

The
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Vol. V, No. 9.

JANUARY-MARCH, 1935.

Price—ONE SHILLING.



Gillbird or Wattle Bird.

THE AUSTRALIAN MUSEUM

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THE AUSTRALIAN MUSEUM MAGAZINE

THE JUMPING JOEY (<i>Lepidoblennius haplodactylus</i>) BASKING IN THE SUN ..	Frontispiece
SOME FISHES OF THE SYDNEY DISTRICT—with coloured plate— <i>G. P. Whitley</i> ..	291
OBITUARY—WILLIAM SUTHERLAND DUN	304
TRILOBITE HUNTING IN THE NORTH— <i>H. O. Fletcher</i>	305
REVIEWS	312, 319
THE LARGEST GLIDERS OR "FLYING POSSUMS"— <i>E. Le G. Troughton</i>	314
AUSTRALIAN SHELLS: EAR-SHELLS AND WIDE-MOUTHED SHELLS— <i>Joyce Allan</i> ..	320
THE SPEAR-THROWER. Photograph by <i>Captain F. Hurley</i>	325
A MANUS HOUSE, ADMIRALTY ISLANDS. Photograph by <i>Dr. R. Fortune</i>	326
NATIVE GIRLS, NEW GUINEA. Photograph by <i>Captain F. Hurley</i>	327
BASKET MAKING, CAPE YORK. Photograph by <i>Miss U. McConnel</i>	328

■ OUR FRONT COVER. The Gillbird or Wattle Bird (*Anthochaera carunculata* Latham) is by Lilian Medland. It is one of a series of postcards issued by the Australian Museum.

The familiar Gillbird is so named on account of the red caruncles or fleshy wattles hung on either side of the mouth. It is the largest of our Honeyeaters. It occurs in flocks, and moves about within certain limits, following the seasons for the flowering trees among which it feeds. It is very partial to banksias and bloodwoods, and is to be found in the coastal belt during the winter when these trees are in bloom. Occasionally it breeds on the coast, but more usually retires into the ranges during its spring breeding season.

The bird is found all across southern Australia, from Queensland to Western Australia. Its note is a peculiar harsh choking or gobbling sound, which is beyond description. It is shot in considerable numbers, since its flesh is very delicate and tasty.

The Gillbird builds a large open nest of twigs and bark, lined with soft bark, grass, and sometimes feathers. Two or three eggs are laid, lustrous salmon colour, with blotches of rich reddish brown and purplish-grey, especially at the larger end.



The Jumping Joey (*Lepidoblennius haplodactylus*) basking in the sun. This fish grows to a length of four inches and is very common in rockpools. Its colours harmonize with those of the coralline weeds.

[Photo.—*T. C. Roughley.*]



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JANUARY-MARCH, 1935.

Some Fishes of the Sydney District

By G. P. WHITLEY.

THE marine fishes of the Sydney district are of considerable commercial value and scientific importance. Many of them have been used as food from the earliest times, as their remains may be found in aboriginal kitchen middens, and the journals of the first white visitors to New South Wales mention the fish they obtained by line and seine as a welcome change from the wearisome diet of long sea voyages. Though most of the Sydney fishes are well known, their habits and life histories are but little investigated, and much work must be performed before valuable data concerning these can be secured.

Fishes are sometimes depicted in aboriginal rock-carvings or have their names perpetuated in place-names. Parramatta, for instance, means the resting-place of eels, and Cape Wollomai, in Victoria, is named after the snapper.

Observations made on our fishes by early naturalists and settlers generally agree with present findings, so that they might almost have been written yesterday instead of about 150 years ago. And any

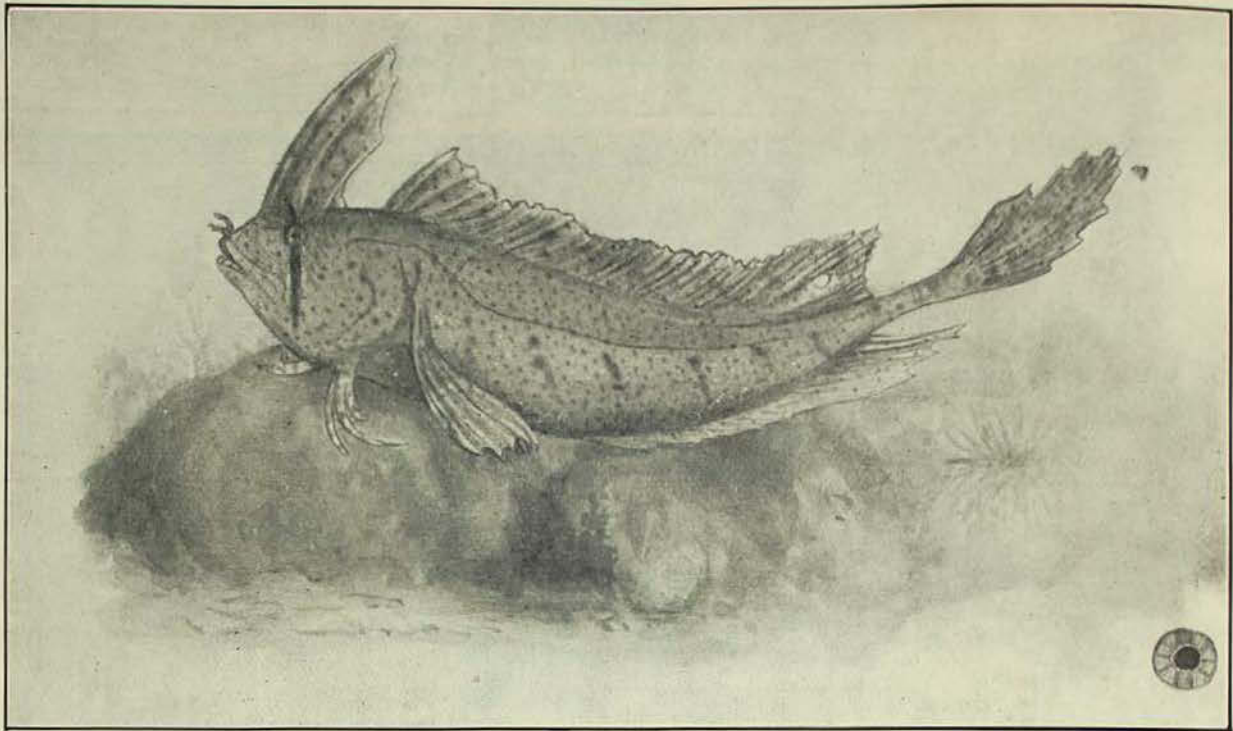
visitor to La Perouse or Kurnell, in Botany Bay, can still see there the identical species of fishes of which mention is made in the journals of Cook, Banks, and Phillip, and by the early French naturalists. There has, however, been serious depletion, as nowadays we do not catch many hundreds of snapper a day as they did.

WHERE FISHES LIVE.

As our fishes are free-swimming animals, it might be expected that they would range uniformly over wide marine areas, unlike the sedentary molluscs and lower invertebrates which are restricted to certain regions. Though fishes may move up and down with the tides or venture farther inshore at night, most of them are found limited to certain zones with definite conditions of environment and food supply.

SEA SHORE OR LITTORAL ZONE.

In rock-pools, the Jumping Joey (*Lepidoblennius haplodactylus*) is easily the most commonly noticed fish. With the body slightly curved and the broad



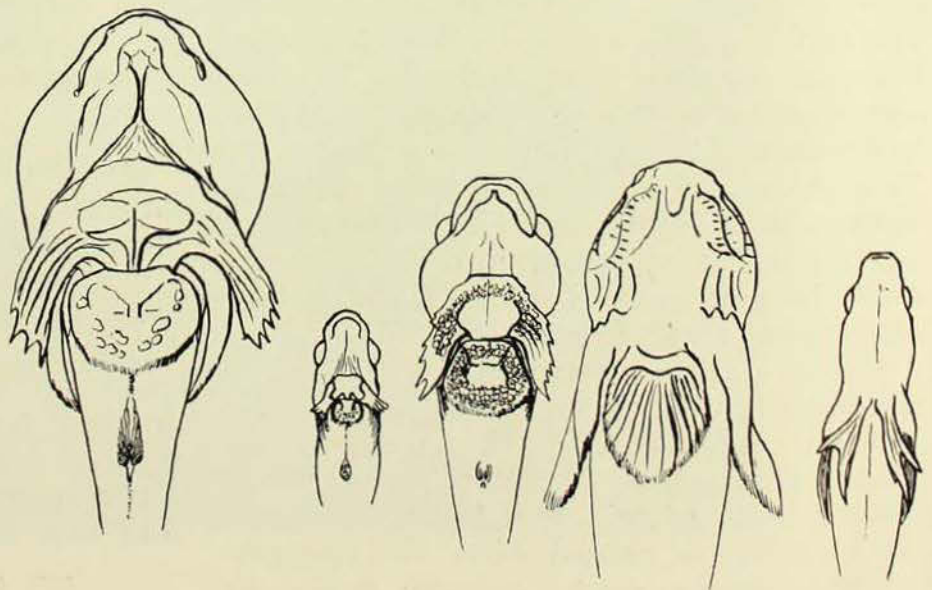
The Crested Weedfish (*Cristiceps argyropleura*) greatly resembles a piece of kelp. The eye, shown on the right, is richly coloured.

[Ethel A. King, *del.*

pectoral fins extended on each side, this fish may be seen lying at the bottom of many a shallow pool. It also delights to leave the water entirely and bask in the sun on some ledge of rock, clinging to weeds or rocks with its finger-like fin-rays. It can leap actively over the ground, and jumps into the nearest pool with a splash when disturbed.

The Three-fin Blenny (*Vauclusella annulata*), a small scaly fish whose colour varies from green to red, often mottled or with the borders of some of the scales dark, and which has three fins along its back, is commonly found by turning over stones. It clings tenaciously to the under surface of rocks, and as its colours match its background, it is often overlooked until it drops into the water from its perch. A curious, small-eyed, elongate brown and white fish, of small size, is also found in shallow pools. This is the Tommyfish (*Limnichthys fasciatus*); it has a flattened head.

