe breathing disturbances from a *Physalia* sting, another will suffer no more than local irritation of the skin. We cannot therefore judge another person's reaction by our own experiences.

Prompt application of first aid measures will always help. Wet sand can be used to rub off any jelly tissues (visible or invisible) which may adhere to the skin, then some ammonia solution such as sal volatile or the prescription for stings, recommended in the handbook of the Surf Life Saving Society, should be dabbed on. Where a patient's reaction to the poison is very violent medical aid should be sought at once. The venom from jellyfish retains its potency even after drying and in seasons when the numbers of medusae are inordinately large, so that they clog fishing nets and break up all over the meshes, fishermen or net menders who subsequently handle such nets, even when dried, suffer from extremely sore eyes and respiratory troubles and may show allergic reactions. One of the features of the so-called sea louse outbreak has been sore eyes, and this made us even more certain that jellyfish medusae were at the root of the trouble.



True cause of recent stings in the surf was the Jellyfish Medusa called *Cyanea annaskala*.

Final proof as to the cause of the January outbreak came from the well-known big game fisherman, Mr. Max Lawson. He undertook to bring into us a specimen of the stinger for examination. Two species of medusa had been specially suspect from

the accumulated evidence of victims and lifesavers. These were the familiar brown blubber (*Catostylus mosaicus*), also known as the Man-of-War, and the giant-sized *Cyanea annaskala* which had an unenviable reputation as a stinger in other parts of the world. This latter species was particularly suspect because in practically all eye-witness accounts there were the words, "the blubber seemed to be breaking up" or "it was going mouldy", descriptions which might well be applied to the appearance of the rather voluminous flounce-like folds of the mouth tentacles. These tend to float up round the solid disc part and give it a look of disintegration.

Mr. Lawson obtained a fine specimen and preserved it for us in a bath tub. He and his friends felt its stinging properties while they were capturing it and one member of the party experienced pain when he merely handled the wet or dry sides of the bathtub in which it was imprisoned. It was also noted that the eyes stung painfully when any fragment of the blubber or of the sea-water in which it was swimming was splashed into them. The colour of the blubber was brown and it certainly looked as though it were breaking up. We thus felt justified in identifying this specimen as the stinger in the present outbreak. Moreover, the species was present in unusual concentrations in the waters just off the coast. These facts, coupled with the oft-repeated accounts of broken-up jellyfish where severe stingings occurred made us certain that the giant jellyfish, *Cyanea annaskala*, was the culprit and in fact the "sea louse". Under these circumstances, the sooner the name "sea lice" is forgotten in connection with the present outbreak of surf stings the better.

Purse-Net Fishing in Arnhem Land

By FREDERICK D. McCARTHY *

THE fishing methods of the Australian aborigines are not as highly developed and varied as those of the Indonesians and Pacific islanders. The aborigines are, however, patient and expert with the fishing apparatus they use, and the coastal tribes subsist chiefly upon a diet of fish, shellfish and plant foods. One method of fishing that I saw employed in the Oenpelli district of western Arnhem Land is not only an interesting example of the seasonal exploitation of the environment, but rather surprising from the point of view of the results obtained. It is used with great success by small local groups, consisting of several closely related families, at the end of the dry season when creeks have dried up to leave a waterhole here and there along their beds, game is wary, and plant foods small and comparatively hard to find.

These natives make a folding purse-net triangular in shape, from one to four feet long. The two-ply twine is made by the women out of bark-fibre, which is rolled on the hip and spun on to a hooked stick as a spindle. This twine is worked into a strip of netting tapering towards both ends, two techniques being employed, the simple loop style and the knotting, the latter being the same as that in our string shopping bags and fishing nets. Four sticks, usually thin young stems from a gum or other tree, are now cut and smoothed down and inserted through the netting along the edges. The pairs of sticks on each side overlap, and the two joints, one at each end, are bound tightly, but the overlap in the middle forms a hinge for the opening and closing of the net.

The natives use these nets in water up to three or four feet deep to catch pike, mudfish, catfish, mullet and other saltwater species in the rivers, and particularly in the lakes and waterholes in which they are isolated after the flood-waters of the wet season have receded.

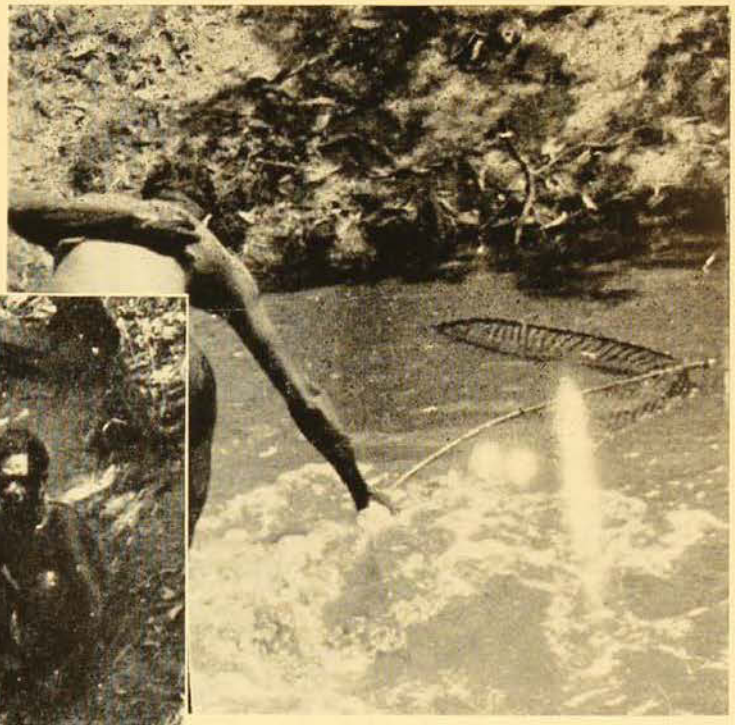
The net is held at the tapered or bound ends, and is either dropped or pushed into

* Photographs by the Author.

the water in front of the fisherman, who frequently sinks down in the water with it to the bottom. Sometimes he throws the net outwards, holding one end and letting the net sink downwards at a wide open angle while he splashes in front of it with one hand to chase the fish into it, or he will leave the net on the bottom and circle round splashing with his hands for the same purpose. He closes the net quickly, and usually lifts it out horizontally, but sometimes vertically, and if it contains a fish one side is carefully opened, the catch is taken out and thrown on to the bank. The weeds and leaves are emptied out after each throw. The net is cast in the weeds along the shore, beside the logs and rocks, and here and there all over a pool in the hope of catching fish. Where two or more people work together one uses the net and his companions act as beaters, splashing the water with their hands and feet to drive the fish towards him. Both men and women use these nets and a man and his wife often fish together.

Right—The net rests on the bottom in shallow water.

Below—A mudfish caught in the purse-net.