Weedfish of the genera *Petraites* and *Cristiceps* are common among kelp and kindred weeds, which they resemble in form and coloration. These fishes are characterized by an elevated dorsal fin, of three spines connected by membrane, which is situated well forward on the head. Their colour exactly matches that of the kelp, and they even have trans-



Ventral fins and suckers of small shore fishes. Left to right: Red Clingfish (*Volgiolus cardinalis*), Little Clingfish (*Parvipepis parvipinnis*), Common Clingfish (*Volgiolus costatus*), a Goby (*Mucogobius depressus*) and Sabre-toothed Blenny (*Ostreoblennius steadi*).

[Joyce K. Allan, *del.*

parent spots on the dorsal fin which simulate holes or torn pieces of weed. The young of these fishes are born as miniatures of their parents.

Gobies are common in almost all shore localities, but the Slimy Goby (*Mucogobius depressus*) is the best known rock-inhabiting form, being common at Bottle and Glass Rocks, Port Jackson. Lazy, pinkish or brown Clingfishes have a peculiar sucker on the lower surface of the body by which they can affix themselves to stones. These belong to the genera *Parvicrepis* and *Volgiolus*, and, if handled, do not bother to swim away, but adhere to the nearest stone or even to the hand of their captor.

A species of Pipefish [*Festucalex (Campichthys) runa*] and the Pigmy Shore Eel (*Alabes parvulus*) are also common in rock-pools, as are likewise the young of some of the kelp-inhabiting fishes, notably the Rock Cale (*Crinodus lophodon*) and the little green "baby" of the huge Groper (*Achærodus viridis*). The ubiquitous Toado (*Spheroides hamiltoni*) also invades the rocky waters of this area, and its greenish, pear-shaped body, ornamented with bands of close-set dark spots and its red tail, render it easily distinguished. Little is known of the breeding habits of the rock-pool fishes, but their young have been collected in the summer time.

In the intertidal and kelp section of the littoral zone the species of fishes become more numerous. The White Ear (*Parma microlepis*), a brown fish with a white patch on each gill-cover, and whose slow-growing young is bright blue and orange; the well-known Blackfish (*Girella triglyphus*), and the Kelpfish (*Chironemus aboriginalis*), which takes a cunjevoi bait, are catches the fisherman is likely to make there. The Red Rock



The Green Eel (*Verdithorax prasinus*), a savage rock-pool fish.

[Joyce K. Allan, del.]

Cod (*Ruboralga jacksonensis*), Rock Flat-head (*Thysanophrys cirronasus*) and Rock Cale (*Crinodus lophodon*) live in this zone, and all closely resemble, in coloration, the weed-covered rocks amongst which they like to lurk. Indeed, the Red Rock Cod often lie one over the other, like a clump of stones. Black Rock Cod (*Epinephelus damelii*), Black Drummer or Rock Blackfish (*Girellipiscis elevatus*), the spotted Wirrah (*Acanthistius ocellatus*) and Sweep (*Scorpiis lineolatus*) are also common. Large fishes like the Groper (*Achærodus viridis*) live in the deeper waters of the rocky reefs in the zone which is probably the least known of all, as it is inaccessible to waders and too rocky for net-fishermen. About this zone curious sedentary species like the Red Indian Fish, Goblin Fish and Leafy Sea Dragon seem to have their homes.

The Wobbegong or Carpet Shark (*Orectolobus maculatus*) lies in wait for its prey at the bottom of water amongst rocks, and the misnamed Blind Shark (*Brachælorus waddi*), which has very small eyes and a feeler on each side of the mouth, is also caught in the same places. Both these species bear living

young. The Piked Dogfish (*Squalus megalops*) is another small shark of the rocky belts of coast-line, characterized by a sharp spine in front of each dorsal fin; this species is uniform greyish in colour, and the spines of the embryo are covered by knobs before birth.

The Green Eel (*Verdithora x prasinus*) hides in the crevices between rocks, and feeds on crabs and other animals. It can bite very savagely, and many people have had nasty wounds inflicted by these eels. Their green colour sometimes tinges the rocky walls of their lairs, but it is a fugitive tint, fading after the death of the eel to a uniform brown.

THE WHARF-PILE SECTION OF THE LITTORAL ZONE.

Small boys fishing from wharves often catch specimens of the dignified little Old Wife (*Enoplosus armatus*), a fish with vertical brown bands of great beauty, the blue Sweep (*Scorpius lineolatus*), the Mado (*Atypichthys mado*), with yellow and black horizontal stripes, and the silvery-bodied Yellowtail (*Trachurus declivis*). These fish shelter near the piles during the day, but spread over the sand-flats at night in search of food.

The wharf-piles themselves are covered with marine growths and often burrowed by borers. The Sabre-toothed Blenny (*Ostreoblennius steadi*) may be found curled up in empty oyster shells, in which it lays its eggs. Care should be taken in handling the little mother, as her long curved canine teeth can inflict a wound which will draw blood. Small yellow Blennies with black spots, the Chessboard Blennies (*Pictiblennius iredalei*), shelter amongst wharf-pile growths in selected spots in our harbours. They may be found at Clark Island, Port Jackson, for



A school of Old Wives (*Enoplosus armatus*), Taronga Park Aquarium. [Photo.—A. Musgrave.]

instance, very commonly, yet search for them in other likely places around Sydney may only result in disappointment. Another Blenny, the Oyster Blenny (*Cyneichthys anolius*), lives in empty cobra burrows, and is noted for its skinny flap on the top of the head, giving it the appearance of wearing a helmet.

The Fan-bellied Leatherjacket (*Monacanthus sinensis*) feeds on the weeds, hydrozoa, and other growths on piles. This species may be identified by the ventral flap hanging down like a dewlap from its body. It is fairly large, but may be accompanied by its tiny relative the Pigmy Leatherjacket (*Brachaluteres fidens*), which grows only to about three and a half inches in length, and has no ventral flap; it feeds on minute crustacea. Captain Cook's Leatherjacket (*Scobinichthys granulatus*) has a very rough integument. Schools of Chanda Perch (*Pseudambassis jacksoniensis*) and Soldier Fishes (*Lovamia fasciata*) also swim near jetties, and the beautiful Banana Fish or Comb-Fish (*Ctenocorissa picta*), a yellowish parrot fish with a black comb-shaped band on each side of its body, is sometimes caught in the same waters.

HARBOUR WATER ZONE.

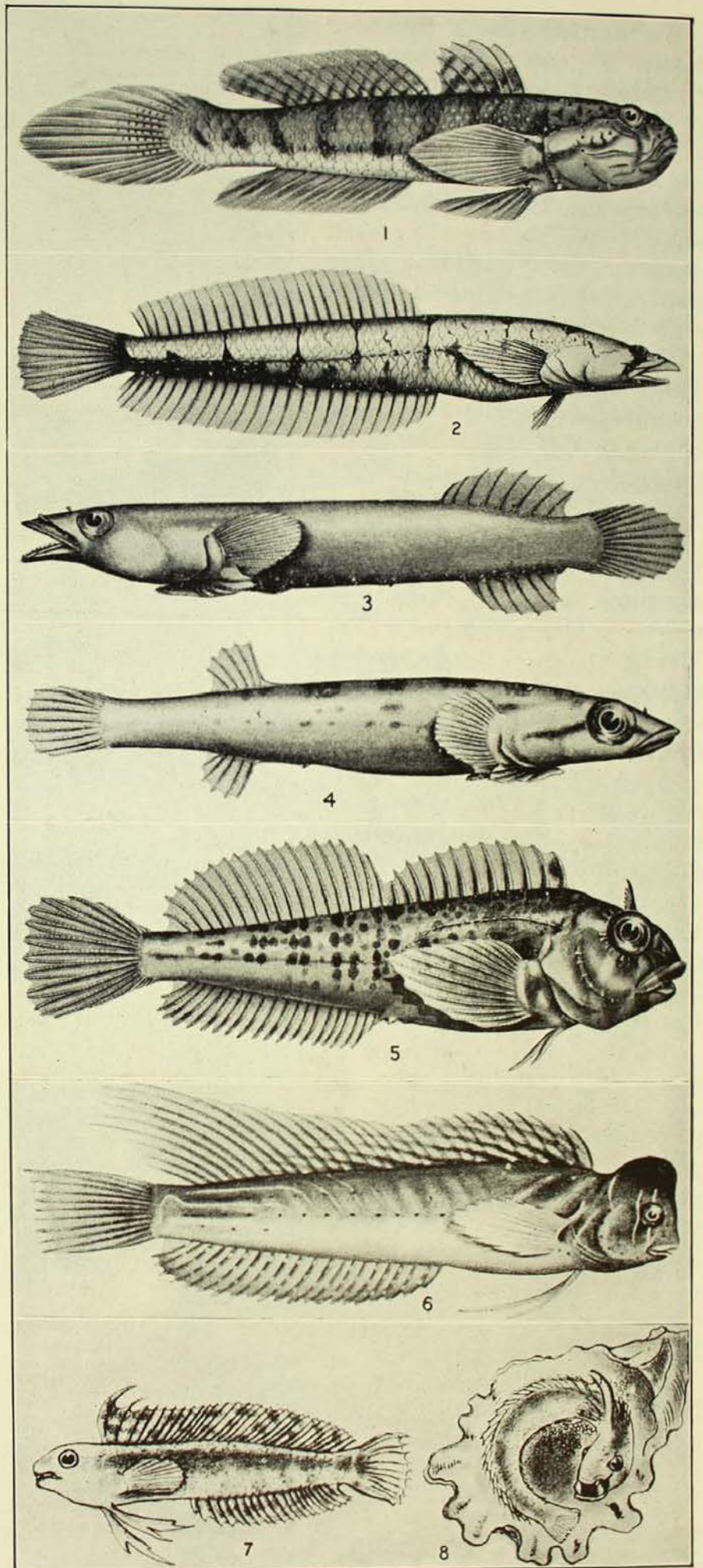
Most of the best-known commercial fishes are found in the waters of this zone, but they are not so much restricted as the fishes of the littoral or surf waters, many of them being found inshore, beyond

the rocks, or in water twenty fathoms or more in depth.