Another method of fishing is to stand the open net against a growth of weed, near a log, or at a constriction in a waterhole, and chase the fish into it. The fish will often jump out of the water and over the shoulders of the fishermen to escape, and there is usually a loud shout when a fish is caught. Where a small group of people, men or women or both, are fishing a pool those not using the net will search for fish in the weed along the shore, feel for them around logs and rocks, both with their feet and hands. They also scoop the fish fry on to the bank with feet or hands, and catch them in baskets.

By these means three or four fishermen will catch up to four fish in a throw. After several hours they will catch from five to ten dozen or more fish in a waterhole from 30 to 60 feet long, but it is more difficult to catch them in the lakes and rivers unless

The weeds and debris at the edge of the pool are searched for fish.

they are very plentiful. Actual results noted include one man catching 21 fish in 15 minutes, and 13 in 10 minutes; two men 22 fish in 45 minutes; three men 40 fish in 40 minutes; and a man and wife 10 fish in 30 minutes; and four men 73 fish in two hours. They all used the one net or their hands, in the same pool for a period of two weeks.

The women sometimes form a line, each carrying an open net, and advance through a pool, catching fish as they go.

The natives enjoy this type of fishing in the hot weather laughing and singing while they plunge about after the fish. They usually keep a fire going, however, so that they can come out and warm themselves or cook some fish if hungry. On one occasion a fish slipped out of a net into the loin-cloth of the fisherman, and the whole party chuckled all day about his embarrassment while getting it out.

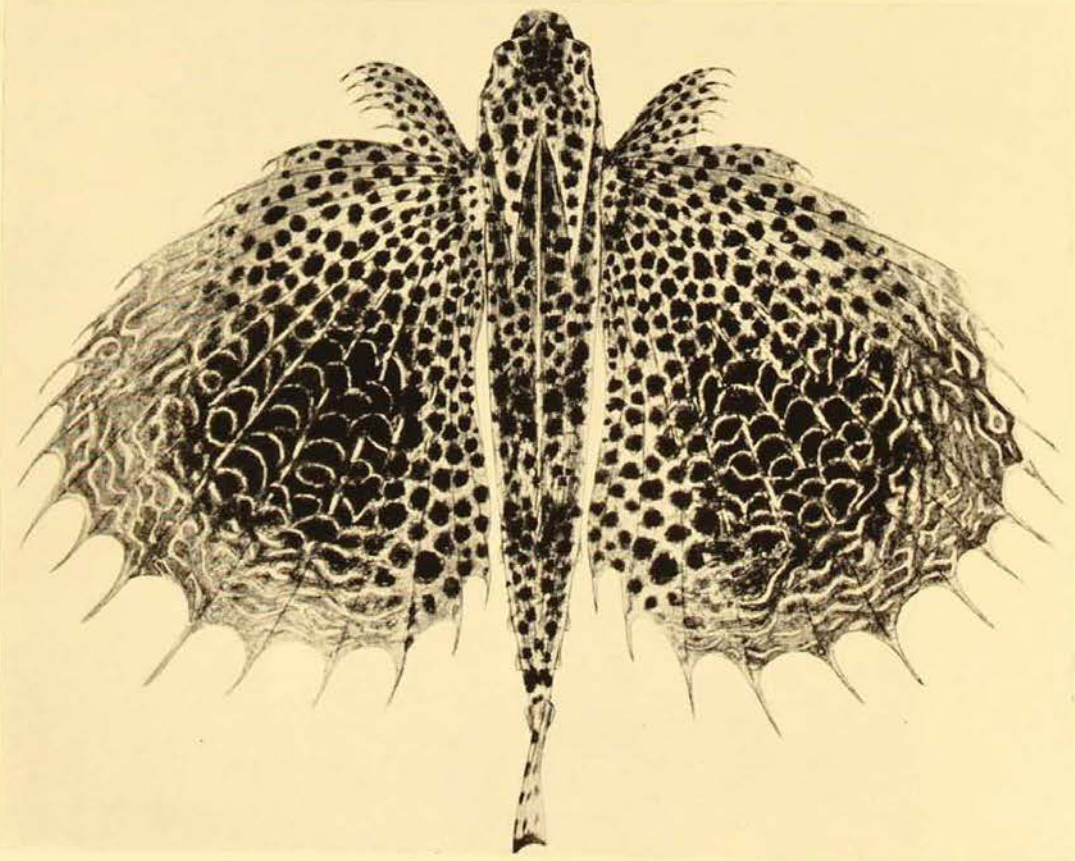
A fisherman about to drop the net into the water.

Gurnards

By G. P. WHITLEY.

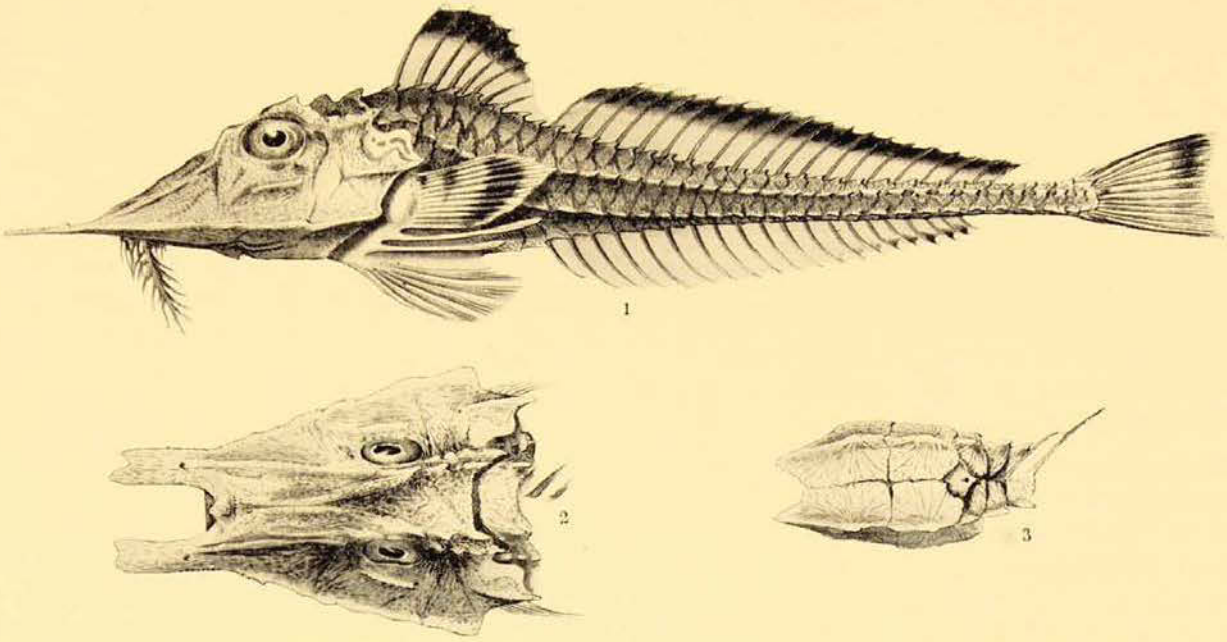
"Here the gay gurnard boasts his rosy dye".

THE Gurnards are easily distinguished from other fishes by their box-like bony heads, often armed with spines and crests and roughened surfaces, not smoothed over by skin. The profile descends steeply and the eyes are large. There is often a row of spines or bucklers at least part of the way along each side of the dorsal fins. The lateral line scales may be armed with spikes or unarmed and the line is divided like a tuning fork on each side of the tail fin. The side fins or pectorals are expansive and gorgeously coloured so that these fishes have been named after birds and butterflies, and they are wrongly termed flying gurnards because of these wing-like fins. The lowermost rays of the pectoral fins are detached feelers which move like the fingers of a pianist as the fish "walks" along the bottom using them to feel or turn over the stones and other objects in its search for food. The front ray is short, the second longer, and the third longest, and the routine "fingering" is 1, 2, 3, ; 1, 2, 3 . . . as 2 overtakes 1 and 3 overtakes 2 in the incessant prodding. But the "fingers" on each side do not move symmetrically and the order is sometimes varied. The fish's tail leaves a groove in the sand and the "fingerprints" combine with this groove to leave a track or spoor on the bottom in very calm water. The fingers, which can probably taste as well as feel, are supplied with special nerves which connect with a series of bulbs behind the fish's brain, an anatomical peculiarity that was first illustrated by Samuel Collins in 1685. The swimbladder or air-bladder differs in each species and can produce a noise by being vibrated by special muscles. So these fishes have been called Crooners in Scotland. Dr. Johnston observes that crooner may have reference



Dorsal view of an adult Flying Gurnard (*Dactyloptena orientalis*) from north Queensland, with outspread "wings".

George Coates pinx



Armoured Gurnard (*Panichthys picturatus*) from deep water in Bass Strait. No. 1, side view; 2, top of head; 3, breast-plates.

A. R. McCulloch and G. P. Whitley, *del.*

either to the hard head of the fish, from *croon* the top or crown of the head; "or it may be derived from the verb *croon*—viz., to hum an air in an unmusical tone, because of the peculiar noise which the fish sometimes utters on being taken from the water. Thompson described the sounds emitted by this fish as a kind of snoring noise"[1] *Pace* the fans of Bing and swing!

Gurnards are known as *kumukumu* in Maori, pipers in England, and by various onomatopoeic names amongst native races because of this grunting. The rosy colouring of their tapering bodies is responsible for other names for them. Some Australians confuse them with the Sergeant Baker, a very different fish with only one soft dorsal fin, instead of a hard and a soft, and no pectoral feelers.

Gurnards feed on crustacea, small fishes, sea stars and molluses.

Older authors believed that some gurnards could not only fly, but emit a light from the head so that, according to Lacepede, their passage through the air resembled the course of a shooting star. Lest one should blame gurnards for some of the reports of "flying saucers", it should be emphasized that they do not fly, the beautiful pectoral fins being for swimming and display purposes only. However, it is possible that, after feeding on certain invertebrates, the head might be adorned by luminescent material, or the lighted heads reported by the ancients might have been due to decomposition and bacteria on dead gurnards. There are some reliable reports of Gurnards "springing" out of water, but not gliding for long distances like flying fishes.

Cuvier complained that the old authors gave no proper description of their gurnards, not even remarking upon the cubic or parallelepiped shape of their heads, preferring to distinguish them by their assumed methods of flight. He chides them for believing that their Greek would never perish, but remain for ever to identify whatever fishes they were talking about, and speaks feelingly of the tortures inflicted thus on modern students, who now try to classify exactly the fishes originally distinguished by non-existent attributes.

Gurnards appear in heraldry. The family of Gurney of Norwich bore for arms, argent, a cross engrailed gules; but their crest exhibits the usual play upon

[1] Day, F., Fishes of Great Britain and Ireland, i, 1880, p. 63. For a detailed technical account of the sounds made by Gurnards see Dufossé, *Ann. Sci. Nat. Paris* (5) Zool, xix, 5, and xx, 3, 1874, pls. 16-19.

the name, a gurnard erect upon a chapeau. In Cornwall, the gurnard is known as the tub fish, and is borne in heraldry by the family of Tubb.[2] Day tells us that "a very ancient mode [of preparing gurnards as food] and still occasionally followed, is after having fried, to souse them in a sour sauce. However, in some places "soused gurnet" is employed as a term of contempt, as when Shakespeare in King Henry IV, Act iv, Scene 2, makes Falstaff say, 'If I be not ashamed of my soldiers, I am a soused gurnet.' "

Gurnards nowadays form an appreciable proportion of Australian fisheries, the otter trawlers and Danish seiners obtaining most of them from New South Wales and Tasmania all the year round. In the year 1950-51 the total production in the Commonwealth was reported as 557,100 lb.

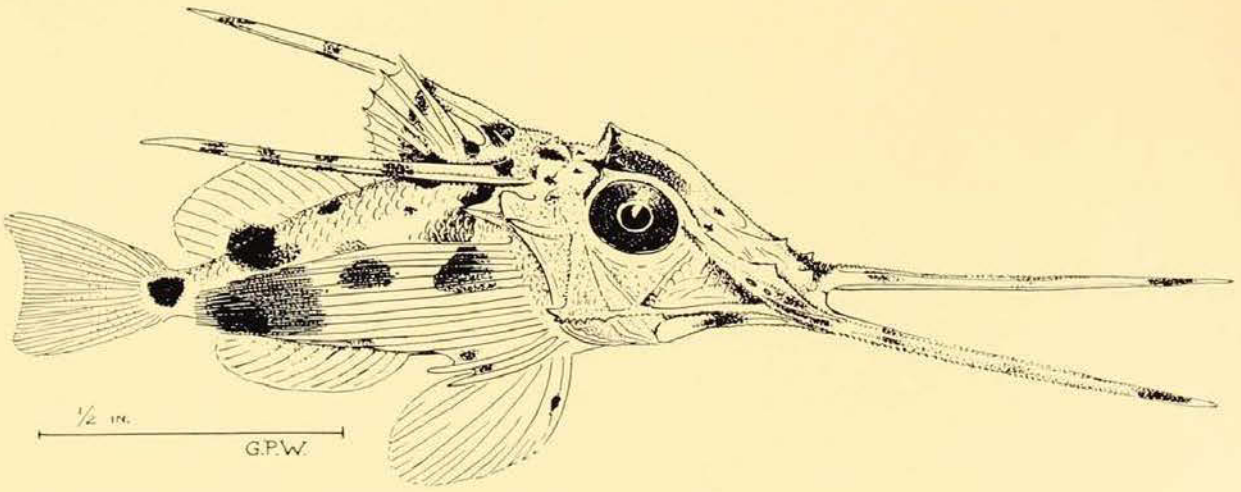
Most of our Australian gurnards (*Lepidotrigla* and *Paratrigla* spp.) are of small size, often only 6 to 9 inches long, a few occasionally exceeding 10 inches, and so, though common, are of no commercial value. The exceptions are the Kumu or Red Gurnard (*Currupiscis volucer*) which grows to 2 feet and about 4 lb. in weight; the Latchet (*Pterygotrigla polyommata*) 21 inches long, the commonest gurnard in the Sydney markets, and the Painted or Spotted Gurnard (*P. andertoni*) which sometimes reaches 14 inches.