The Snapper (*Chrysophrys guttulatus*) holds pride of place and commands the highest price. Next in popularity to the Snapper is the Black Brim (*Roughleyia australis*), which is olive-coloured and lacks the gibbositities on the head characteristic of its larger cousin, the Snapper. This species is very common. The largest specimen in the Australian Museum measures 22 inches and weighs 7½ pounds. The true Bream of Europe is a fresh-water fish, very unlike any Australian species, so that the spelling "Brim" might well be employed for our local fish, whose name is always thus pronounced.

Another fine food-fish is the Sand Flathead (*Trudis caruleopunctatus*), but the species exposed for sale in most Sydney shops is the trawled Tiger Flathead (*Neoplatycephalus macrodon*), a deepwater species. The Dusky Flathead (*Planiprora fusca*) was called Paddewah by the aborigines.

The commoner Flatfishes of the harbour-water zone are the Flounder (*Pseudorhombus jenynsii*) and the Black Sole (*Synaptura nigra*). Flounders lie flat on the bottom, half buried in sand, or changing their colours to match their surroundings, their eyes standing up like knobs above their twisted faces.



Blennies and their kin. 1, Bridled Goby. 2, Tommyfish. 3, Common Clingfish. 4, Little Clingfish. 5, Chessboard Blenny. 6, Oyster Blenny, with crest on head. 7, Sabre-toothed Blenny. 8, Sabre-toothed Blenny guarding its eggs in oyster shell.

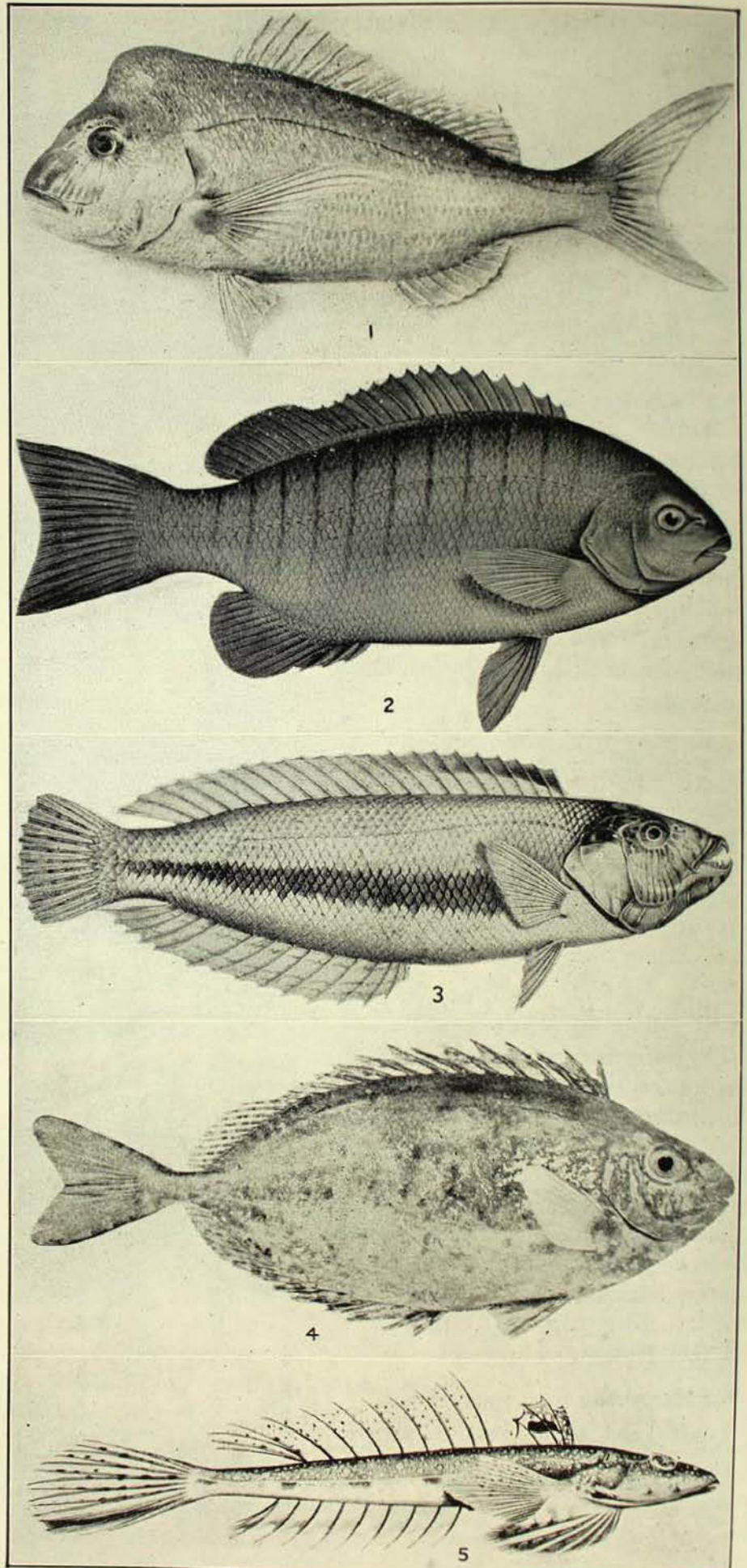
[1-6, after McCulloch, Fish. N.S.W.
[7-8, drawn by Joyce K. Allan.

To distinguish a flounder from a sole you should examine the side of the head; if the margin of the preoperculum (the bony flap between cheek and gill-cover) is free, the fish is a flounder, but if it is covered with scales and without a free margin, it is a sole; the soles also have the tailfin united with the dorsal and anal fin. The Tongue Sole (*Paraplagusia unicolor*) is a long brown sole with the tail pointed. All these species have a delicate flavour.

Three species of Red Mulletts or Goatfishes are common in the Sydney district. The Spotted Red Mullet (*Barbupeneus signatus*), with a dark spot over the caudal peduncle; the little Bar-tailed Goatfish (*Caprupeneus jeffi*), with oblique brown bars on its tail, and the large Blue-striped Goatfish (*Upeneichthys lineatus*), with a striped face and deep body. These are illustrated on the accompanying coloured plate.

Parrot fishes are very common, and like to lie, almost on one side, on the bottom of the water or near rocks. The so-called White-spotted Parrot Fish is the young of the Crimson-banded Parrot Fish (*Pseudolabrus gymnogenis*), and is the commonest kind caught.

The Lilac-banded Parrot Fish (*P. tetricus*) is also a common species, whose colours are extremely vari-



1, Snapper. 2, Blackfish. 3, Maori.
4, Spinefoot or Black Trevally.
5, Stinkfish or Dragonet.
[After McCulloch, Fish. N.S.W.]



Red Gurnards (*Currupiscis volucer*) in Taronga Park Aquarium.

[Photo.—A. Musgrave.]

able. The Maori (*Ophthalmolepis lineolatus*) is so called because of the similarity of the blue lines on its cheeks to the tattoo marks on the old Maoris. It is a good food-fish and, like the other parrot fishes, often buries itself in sand.

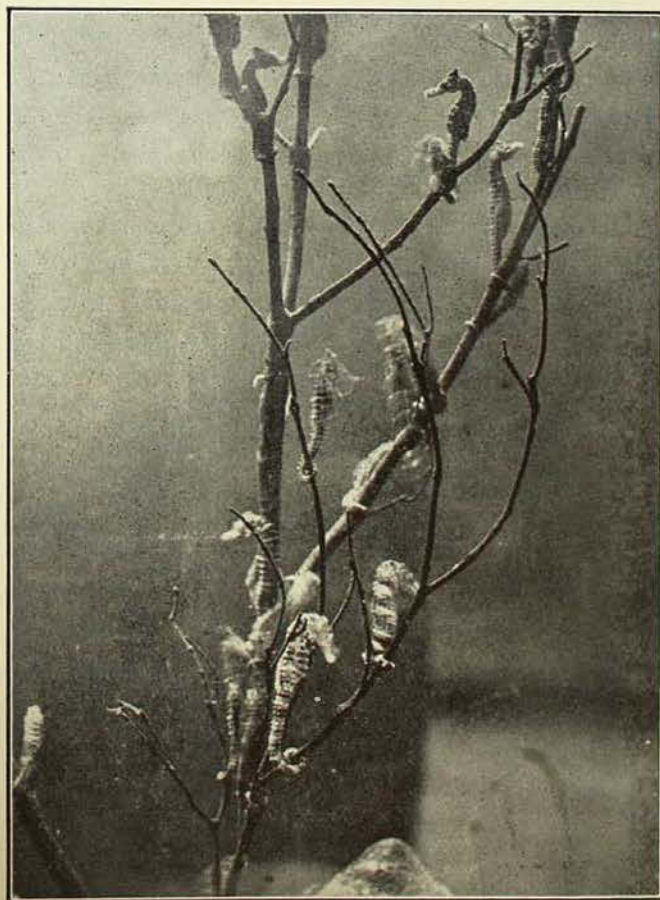
The Common Green-banded Parrot Fish (*Pictilabrus laticlavius*) is green with two broad purple bands along each side, but reddish specimens are sometimes caught. The membranes of the spinous dorsal fin are not produced into flag-like flaps as in the genus *Pseudolabrus*.

The Pigfish (*Verreo unimaculatus*) is a brilliant pink parrot fish with a somewhat pointed head. An allied species or variety (*V. bellis*) has red blotches on the body, but the typical form has a blackish spot on the dorsal fin.

Other food-fishes of the harbour water zone, some of them of great beauty, are the Herring Cale (*Olisthops cyanomelas*), no relation to "Caller Herring", in which the male is dark bottle green and the female brown with dense mottlings, and the Black Trevally (*Amphacanthus nebulosus*), with several sharp spines in the dorsal, anal and ventral fins, wherefore it is sometimes called Spinefoot. The Trumpeter or Trumpeter Perch (*Pelates sexlineatus*) has brown horizontal stripes along the body. It is usually caught in seine nets and derives its name from the curious noise it produces by drawing air into its gullet and quickly expelling it. The Grunters (*Terapon*) of our fresh-water rivers, the estuarine Bullrout (*Notesthes*) and the marine Gurnards (*Triglidae*) have a similar habit.

Dragonets or Stinkfishes (*Repmucenus calcaratus* and *Fætorepus achates*) are sometimes dredged from the harbour bottom. They superficially resemble flatheads, but have only a small gill opening on each side of the top of the head. They derive their name from their rather musky smell. They have a curious hooked spine on each preoperculum, and the males have the fins lengthened and ornamented with beautiful colours, which they display during courtship. (I have noticed *F. achates* displaying at Coogee in October.)