The Kumu Gurnard was discovered on Cook's first voyage and was named *Trigla papilionacea* in the manuscript of Solander, which is still in the British Museum (Natural History) together with Parkinson's drawing (no. 104) of the same from Opoorage, New Zealand. A painting of a Sydney example was made about 1790 and is amongst the Raper watercolours in the Mitchell Library.

Ogilby found that the breeding season of our Kumu Gurnard occurred in November and December in New South Wales, and that of the Latchet in July and August. Gurnards probably migrate in schools, but the movements of the Australian species have not yet been determined, though a number of dates and depths have been recorded for some species. The movements of British Gurnards have been discussed in Meek's *The Migrations of Fish*, 1916, and his diagrams give a general picture of a rather complicated subject. Gurnards are fishes of the continents and continental shelves. They do not adorn the coral reefs where their beautiful colours might be expected to be more at home.

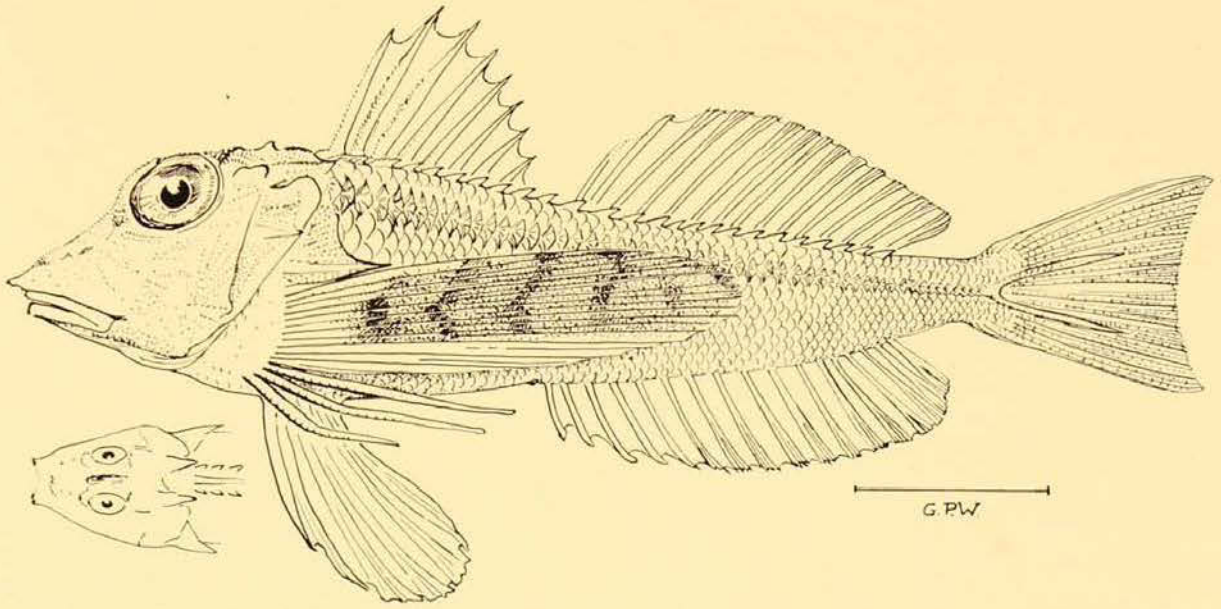
Gurnards seem content in captivity and the Red Gurnards (*Currupiscis*) have lived

[2] Moule, The Heraldry of Fish, 1842, p. 104 & fig. In my library I have Moule's own copy of this book interleaved and with his annotations, amongst which appears, anonymously, the line quoted at the head of this essay.



A young Gurnard (*Dixiphichthys ferculum*) found washed ashore on Palm Beach, near Sydney. The remarkably long lachrymal and occipital spines and the expansive fins probably help it to float and drift in its youth. Later, when adult at the bottom, the lower pectoral rays would become detached as feelers, the spines probably shrink or break off, and scales and body armature would be heavier.

G. P. Whitley, *del.*



Long-finned Gurnard (*Lepidotrigla calodactyla*) from North Reef, Queensland.

G. P. Whitley, *del.*

for many years in Taronga Aquarium where their swimming delights spectators. The characteristic occasional spread of pectoral fins may be a defensive action showing the "eyespots" to a prospective enemy or it may be a signal to other gurnards.

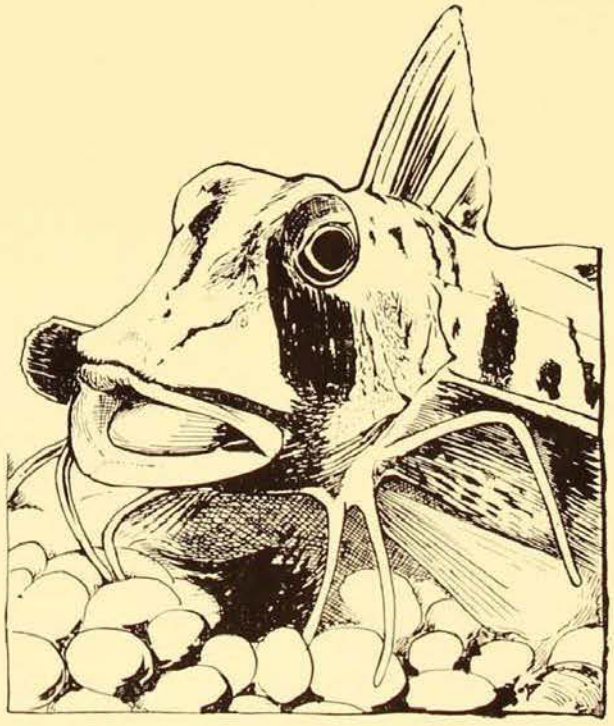
In the Shedd Aquarium, Chicago, gurnards have been noted as becoming "quite tame . . . . and have the habit of sticking their mouths above the surface and ejecting a quantity of water. This habit is also noticed in some of the turbots, margates [snapper-like fishes] and boxfishes."

The Gurnard family (*Triglidae*) has about fifty nominal genera, of which the following five occur in Australia.

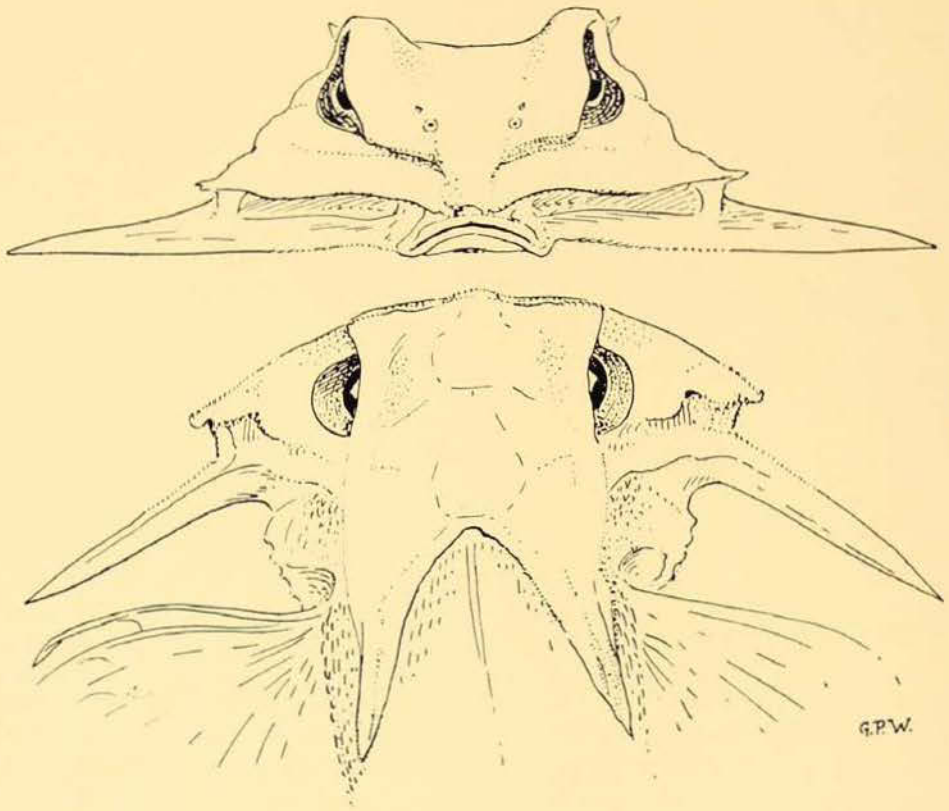
Key to Australian Genera of *Triglidae*:

A. A row of spines along bases of both dorsal fins.
  B. Scales larger, 50-60 on lateral line.
    C. Lateral line not armed with spiny plates. ..... *Lepidotrigla.*
    CC. Lateral line armed with spiny plates *Paratrigla.*
  BB. Scales smaller, 100 or more on lateral line ..... *Currupiscis.*
AA. Large bucklers along base of spinous dorsal only, or none.
  D. Head spines moderate. Bucklers along base of first dorsal only *Pterygotrigla.*
  DD. Four very long head spines. No bucklers ..... *Dixiphichthys.*

There are probably between fifteen and twenty Australian species, but some of them have yet to be critically differentiated. Since thousands may be trawled at a time, there is no lack of material for study, but a good deal of time has to be spent in measuring them, counting their fin-rays and scales, dissecting out their air-bladders, tabulating their variation and comparing one kind with another. Then when all the species are identified comes the really fascinating job of piecing together their life-histories, finding out when and where they



A Red Gurnard (*Currupiscis volucer*) feeling its way over stones with the finger-like pectoral fin-rays. Drawn from a photograph taken at Taronga Aquarium, Sydney.



This Butterfly Engloute (*Dactyloptena papilio*) looks like some satanic cat as it spreads its long preopercular spines.

spawn and the changes which the fantastic-looking young ones are obliged to make before they become adults.

Only the true Triglid gurnards have been dealt with above. Often associated with them are two other families, the Armoured and "Flying" Gurnards.

Unless very immature, fishes belonging to these three families may be distinguished as follows:—

A. Lower pectoral rays free and finger-like.
B. Three finger-like rays each side. Body scaly. Fine teeth in jaws. True Gurnards, Triglidae.
BB. Two finger-like rays each side. Body with armour-like plates. No teeth. Armoured Gurnards, Peristediontidae.
AA. Front (not lower) pectoral rays forming a small separate fin. Scales hard, dense, and with some sharp ridges. Flying Gurnards, Cephalacanthidae.

Fishes of the family Peristediontidae are facetiously termed Malarmats (poorly armed) by the French; in reality they are encrusted with scales like armour plates and the head is produced into a pair of bony prongs with which they plough amongst bottom-debris. In appearance they somewhat recall Sturgeons. There are only two feelers to each pectoral fin and tassel-like barbels depend from the chin. The Australian representative (*Panichthys picturatus*) is pink or reddish with black or dusky brown markings and is trawled over our south-eastern Continental Shelf.

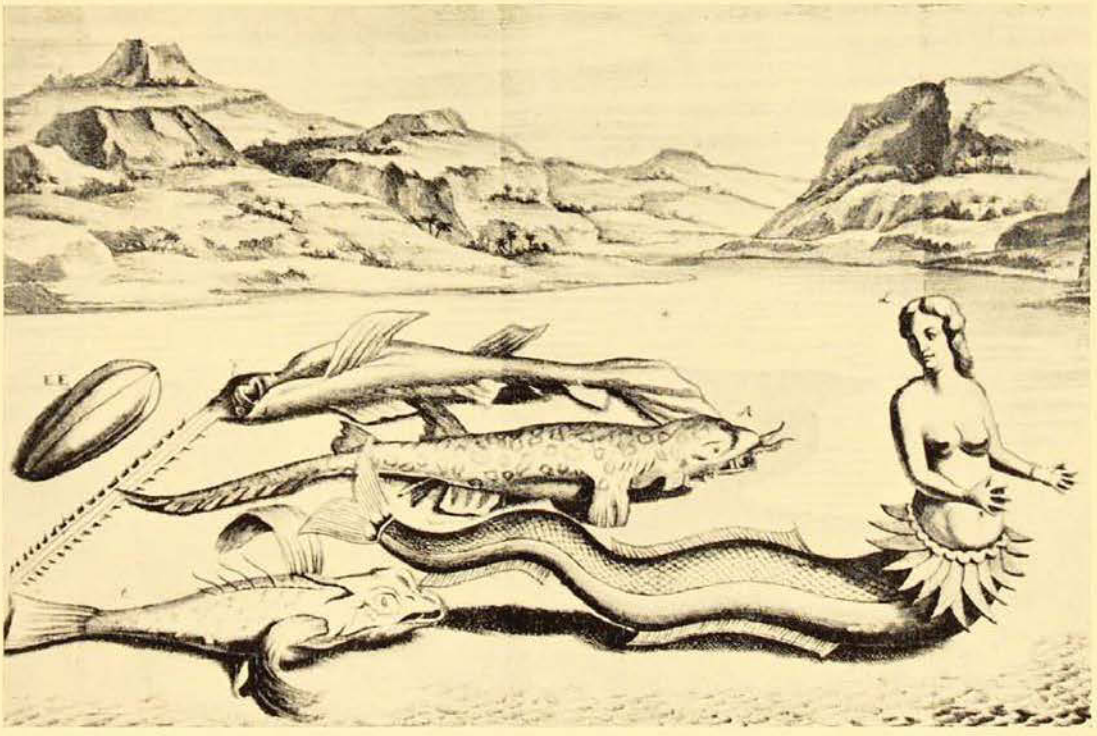
Finally we come to the extremely odd "Flying" Gurnard which might, however, be better termed the Grounded Gurnard since it is doubtful whether it ever flies. When very young it is common at the open ocean surfaces where it is preyed upon by tunas and other surface fishes; then when quite small it sinks to the bottom and migrates, often with prawns, by "walking" on its ventral fins, along harbour bottoms. I have seen one energetically wriggling at the bottom of its tank at Taronga Aquarium, but Beebe in America observed one "now and then actually folding up one leg fin"—quite a Charlie Chaplin effect. The long front dorsal spines are waggled in various directions as balancers. The fish can also change its colours like a chameleon and has two methods of making noises: by stridulating with the long preopercular spines or by vibrating its dorsally situated internal airbladder. Altogether a versatile, intelligent and rather uncanny fish!