Red Gurnards (*Currupiscis volucer*) are occasionally caught in Port Jackson and are of amazing beauty. The head is encased in bony armour and the fins are protected by rows of bony bucklers. The first three rays of each pectoral fin are separate and form sensitive fingers with which the gurnard continually feels its way along the bottom, looking almost as if it were



The decorative little Sea Horses cling to submerged branches by means of their curling tails, Taronga Park Aquarium.

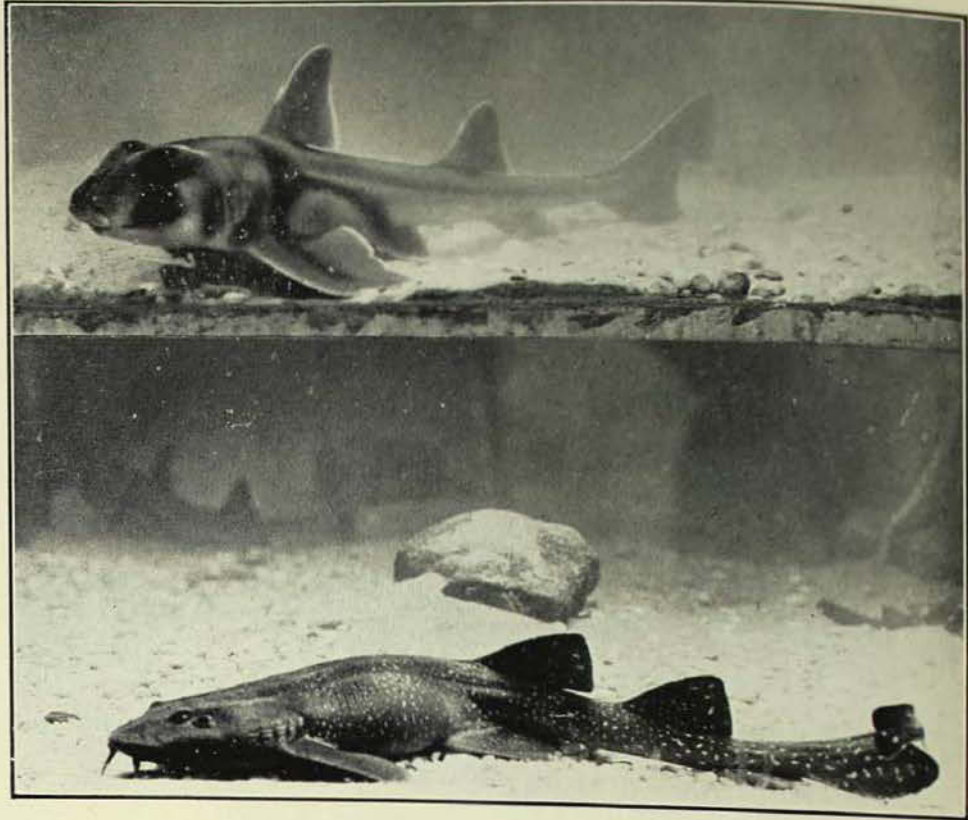
[Photo.—A. Musgrave.]

walking on little legs. The membranous portion of the pectoral fin is almost like a butterfly's wing, and is gorgeously coloured with velvety green, ornamented with bright blue eye-spots. The gurnard usually either glides along the bottom or swims with a wriggling motion of the body, but when it descends through the water it opens out the beautiful pectoral fins and volplanes slowly down.

Seahorses of various kinds are common in harbours, especially amongst weeds. The best known Sydney species is the little *Hippocampus whitei*, which swims upright by flicking undulations of its fins until it touches some anchorage, when it coils its tail tightly around it and rests for a while. The horse-like head has a long tube-like snout with tiny jaws at its extremity. The food of the seahorse consists mostly of small crustacea. After the female lays her eggs, the male carries them in an abdominal pouch until hatched.

The Flutemouth (*Fistularia depressa*) is a giant pink or brown relative of the pipe fishes and seahorses, and is sometimes captured by line in our harbours. It has a long filament extending from the middle of its forked tail.

Sharks are common all the year round in the Sydney district, but most of them are harmless to man. The dangerous species like the Blue Pointer, White Shark and Grey Nurse are oceanic and commoner in the summer. The most interesting from a scientific point of view is the Port Jackson Shark. There are two species in New South Wales—the Crested Port Jackson Shark (*Molochophrys galeatus*) and the Common Bullhead (*Heterodontus portusjacksoni*), known to our aboriginal forerunners as Tabbigau. The former has elevated crests over its eyes, but the common Port Jackson Shark may be readily distinguished by the brown



Above: The Port Jackson Shark. Below: The Blind Shark. Taronga Park Aquarium.

[Photo.—A. Musgrave.]

stripes on its body. Sharks of this kind were commoner and more widely distributed in prehistoric days than they are at present, as fossil remains have been found in various parts of the world where the family is now extinct. The jaws of the Port Jackson Sharks are characteristic: there are rows of sharp teeth in front for catching their prey or for levering molluscs or sea-urchins off rocks, and hard scroll-shaped molars at the back of each jaw for crushing the food; these teeth may often be stained red from eating large purple Sea Urchins, and one Port Jackson Shark in the Australian Museum is coloured red all over from this cause. Bullheads are harmless to man, and only grow to a length of about four feet. They lay remarkable eggs, which are pear-shaped, horny objects, spirally flanged, and, in the case of the Crested Port Jackson Shark, provided with long tendrils.

The curious Hammerhead Shark (*Sphyrna lewini*), whose name describes its general appearance, arrives from the north at the beginning of the summer, and small specimens are said to become fairly common later.

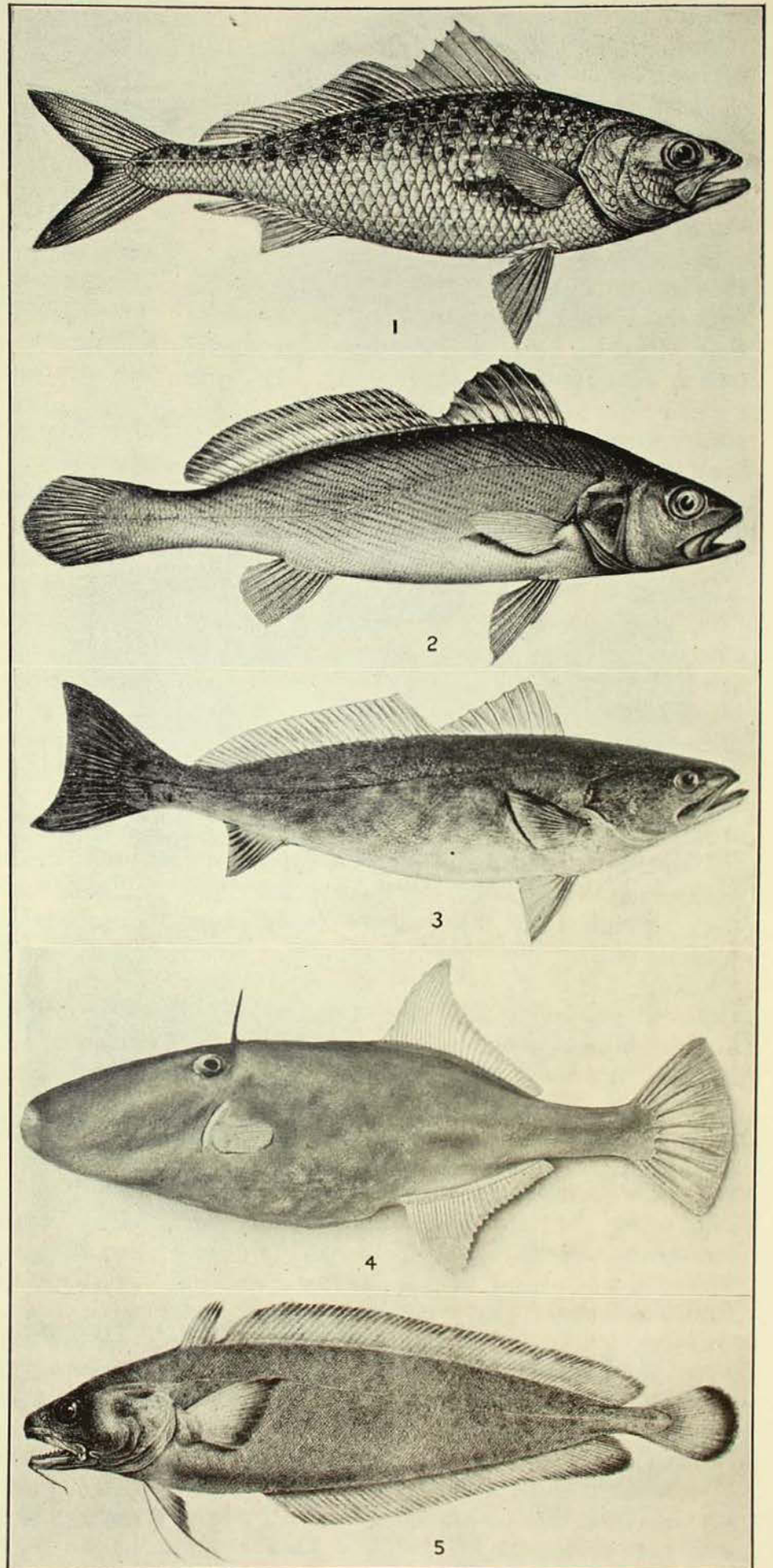
The Tiger Shark (*Galeocerdo rayneri*) is a large, slow, prowling scavenger. The broadly rounded snout, characteristic rounded, notched and serrated teeth, and the dark transverse bars on the body serve to identify it.

The Angel Shark (*Squatina australis*) is a link between the Sharks and their flattened relatives the Rays. The body of the Angel Shark and its pectoral and ventral fins are depressed and flattened, but its gill-membranes are on its sides, as in sharks, and not underneath the body as in rays. The species is common in rocky or harbour waters in-shore, and produces living young; the breeding season is between June and September.

THE OCEAN BEACH ZONE.

In the sand at the edge of the waves the unusually observant (or lucky) collector may catch the Sand-fish (*Crapatalus arenarius*), an elongate creature, up to nearly four inches long, which is so much like the sand in colour that, mixed with it, the fish is almost indistinguishable.

The tumbling surf is not popular amongst fishes as a place in which to live, yet the Surf-fish or Flower of the Wave (*Iso rhotophilus*) thrives there, and swims in dense shoals in the heaviest waters, although many are sometimes washed into rock-pools and isolated as the



Good food fishes: 1, Kahawai. 2, Jewfish. 3, Teraglin. 4, Leatherjacket. 5, Ling.
 [After McCulloch, Fish. N.S.W.]

result of cyclonic storms. The Dart (*Cæsiomorus velox*) is a trevally-like fish with a row of black spots along the sides. It lives in the surf and waves, and can swim to the edge of the water without being stranded on the beach. It is now scarce around Sydney, probably owing to the popularity of surfing.

Sea-Salmon (*Arripis trutta*) appear in thousands during the summer months, and the surf may be thick with them as they migrate. For Sea-Salmon the Maori name Kahawai is preferable, as our marine fish has no affinity with the fresh-water Salmonidæ. Young Kahawai have been termed Newfish. They are preyed on by Sharks, notably the Grey Nurse, and Dolphins round them up into schools and sometimes cause the frightened Kahawai to leap out of water on to land. They are good food-fish, but are usually spurned because fishes of better quality are plentiful. Kahawai should be cleaned immediately after death, as their viscera decompose rapidly and render the fish unfit for consumption; Blackfish and other vegetarians should also be thus treated.

Fishermen using handlines from our ocean beaches are usually fishing for Jewfish, though they often have to be contented with the less imposing sand whiting, flathead, or dart, and are sometimes disgusted to find stingarees on their hooks. The Jewfish (*Sciaena antarctica*) is a silvery fish up to six feet in length, and large specimens are often landed. Nobody seems to have seen a young Jewfish in New South Wales, and fishermen are puzzled as to the origin of the big ones; perhaps they breed in our southern waters. The Teraglin (*Zeluco atelodus*) is allied to the Jewfish, and is found off the rocky coastline, sometimes in large schools. It may be distinguished at a glance by having a concave margin to the caudal fin; in the Jewfish the margin of the tail is convex, or rather pointed.

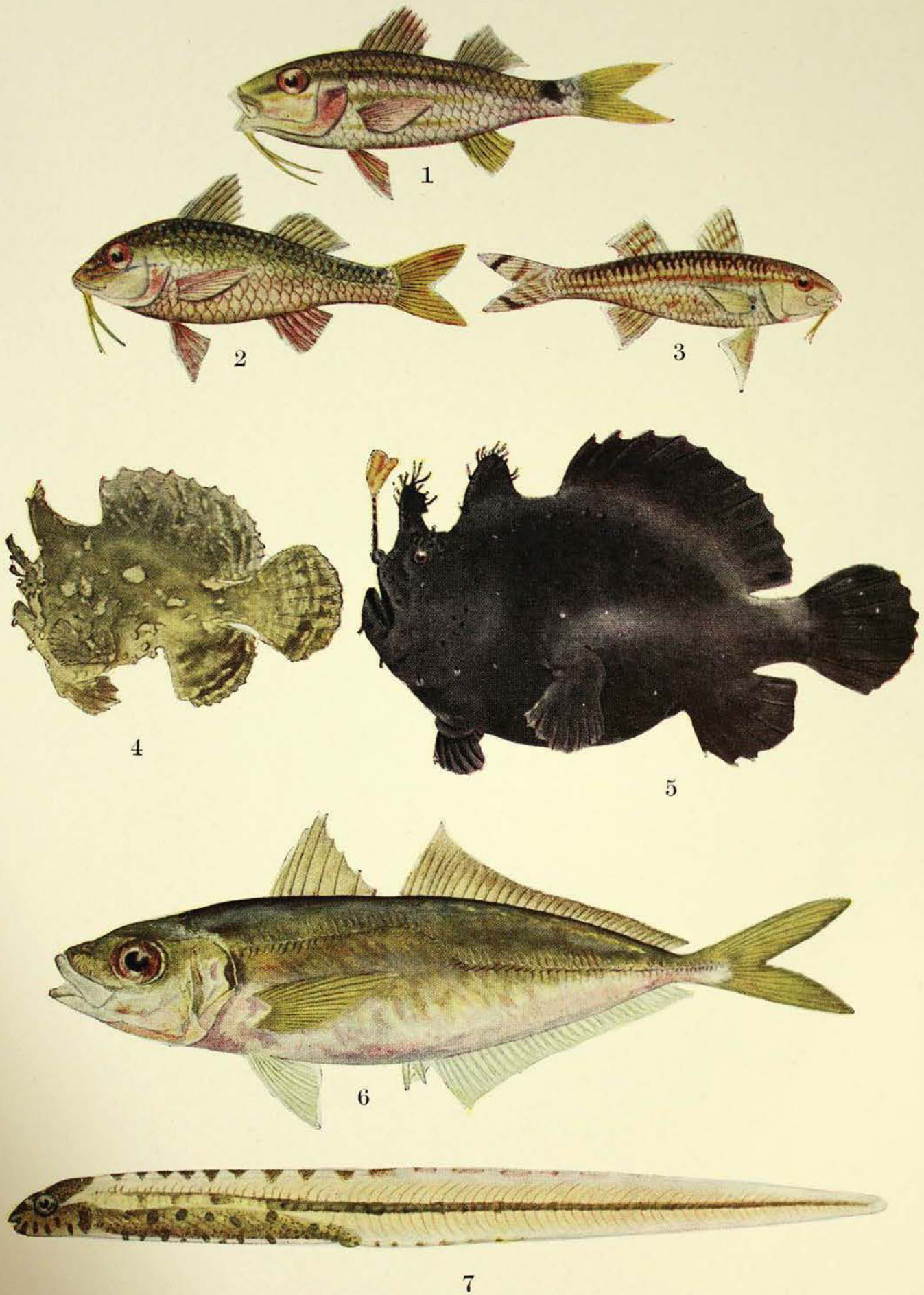
Jewfishes sometimes have bony tumours on the spine-like processes of the vertebrae, and people dining in restaurants are surprised to discover bulbous lumps on the

bones of fish they are eating. Such deformities are fairly common in jewfish, leatherjackets, and snapper, and are only due to extra activity in the bone-making cells, and do not indicate any dreadful disease; the name of the abnormality, "hyperostosis", is far more fearsome.

If one sees a launch going round in circles in an erratic sort of way, it is generally safe to deduce that Kingfish (*Regificola grandis*) are in the vicinity. When a school of these fine fishes is encountered, a hook is trolled behind a boat, and soon quite a number of them are caught, as they strike quickly and savagely. Sometimes they leap joyfully from the water. Kingfish are also netted when they enter our harbours.

By using a seine net early on some summer mornings or in the autumn when they arrive inshore to spawn, large quantities of Sea Garfish (*Reporhamphus australis*) may be caught off our beaches. Farther offshore, line fishermen catch fishes in water several fathoms deep which are the same as those of the harbour waters zone, and their boats contain Sergeant Baker (*Latropiscis milesii*), a large, reddish fish, named after an early colonial military gentleman, not otherwise immortalized; Nannegai [*Trachichthodes (Austroberyx) affinis*], a beautiful pink or red species, with large eyes; Yellow-finned or Chinaman Leatherjacket (*Nelus vittatus*), Snapper or Redfish, and Morwong.

A walk along the beach often brings to light interesting fishes stranded by the sea a few days after storms. The Banded Sea Perch (*Ellerkeldia annulata*) and the Half Banded Sea Perch (*E. maccullochi*) are often found in this way. The Beardie or Ling (*Lotella callarias*), a brown fish with a small barbel on the chin, is one of the few true cod fishes found in Australia. Another is the little fleshy *Dermatopsis* of the rock-pools, whilst another is said to live in sea squirts. The Bullseye (*Pempheris compressa*) and the Roughy (*Trachichthys australis*) are two interesting fishes often found washed up on ocean beaches. Boxfishes are occasionally found there also, notably the large



SOME FISHES OF THE SYDNEY DISTRICT.

- 1. Spotted Red Mullet.
- 2. Blue-striped Goatfish.
- 3. Bar-tailed Goatfish.

7. Shore Eel.

- 4. Mouse Fish.
- 5. Black Angler Fish.
- 6. Yellowtail.

[Allan R. McCulloch *pinxit.*

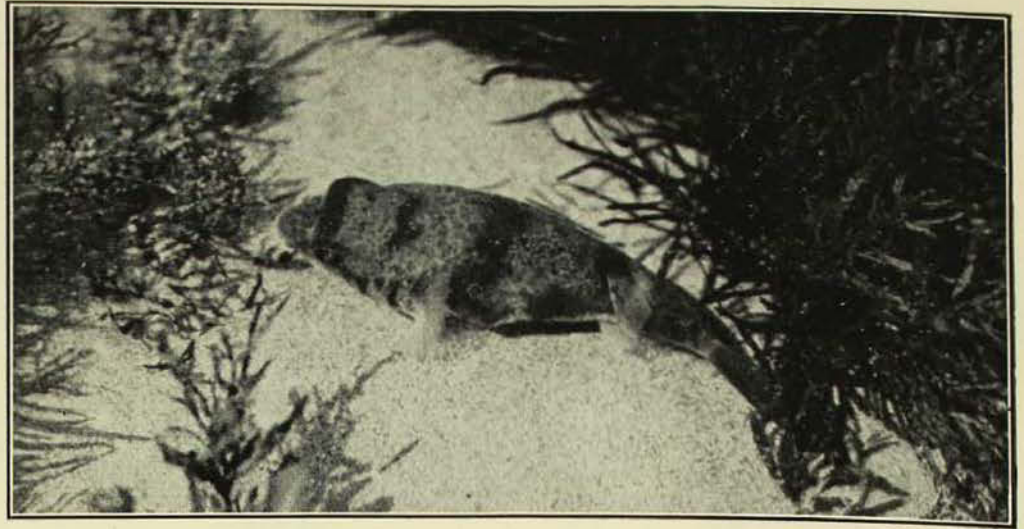
common species (*Anoplocapros lenticularis*), with a deep body, and the smaller spiny Turret Fish (*Triurus reipublicæ*). The Spiny Sea Dragon (*Solegnathus spinosissimus*), a species of Pipe Fish, and the Leafy Sea Dragon are also commonly washed ashore.