According to William Beebe, "A flying gurnard from the point of view of limb function, finds its nearest allies among bats and angels, its fins functioning distinctly as hands, feet and wings. . . . it is almost in a class by itself, for while angels and bats have conquered only two elements, a flying gurnard is at home not only in water and air but is able to trot easily about on solid earth . . . I have seen gurnards rise and scale away from the path of a vessel . . . even a two-incher will leap out and spread its diminutive batlike wings, only to flop back at once . . ." Gurnards may be said to have great muzzle velocity but comparatively little trajectory or range. One of these fishes has been known to knock a sailor senseless by a head-on blow between the eyes, as the man stood at the wheel of a schooner, quotes Beebe. However, Hubbs (who has made very extensive field studies on flying fishes) remarks "the flight of the 'flying' gurnard may, I believe, be confidently added to the long list of sea myths."

There are two species of *Dactyloptena* in Australia: (1) the commoner Flying Gurnard (*D. orientalis*)[3] with no ocellus or prominent blotch on the huge pectoral fin; it grows to one foot long and is found north of the tropic of Capricorn, sometimes extending as far south as Jervis Bay; and (2) the Rufous Flying Gurnard or Butterfly Engloute (D. papilo) with a wider area between the eyes, and shorter pectoral fins, each with a dark ocellus and not reaching as far as the tail fin. This has been trawled in Queensland.

Truly the gurnards are fascinating fishes, beautiful, talented, resourceful, versatile and probably having a much higher degree of intelligence than is usually ascribed to fishy folk.

[3] The Queensland species named *Ebisinus procne* by Ogilby seems indistinguishable from *Dactyloptena orientalis*.



In this quaint eighteenth century scene, laid in an Indonesian estuary, a mermaid is looking at a Flying Gurnard (lower left), whilst a wobbegong, a sawfish and a Maldive coconut adorn the background.

After Valentijn, 1726.

The Shells of Rivers and Lakes—III

By DONALD F. McMICHAEL, B.Sc.

THE remaining group of freshwater molluscs are the snails or gastropods. The name "gastropod" means "stomach-foot" and, in fact, most of the gastropods do have a large fleshy foot for crawling, above which lie the stomach and many of the internal organs. The foot is expanded by blood being forced into spaces in it, and can become quite large compared to the shell, but in most cases it can be retracted again right inside the shell, giving the snail safety from its enemies. The gastropod shell can be considered as a single conical tube, which has become twisted into a spiral. Some snails have either lost the twisting, or perhaps have never developed it properly, and their shell is a simple conical one, such as is found in the marine limpets and in the freshwater limpets. Most snail shells are twisted into a conical spiral but some are flattened, such as the freshwater ramshorn snails of the family Planorbidae.

There are eight families of gastropods which live in fresh water proper, and they can be divided into two groups of four families each. One group shows by its anatomical features that it is related to the marine snails. They have a true gill and an operculum (a limy or horny door, generally found on the back of the foot, which seals the shell when the animal is retracted inside). This group has probably evolved by a gradual transition up the rivers through estuarine and brackish water stages to the true fresh water. The other four families are more closely related to the land snails as shown by the fact that they have a true lung and no operculum. They probably evolved from a group of land snails, which gradually became adapted to living in very wet conditions and finally in the water itself. It is interesting to note that, although these freshwater snails can "breathe" slightly through their skin, they still have to come to the water surface periodically to fill their lung with air.

Freshwater snails are not as pretty as their marine relatives, being as a rule brown or greyish-black in colour, or almost transparent, and very fragile. They are usually quite small, although some species are well over an inch in length. Their shells may be ornamented with spines or bands but they do not show the variety of design and sculpture which is found in seashells. A few species have red pigment in their body, which is similar to that found in human blood, and they can be quite attractive in an aquarium. Several European, Japanese and Australian species have been introduced into many countries for this purpose.

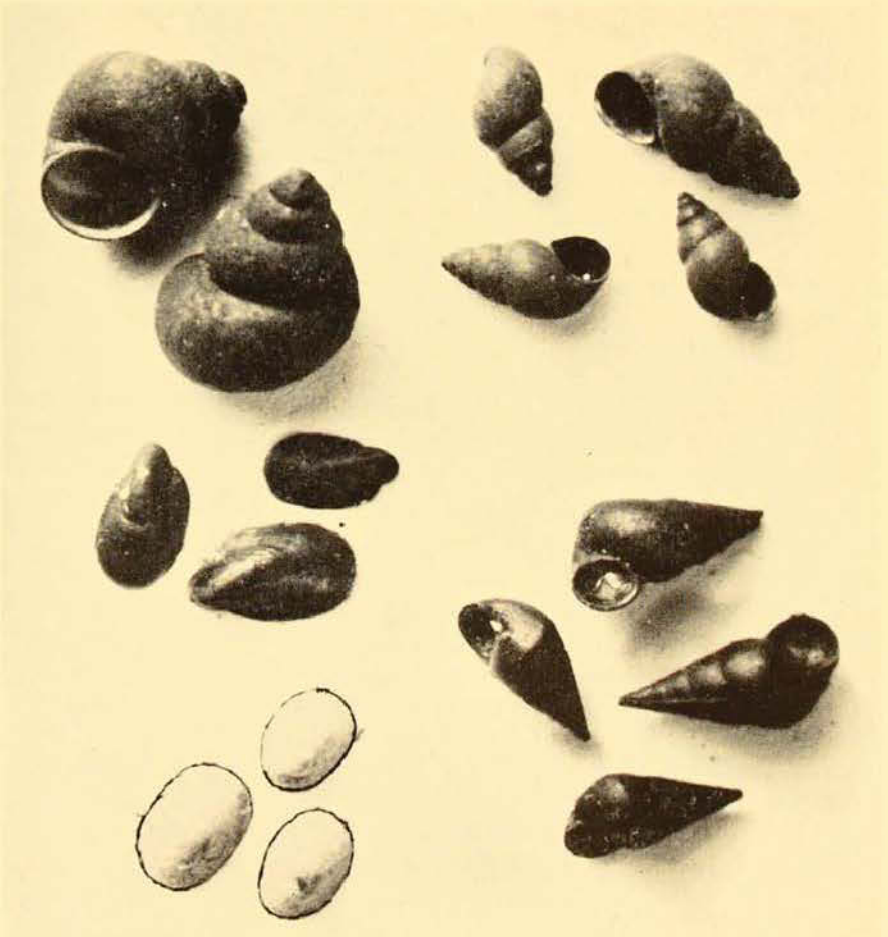
In some parts of the world, freshwater snails are of major health and economic importance, because they transmit the parasitic worms responsible for a number of diseases, including "Liver Fluke" in sheep, and Schistosomiasis, Bilharziosis, and various skin diseases in man. One Australian species is responsible for the transmission of the dermatitis known as "Bathers' Itch" which broke out in the Lower Murray district some years ago after people had swum among pond-snails in some of the swamps nearby. The majority, however, are harmless, and need cause no concern in an aquarium.

Freshwater snails feed on water plants, both living and dead. Aquarium plants such as *Elodea*, *Myriophyllum*, and the minute diatoms and algae coating the walls of the aquarium provide an adequate food supply for them, as well as lettuce leaf, apple and dried leaves. They can move quite rapidly and are often seen walking on the surface film of the water, using the surface tension for support, and with their body and shell hanging upside-down.

The operculate snails, that is, those with marine ancestors, are not as common as the other group. The family Viviparidae, as their name suggests, produce their young alive, and are found throughout the tropical and subtropical regions of the world.

They are common in the northern regions of Australia but do not occur as far south as Tasmania. They are large shells, sometimes reaching one inch in height and breadth, and have large rounded whorls, greenish-brown in colour, often with a number of brownish stripes running around the shell. The operculum is about $\frac{3}{8}$ inch in diameter, horny, with concentric growth marks. There are several Australian species, most being classified in the genus *Notopala*. From the Murray River the species is called *Notopala hanleyi*, while a very similar form from New South Wales is named *Notopala sublineata*. The other species are mostly found in the Northern Territory and North-west Australia, a common species being *Notopala essingtonensis*.

The family Paludestrinidae includes a variety of small shells which show considerable variation in form due to differing ecological conditions. They have darkish shells, conically spiral, some being short and rounded, others tall and pointed. Some species are found in brackish water in the coastal lagoons of New South Wales, but most are true freshwater shells. The genus *Potamopyrgus* is confined to New Zealand and most of the Australian species are now classified in three genera, *Austropyrgus*, *Rivisessor*, and *Tatea*. This group is more common in South Australia and Tasmania than elsewhere in Australia. One species of this family recently appeared suddenly in England and spread throughout the country very quickly. It is still not certain whether this species was introduced from Australia. All these shells are somewhat variable and yet quite similar superficially, seldom reaching more than $\frac{1}{8}$ to $\frac{1}{4}$ inch in height. The several genera are quite similar, differing only in minute characters of the shell, radula, and the operculum. *Tatea* is quite distinct, however, having a tall pointed shell and flattened whorls, giving it a distinct conical shape. It occurs more commonly in brackish and estuarine waters.



On the right, above is *Austropyrgus niger* from Tasmania, and below *Tatea huonensis*, also from Tasmania. On the left, top is *Gabbia australis*, and below, two species of freshwater limpets. The middle species is *Problancylus beddomei*, from Tasmania, showing the secondary cap on the *Pettyancylus tamesus* from Tamworth, New South Wales. back of the shell, and below, a normal freshwater limpet.

On the left are three species of viviparous river snails. At the top, two specimens of *Notopala hanleyi* from the Murray River, New South Wales, with its operculum immediately below, middle the large *Notopala essingtonensis* from North Australia, and bottom *Notopala sublineata* from inland New South Wales. At the top on the right is *Plotiopsis australis* one of the commonest of Australian "Melanias", and below this, the common *Limnaea lessoni* from inland New South Wales. On its left is *Lenameria pectorosa*, from the same region. At the bottom in the middle is *Isidorella brazieri* from southern New South Wales, and on the bottom right is *Limnaea* (*Simlimnaea*) *brazieri*, the snail which transmits Liver Fluke in New South Wales. Note the different direction of coiling in *Limnaea*, as compared with *Isidorella* and *Lenameria*.

The family Bithynidae is a closely related group, the commonest species being *Gabbia australis*, a rounded shell about ¼ inch high, and ¼ inch in diameter, with a large body whorl, blackish-brown, its operculum horny, with marked ridges externally, but shelly and smooth internally.

The family Thiaridae includes a large number of species from the Indo-Malayan Archipelago, but comparatively few are found in Australia. It includes those species which were known as *Melania* and its allies. The shells are tall, pointed, up to an inch long, and are often ornamented with spines and tubercles. They occur mainly in Northern Australia.

A distinct family of shells occurring in the inland salt lakes of Australia is not clearly related to any of the above groups and is not found in truly fresh water. This is the family Coxiellidae. They are somewhat similar to the "Melanias" in shape, but if anything, they are related to *Gabbia*. There are about half a dozen very similar species up to half an inch long placed in two genera, which differ in minor characters, *Coxiella*, and *Coxieladda*.

The remaining four families, which are related to the land snails, are much more common and generally larger than the previous groups. These are the snails which are commonly seen in aquaria and which are mainly responsible for the transmission of the various fluke diseases. The family Lymnaeidae has recently been revised by overseas workers, who consider that a great many of the so-called Australian species are in reality only variations of the commoner species, whose shells have developed a slightly different form due to the particular conditions under which they live. These numerous species have been split up into several genera, different from those overseas, but it is now thought that they are not really very different, and that they are best considered as belonging to a few genera, which are widely distributed over the world. *Limnaea lessoni* is found very widely in Eastern Australia and is a large globular shell, very fragile, with a large body whorl, and a short variable spire. It grows to about ¾ inch long and is usually

a pale straw colour. The shells of *Limnaea* are coiled in a clockwise fashion, from the top of the spire to the mouth (dextral coiling). A group of smaller shells living in South-eastern Australia has been called *Simlimnaea*. The species which is responsible for liver fluke transmission in Australia is *Limnaea* (*Simlimnaea*) *brazieri* and it occurs throughout the eastern half of New South Wales. This group has a small shell, being only about ½ inch long, a tall spire, and the shell is usually greyish-black to brown. Another tiny species called *Limnaea* (*Glacilimnaea*) *gelida* occurs in the Blue Lake at Mount Kosciusko but is probably only a coldwater form of one of the commoner species.