About February, living tropical fishes appear to drift down from the north on the warm notonectian current, and any such small fishes found on our ocean beaches deserve careful examination. Small Leatherjackets (*Pervagor alternans* and *Monacanthus flicauda notonectianus*) and the rarer Boxfishes are amongst the offerings of the sea at that time.

The Bluebottle or Portuguese Man-o'-War is often stranded in great numbers on our beaches, and sometimes shelters a little blue and silver fish (*Nomeus dyscritus*) superficially rather like the Bluebottle, and which seems to be immune to its stings. The tentacles of Jellyfishes, too, often shelter young Yellowtail or Trevally.

The Red Bullseye (*Priacanthus macracanthus*) is a small red fish with large eyes and a prominent preopercular spine. It is found occasionally around Sydney, and young ones are washed up on our beaches in the early part of the year. The Brown Bullseye (*Pempheris compressa*) has no preopercular spine, a much deeper body, and larger scales.

Curious transparent larvæ or young fishes may be found on our beaches, and should be submitted to the Museum for identification, as they are often of considerable interest. One form is the curious *Goodella* stage of the Saury or Lizard Fish (*Trachinocephalus*), whilst the Glass Eels or transparent leaf-shaped larvæ of eels are always of interest, and several kinds have been recorded from our waters. Some grow into Congers and



The Toado (*Spheroides hamiltoni*) is poisonous to eat.
[Photo.—T. C. Roughley.]

others into freshwater eels (*Anguilla*); the latter migrate from the sea into rivers, as do also young Jollytail (*Austrocobitis*) and Blue Eyes (*Pseudomugil*).

ESTUARINE SANDFLAT AND MANGROVE ZONES.

The sandflats and mud, sometimes covered with eel-grass, which are more or less exposed at low water, and the Mangrove swamps and brackish pools support a fish fauna which is distinctive in facies but not definitely marked off from the harbour waters zone, as fishes can easily swim from one to the other.

Stingrays of many kinds like to lie on the sandy bottom in shallow water, but retreat as the tide ebbs, and often leave bare spaces in the sandflats where they have been resting. They are chiefly noted for the long serrated spine on the tail, with which they can inflict a nasty wound. There is no definite venom gland associated with this spine, but the slime on it is often sufficient to cause blood-poisoning in a human victim, and in every case much pain ensues, usually said to persist till sundown.

Stingrays have hard grinding plates in each jaw which they crush the shellfish and crustacea upon which they feed, and the large Eagle-Rays are particularly destructive to oysters.

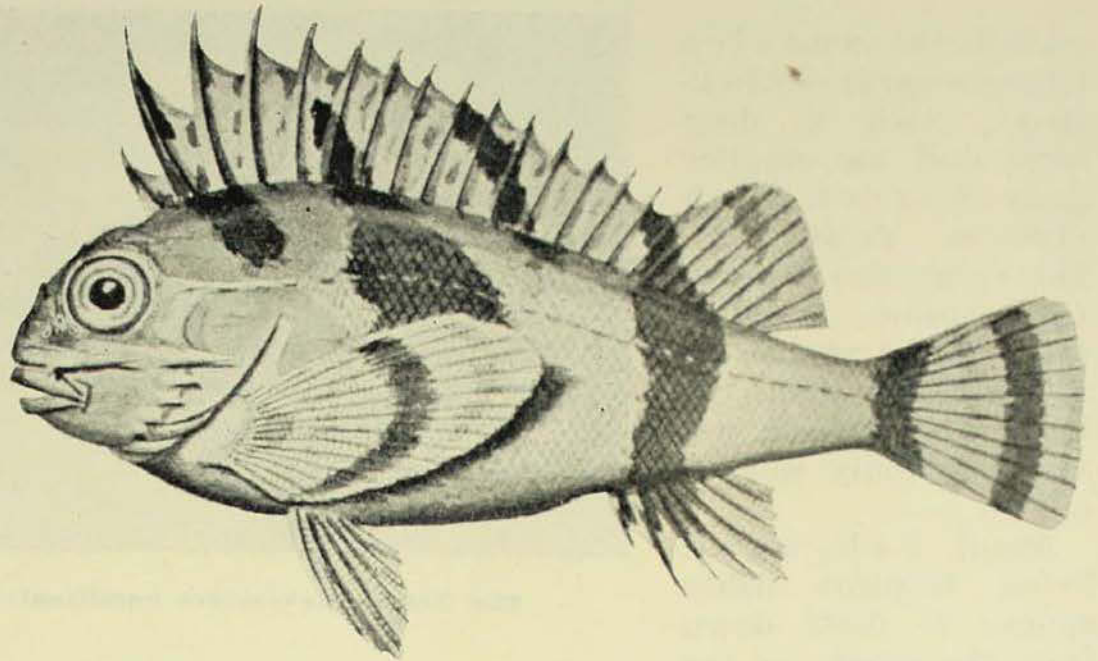
The Common Stingaree (*Trygonoptera testacea*), the Giant Black Ray (*Bathytoshia thetidis*), made famous by Cook's

expedition, the Shovel-nosed Ray (*Aptychotrema rostrata*), with a long, blade-like snout, and the Fiddler (*Trygonorrhina fasciata*), with markings on the body reminiscent of the holes and purfling of a violin, are all common in the Sydney district.

A very curious Ray is the Numbfish or Electric Ray (*Hypnos monopterygium*), which looks like a slab of beef in the water, as it is brown in colour and very variable in shape. If touched, it can give several severe electric shocks, but these gradually diminish in power as the fish exhausts its power. The electric organs are situated between the upper and lower surfaces of the sides of the head and body, and are in the form of hexagonal upright cells containing a jelly-like fluid. I have seen a leech, apparently acclimatized to the shocks, firmly fixed to a Numbfish's head.

The Striped Angler Fish (*Phrynelox striatus*) is found amongst seagrass, which its colours resemble. It walks slowly along the bottom on quill-like fins, or lies in wait for its prey, which it lures by flicking or waving the fishing-rod over its snout, bringing the "bait" towards its mouth. In the coloured plate are shown a velvety black allied species (*Batrachopus insidiator*) and the variegated Mouse Fish (*Pterophrynoides histrio*), which floats in clumps of seaweed.

Burying itself in sand, with only its eyes and mouth showing, the Stargazer or Stonelifter (*Kathetostoma laeve*) awaits its food. It is quite a large species, growing to a length of twenty inches, and has a hard, squarish head, with the eyes on top; this species is named Catfish in Tasmania. Our true Catfish has whiskers



The Fortesque infliets very painful wounds on incautious fishermen by means of the venomous spines on its head and back.

[After McCulloch, Fish. N.S.W.]

around the mouth and can give a painful sting with its serrated fin-spines.

Even the wet sand or mud left bare by the low tides may yield fishes to the enthusiast who cares to dig for them. The Worm Eel (*Muraenichthys australis*) is an adept at passing through wet sand, burrowing rapidly head or tail first, being aided by its pointed extremities, cylindrical body and almost rudimentary fins.

In shallow water over sandflats, schools of Silverbellies (*Gerres ovatus*) are sometimes seen, or the long graceful forms of Mullet (*Myxus elongatus*) browsing over the sediment at the bottom, sucking up their food.

When walking over sandflats such as those at Gunnamatta Bay, you will notice numbers of little fishes in the pools left as the tide recedes. They dart into sand and weeds and then, keeping still, become quite inconspicuous. These are Gobies of various species, marine relatives of our freshwater gudgeons. They may be distinguished from other fishes by their ventral fins, which are joined so as to form a sucking-disc, which they use for attaching themselves to stones or for resting on the bottom. They feed on little water-fleas, and probably act as scavengers. The species are mostly small, and their exquisite colourings and

graceful forms can only be appreciated when they are seen under a lens or a microscope. Some are rare, and for this reason any collections of gobies are welcomed by the Australian Museum.

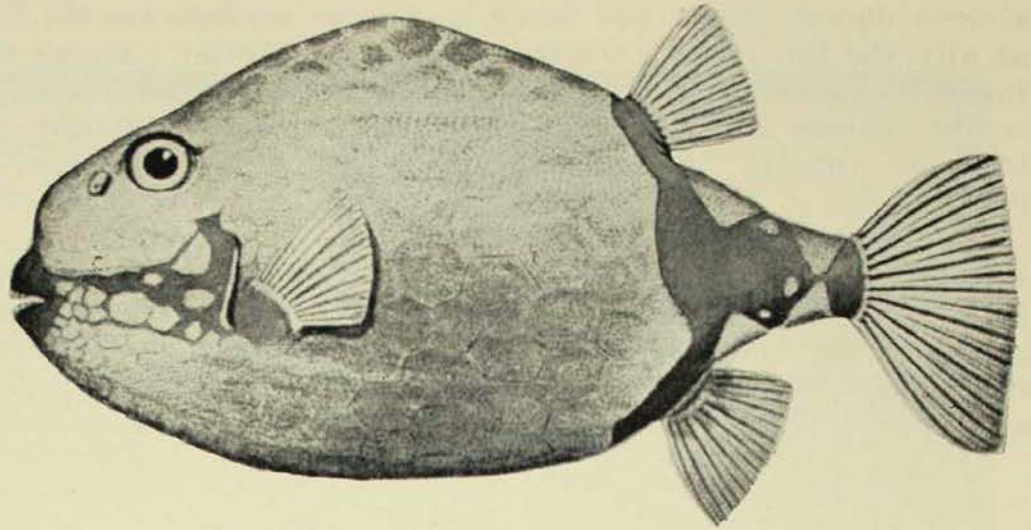
One of the commonest and largest kinds is the Bridled Goby (*Arenigobius semifrenatus*), sometimes wrongly called Mud Gudgeon, a greenish species with two

purplish stripes on the face recalling the bridle of a horse. This fish is often caught with prawns and sold with them as bait. Gobies can stand changes in water temperature and salinity which would kill other fishes, and even some of the tropical coral reef gobies have been acclimatized to freshwater aquaria.

The smallest Australian vertebrate is the tiny yellow and black Pigmy Goby (*Berowra lidwilli*), which is adult when just over half an inch long. A Philippine species of goby is smaller still, about one-eighth of an inch, and is the tiniest known vertebrate.

Another common estuarine fish is the Toado (*Spheroides hamiltoni*), which swims in shallow water. It will feed on any scraps thrown to it (except the scrap with a hook in it), and also attacks the Soldier Crabs (*Mycteris*). Toadoes are poisonous, and cases of suffering and even death have resulted from persons eating them. Children catch them, and by rubbing them cause them to swell up like globes, when they look very indignant and comical. The Porcupine Fish is really a kind of toado which has developed a very prickly external protection.

In eel-grass or *zostera*, a scoopnet will secure the spotted Pipefish (*Stigmatopora nigra*), a thin fish very much like a blade of eel-grass in appearance, as it is greenish with small spots, and up to seven inches long. The males carry the eggs in a pouch formed by flaps of skin



The Boxfish, sometimes stranded on our beaches, is encased in a bony armour.

[After McCulloch, Fish. N.S.W.]

under the abdomen as in the seahorses, to which the pipefishes are related.

The Little Rock-Whiting (*Neogadus balteatus*), known as the Stranger in our southern States, is also found amongst *zostera*. Perhaps the most remarkable of the estuarine fishes are the minute Silver-sided Soldier Fishes of the genus *Adenapogon*, which carry their eggs in their open mouths until they are hatched. This phenomenon is known as oral gestation, and although it is now recorded as natural to many groups of Soldier Fishes, the first discovery of it was made in Rose Bay, Port Jackson, in 1886.

Anyone who has been stung by a Fortescue will not need to be told what it is, and they will probably have already bestowed a more pungent name to this little fish than the one of obscure derivation by which it is known to naturalists. "Forty skewers", referring to the sharp dorsal spines of this species, may have originated the name Fortescue; but some impute an aboriginal derivation. The Fortescue (*Centropogon australis*) is allied to the Red Rock Cods, but is generally greyish or brownish in colour, with four or five dark cross-bands. The sides of the head are provided with long sharp spines, which, like those of the dorsal fin, can inflict a painful wound. It is found amongst eel-grass on sandflats, and is thus often unwittingly handled amongst the weeds which foul nets as they are being hauled in. The Fortescue has

sixteen dorsal spines, not forty, and has an ally, the Bullrout (*Notesthes robusta*), found in estuaries, which has a quieter colour scheme and fifteen dorsal spines, but is equally mischievous in its habits.

Another common fish is the Sea Mullet (*Mugil dobula*), also known as Grey Mullet or Sand Mullet in the southern States. This fish migrates northward in the winter months in enormous schools, seeking spawning grounds. Other common

mullets are the Tallegalane, Lano, or Sand Mullet (*Myxus elongatus*), not to be confused with the Sand Mullet of Victoria and Tasmania, and the Flat-tail Mullet (*Liza argentea*), Tygum or Tiger Mullet of south Queensland or Wankari of South Australia.

These are just some of the commoner fishes of the Sydney district; from the State of New South Wales as a whole no less than 630 different species of fishes are recorded.

Obituary

WILLIAM SUTHERLAND DUN.

IT is with much regret that we record the death of W. S. Dun, Palæontologist to the Geological Survey of New South Wales, and Lecturer in Palæontology in the University of Sydney, which took place at Mosman, Sydney, on 7th October, 1934, after an illness of some months.

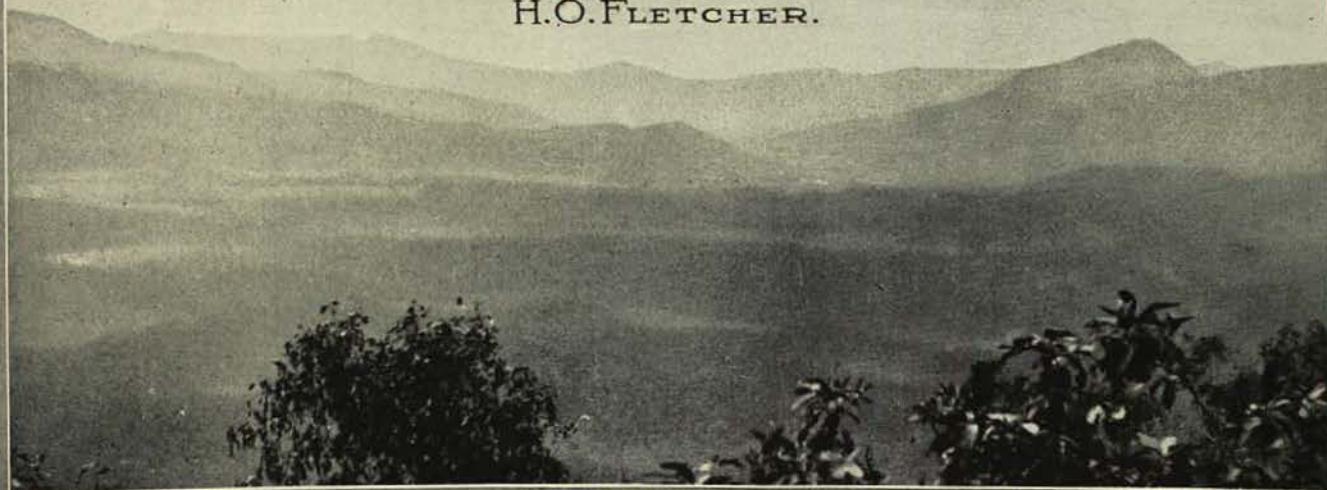
He was descended from a well known military family, his father being Major Percy Henderson Dun of the East India Company's Service, who held an important command in the Indian Mutiny; General William Dun of the same Service was an uncle. He was born at Cheltenham, England, on 1st July, 1868, and at the age of about twelve months came to Australia on the ship *Sobraon*. He was educated at Newington College and the University of Sydney, and entered the Department of Mines, New South Wales, in 1890. In his earlier years of service he acted as assistant to the late Professor T. W. E. David in his important work on the Hunter River Coalfield. He afterwards became assistant to the late Robert Etheridge, Jnr., who was then Palæontologist to the Geological Survey of New South Wales and to the Australian Museum. In 1899 Dun became Palæontologist and Librarian to the Survey, from which he retired in 1932, and in 1902 he was appointed Lecturer in Palæontology in the University of Sydney, a position he held at the time of his death.

He had an unrivalled knowledge of the fossil fauna, not merely of New South

Wales, but of Australia generally, and, being gifted with a remarkable memory and a wide acquaintance with geological writings, he was frequently referred to by other workers, and seldom was he unable to supply the information sought. He contributed many papers to palæontological literature, covering a wide range of subjects both botanical and zoological, from diatoms to fossil mammals. He paid special attention to fossil bivalves and to the Brachiopoda, of which his knowledge was extensive and sound, but he was exceedingly versatile and his pronouncements in regard to the identity and stratigraphical range of fossils were regarded as authoritative far beyond the limits of his own State. Directly and indirectly his work had an important influence on the progress of geological investigation in Australia.

Dun had a genial disposition and was a splendid and entertaining companion at home or in the field. He was never so happy as when with collecting bag and geological hammer he tramped over hill and dale in search of fossils, and at the close of the day's work he took part, with zest, in the joyous abandon of camp fire amusements. He was always prepared to assist his colleagues in the most generous manner, and on account of his tact and sound judgment he was often consulted on various matters and his advice and counsel were highly valued by all who had the privilege of his friendship.

Trilobite Hunting in the North
by
H.O.FLETCHER.



Looking across the Mulgrave Valley towards the Mountain Peaks of Bellenden Ker and Bartle Frere.

[Photo.—H. O. Fletcher.

TRILOBITES are an important group of marine animals which lived and became extinct in the Palæozoic era about three hundred to seven hundred million years ago. They occurred in great numbers and with extreme diversity of form, had a world-wide distribution, and are classed amongst the earliest known forms of life.

As the name suggests, the body is distinctly trilobed, and is protected by a well-developed calcareous shield which covers the whole dorsal surface of the body. They ranged in size from half an inch to over a foot in length, and frequented the sandy or muddy bottoms of the ancient Palæozoic seas. The structure of the appendages made it possible for these animals either to crawl or swim.

In the early Cambrian rocks the trilobites attained a wonderful development, and show such variation in form that there is very little doubt that long lines of ancestors extended far back into the Pre-Cambrian period.

One-third of the Australian continent is built up of Pre-Cambrian rocks, but they have been subjected to such extreme

pressure and alteration that any entombed fossils have been destroyed, so that it is in the early Cambrian that we must search for the start of the trilobite fauna. Trilobites continued to be exceedingly abundant until the Devonian period, when they gradually declined in numbers and species, finally becoming extinct in the Carboniferous age.

MOUNT ISA.

In northern Queensland new outcrops of Cambrian fossiliferous beds were discovered only twelve years ago by Mr. J. Campbell Miles, who was prospecting amongst the barren and inhospitable Pre-Cambrian hills, west of Cloncurry. He collected trilobites from the Templeton River, and, besides other localities, from the Thornton River, which lies about seventy miles north from Mount Isa. At the same time he discovered an outcrop of ferruginous oxidized silver lead ore and forwarded samples to the assay office at Cloncurry. The samples of ore proved to be rich in silver and lead, and from this discovery there sprang up in this desolate and inaccessible spot the mushroom city of Mount Isa.



A trilobite from the Cambrian rocks of the Templeton River, near Mount Isa. Approximately natural size.

[Photo.—G. C. Clutton.]

In ten years over £4,000,000 was spent in the development of the Mount Isa mines, but, although the construction gangs started work in 1924, it was not until 1931 that the production of lead commenced. There is now a population of about four thousand at Mount Isa, and the trilobite horizon at the Templeton River, seventeen miles from the town, has become the show place of the district. The trilobites occur in such numbers that visitors are always assured of collecting a "beetle", as the townspeople call them, a souvenir of the life that existed in the Cambrian seas seven hundred million years ago.

In May last the Trustees of the Australian Museum decided to send an expedition to the Gulf country to search for these Cambrian fossils and also to do general zoological collecting. The party consisted of Mr. E. Le G. Troughton, mammalogist, Mr. R. S. Preston, volunteer assistant, and the writer, who acted in the capacity of palæontologist.