The family Bullinidae is the commonest of all the Australian groups, and as a result, many species have been named, but as with the Lymnaeidae, the several forms are probably only variations of a small number of species. The shells are all sinistrally coiled, that is, in an anti-clockwise fashion from the top of the spire to the mouth. The shells from eastern Australia are classified as *Lenameria*, the common species around Sydney being *Lenameria gibbosa*. This is a very widely distributed form, showing many variations, from a tall spired thin shell, more than ¾ inch long, to a shell with a large fat body whorl and almost no spire at all. From Central Australia, ranging into northern New South Wales, and South Australia, the species are all small and globular, with a darkish periostracum and they have been called *Isidorella*. One or two species have been described from the coastal regions of New South Wales and Victoria but they may not belong in *Isidorella*. A peculiar group confined to Northern Australia is the genus *Amerianna*, which probably occurs in New Guinea and the islands, as well. It has a keel or ridge on the upper part of the whorls, which gives them a squared appearance, and the spire is reduced so that it does not show above the top of the body whorl. A somewhat similar group from South Australia and Victoria, which retains the tall spire but has keeled whorls and a distinct sculpture on the shell, is named *Glyptamoda*. There is not space to consider all the species of this family here and their separation is based mainly on minute details of form, sculpture, and on their geographic distribution.

The small flat coiled shells of the family Planorbidae, are related to the preceding family, and are quite common in Australia. We have no species as large as *Planorbis corneus* of Europe, nor the *Planorbis* of Japan, commonly found in aquariums, but there are a number of small pretty red species, up to ¼ inch in diameter, and about ⅛ inch tall. The differences between the species, and even the genera are too small to be described here. One interesting species is *Glacidorbis hedleyi*, a comparatively tall form from the Blue Lake, Mount Kosciusko. The common species around Sydney is *Segnitila australiensis*, which is found among thick vegetation in small creeks and ponds occurring on the Wianamatta shale.

Last but not least is the family Ancylidae, the freshwater limpets, also known as caplimpets. These are tiny creatures, scarcely visible to the casual glance, but appearing in large numbers on water plants when seriously looked for. If some water grass or reed stems are left in a white enamel dish for some time, the tiny black limpets will often be seen crawling on the white enamel.

They are slightly oval, about ⅛ inch long, and the top of the conical shell is nearer the front end of the shell. The species are separated by minute differences in the shape, size and sculpture of the shell. A few species have a secondary cap-like structure on the apex of the conical shell and these have been grouped in a separate genus, *Problancylus*, although it is probable that the cap develops only under peculiar conditions, such as the drying up and subsequent flooding of a swamp or pond. The other species are mostly placed in the genus *Pettancylus*, while three Tasmanian species only are placed in the genus *Legrandia*.

These freshwater snails are an interesting and easy group to study in the aquarium and, when a great deal of observation on their habits and structure has been done, we will be able to classify and separate correctly the different kinds.

Reviews

AUSTRALIAN SEASHORES. By W. J. Dakin, D.Sc., C.M.Z.S., assisted by Isobel Bennett, Department of Zoology, University of Sydney, and Elizabeth Pope, M.Sc., The Australian Museum, Sydney. 372 pp. with text illustrations, 4 colour plates and more than 100 black and white photographs. Angus & Robertson Ltd., Sydney, 1952. Obtainable at all booksellers. £2 5s.

Readers of the AUSTRALIAN MUSEUM MAGAZINE must include a large number of students of marine life and, to them, as well to all who are interested in natural history, the appearance, at last, of this book must be a notable event.

In designing the book the authors aimed high, for they desired that it should not only be of sufficient scientific worth to attract the pure zoologist, but that its form and phrasing should appeal to a much wider reading public. There must be a minimum of technical language and the illustrations must be plentiful and of a high standard. This is a very difficult object, which is seldom achieved, but "Australian Seashores" fulfils the conditions admirably.

In some ways it is unique for, although its main purpose is that of a working handbook of shore life for the student, who in many cases can get the information he wants just by looking at the pictures, there is a valuable first part which deals with general features of the sea. This covers such interesting topics as methods of sounding ocean depths, conditions of life at the sea bottom, the colour of the sea, the chemistry of sea water, tides and what causes them, ocean waves, how coastlines are moulded, luminescence of marine organisms, and the plankton.

Having given the reader this general background and made him realize that the study of the sea has many facets, this first part of the book ends with a chapter on camouflage and living colour on the seashore. This chapter serves as an introduction to part two, occupying more than two-thirds of the entire work and devoted to the animals and plants of the shoreline. These are dealt with, group by group, and are accompanied by photographs, the originals of which have lost surprisingly little in the process of being made into half-tone blocks. The colour plates are very good indeed. The production of this book is the result of many years' work, along some 2,000 miles of Australian coastline, and had long been the dream of its principal author, the late Professor W. J. Dakin. It is a tragedy that he did not live long enough to see it appear in print, for to him goes the credit for the original idea and the writing of the entire manuscript.

The co-authors, who accompanied and assisted him on his expeditions, were left with the formidable task of seeing the book through the press, a task beset with tedium and frustration. They are to be congratulated on the fine job they have done.

It is fitting that this review should appear in the AUSTRALIAN MUSEUM MAGAZINE, for Professor Dakin was a Museum Trustee for many years, one of the co-authors is a present Assistant Curator, and acknowledgment is made in the preface to other Museum Officers who gave much-appreciated assistance.

—A. N. COLEFAX.

DANGEROUS SNAKES OF AUSTRALIA. A Handbook for Bushmen, Bushwalkers, Mission Workers, Servicemen, Boy Scouts, New Australians, and Naturalists on the identification and venoms of Australian Snakes, with directions for first-aid treatment of snake-bite. By Eric Worrell. 64 pp. with 32 photographs by the author. Angus & Robertson Ltd., Sydney, 1952. Obtainable at all booksellers. 10s. 6d.

"The Dangerous Snakes of Australia" by Eric Worrell is an excellently illustrated and very good little book of its kind and should be quite useful to the bushman and the man-in-the-street for whom it was written.

Mr. Worrell, who is one of our foremost reptile collectors, has a wide knowledge of snakes in their native state and it is a little disappointing to find that he had not included more notes on their habits and less of the technical descriptions which should be left to the professional herpetologist; such descriptions are most valuable in their place but only when a key to the species is included, which is not the case in Mr. Worrell's book.

However, the author is well known to herpetologists and other specialists with whom he keeps in touch and it can safely be said that his chapters on venoms, serums and treatment of snake bite are factual and informative to the point.

A member of the staff of the Museum is anxious to obtain copies of old numbers of the MAGAZINE, No. 1 of Volume I, Nos. 9 and 10 of Volume 2 and No. 2 of Volume 3, which are now out of print. We would be interested to hear from any reader who has these numbers and is willing to sell them.