We travelled in the Museum Ford utility truck and carried all the neces-

sary equipment for a three months' stay in the field. It was decided to make straight for the first fossil outcrops on the Templeton River by way of Bourke and central Queensland. After crossing the border at Barrington we travelled over the vast rolling plains of the Downs country. These immense level plains have nothing but mulga, myall, and brigalow bushes to break the monotony, with an occasional sinuous watercourse with fast drying waterholes. Queensland towns are very compact in the west, as the homes are usually centred around the water supply. The rainfall in the greater part of the interior is unfortunately very small, but this defect on the part of Nature has been remedied by the sinking of artesian wells.

Nearing Cloncurry we saw blue cone-shaped hills beyond the Downs and before long had entered the copper-bearing mountains of the Cloncurry district. The township is situated on the right bank of the Cloncurry River and is four hundred and thirty-four miles west of Townsville. The copper deposits are very extensive, and many mines have restarted during recent years. Large sums of money have been expended in machinery and in sinking shafts to open up the rich lodes of copper, but the isolation of the field and the depreciation in value of copper has caused the suspension of many activities.

Leaving Cloncurry one passes the Black Mountain, which looks down on the town from the opposite bank of the river. This mountain consists of almost pure iron ore, and it has been calculated that the amount in sight is over thirteen million tons. Great masses of ore broken off from the main enormous outcrop are lying at the base.

Since we had left the Downs country the roads had been getting much rougher, but between Cloncurry and Mount Isa, via Duchess, the climax was reached. The distance is not great, a little over a hundred miles, but the road is such as to make anyone but an enthusiast travel by rail. Cambrian strata, vertically

bedded, does not make a perfect highway, and we marvelled at the strength of our truck as it struggled and swayed over this road, which serves as the entrance and exit to Mount Isa.

TRILOBITES OF THE TEMPLETON RIVER.

The Museum party passed slowly through Mount Isa, heeding the signs of "Drive carefully or be crippled", and arrived at the Templeton River, our first fossil locality. The outcropping rocks discovered by J. Campbell Miles at the same time as he discovered the Mount Isa field are found on the banks of the river. Uplifted during bygone tremors of the earth, the masses of layered rocks contain tremendous numbers of beautifully preserved trilobites. We were now working on what was the floor of the Cambrian Sea, seven hundred million years ago, and the entombed fossils, representing the life of that period, now appear as the manuscripts which Nature has left for the geologist to read and decipher. The river bed was dry and the heat and flies were almost intolerable. A week's stay on the Templeton was sufficient to reward the party with a representative collection of trilobites, which ranged in length from a quarter of an inch to about five inches, although in North America trilobites over a foot in length have been collected bearing very close relationships to the Templeton River fauna.

TO THE NORTHERN TERRITORY.

Other localities awaited us in the Northern Territory, so returning to Mount Isa we left there for Urandangie,



The northern section of the silver-lead mines at Mount Isa, Queensland.
[Photo.—H. O. Fletcher.]

via Mica Creek. Urandangie is one of the most isolated towns of Queensland, being situated on the Georgina River twelve hundred and eighty miles from Brisbane. The town, if one may flatter it by such a name, was crowded, as the Urandangie picnic races were in progress. People had come hundreds of miles to attend them, and a temporary bar, hurriedly erected to cope with the frequent demands for refreshments, groaned ominously as favourite after favourite romped home in a cloud of dust on the adjacent flat.

On the way to Camooweal we followed the border fence through Headingley and Barkly Downs Station and stayed the night at No. 6 Bore. Rats, however, made it impossible to sleep, as the night was made hideous as they fought and screamed till the dawn, when once again quiet reigned. Travelling at night one sees them on the road in hundreds, and many are killed by the car wheels. Flashes of white in the glare of the headlights revealed the presence of the untiring rat hunter, the Barn Owl.

The border gate into the Northern Territory was passed through a few miles out of Camooweal, and our first stay was



The road leading from Mount Isa to Camooweal. The mountains it crosses are some of the oldest in Australia, being Pre-Cambrian in age.
[Photo.—H. O. Fletcher.]

at Avon Downs Station. Here the mammalogist collected a fine series of the plague rat, which turned out to be a native endemic species and not the introduced species or ship-rat. The blacks on the station were very amused at the care taken with the rats and asked why we did not eat them there instead of taking them "to eatem rat feller alonga big city". When the plague first started about two years ago the blacks ate rats assiduously, but now say "too much bingy ache" and refuse to eat them. This feeling is also shared by the station cats, and it is no uncommon sight to see cats and rats drinking milk together from the one saucer.

One hundred miles west of Avon we came to Alexandria Station, the largest holding in the world. It consists of eleven thousand five hundred square miles of country, and has about seventy-five thousand head of cattle on it. At this station we met a willing helper in King Victor of the Alexandria tribe. King Victor had assisted a British Museum collector in 1904 and not only remembered the localities visited, but also the collector's name. Twelve days were

spent in collecting around the station and many specimens were secured, particularly from Black Gin Creek, in the hills.

From rock brought up from a depth of sixty feet out of a well at Alexandria many fossils were collected. These were similar to the surface rocks at the Templeton River, although several different forms and species were collected. This find indicates that the Cambrian

strata dip near Mount Isa and sweep over four hundred miles to the west, where it is found at a depth of sixty feet at both Alexandria and Alroy Downs.

THORNTON RIVER AND LAWN HILL STATION.

Our next locality was the Thornton River in Queensland, about seventy miles north of Mount Isa, and to reach there we used the Alexandria Station road to their outstation at Gallipoli. This route lay to the north-east, and after passing through Herbert Vale Station we began to descend the coastal fall from the Barkly Tableland. At The Spring the track branches, one leading east to the Gregory River, while the other continues north to the historic Lawn Hill Station and Burketown.

The Spring, as its name denotes, marks the site where fresh water issues from the base of a large series of weirdly contorted sandstone hills. To reach the Gregory River one follows the base of the hills for some fifteen miles. The crossing is fairly wide and difficult, but negotiable, and soon we were well on our way to Thorntonia Station, passing Riversleigh about four miles on the east

bank of the Gregory. Mr. Finley, the owner of Thornton Station, remembered that about ten years ago J. Campbell Miles had passed through and mentioned finding small fossils in the Thornton River near Bee Waterhole. After negotiating thirty miles of virgin country we came to the camping site of the prospector, and after several hours' search through the rocks



The shale beds on the bank of the Templeton River, near Mount Isa. It was from these beds that the rich and varied Cambrian trilobite fauna was collected.

[Photo.—H. O. Fletcher.

discovered the fossils we had come so far to collect. The full-grown specimens did not exceed a quarter of an inch in length, and a most careful survey of the rocks had to be made to discover them. On the return journey to The Spring an outcrop of limestone near Riversleigh Station was found to contain numerous fragments of the fossil remains of large Post-Tertiary mammals.

Lawn Hill Station is one of the most beautifully situated stations in the northern country. It is built on the summit of one of the hills and is one of the oldest properties in Queensland, having been taken up in 1875. Lawn Hill Creek runs through the property and forms an oasis of beauty in very dry country. Thick vegetation and tropical vines with tall waving palms are a home to myriads of birds of all description, while the wallaroos and wallabies make for the water every evening over well-beaten pads.

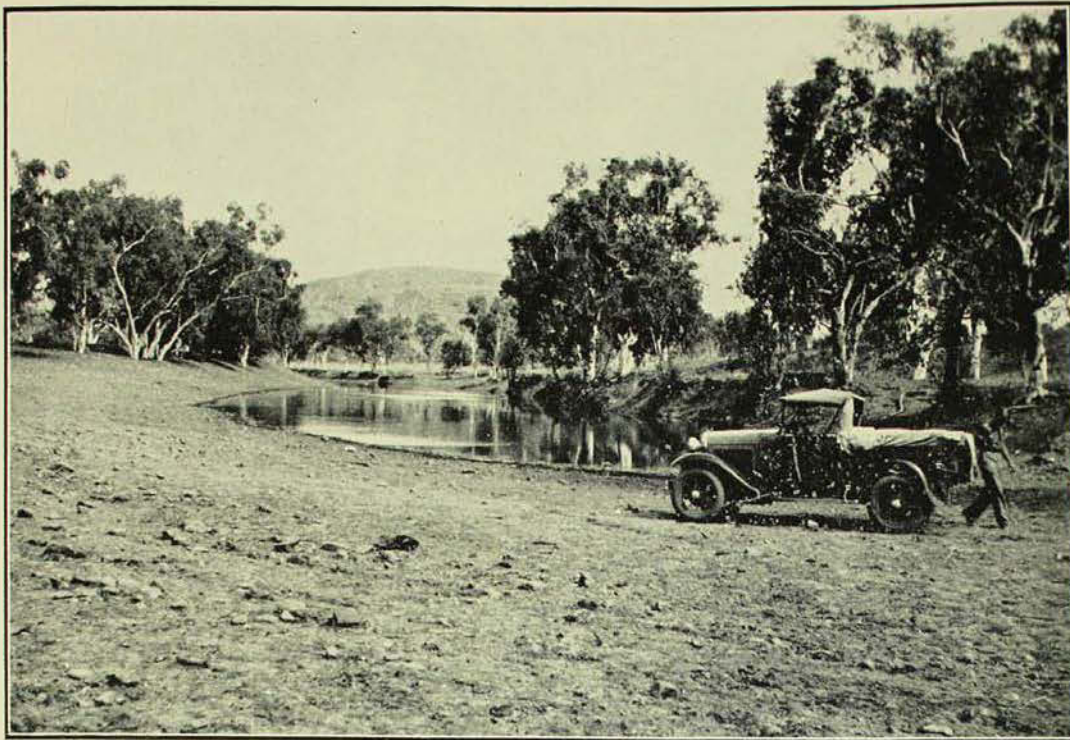
At this delightful station we were introduced to His Excellency Sir Leslie Orme Wilson, who was making a northern tour. The vice-regal party had come over roads that we had to traverse, and their

remarks were by no means comforting, particularly in respect of the many northern river crossings.

Small crocodiles infested the creek but, despite sharp and formidable looking teeth, it is a harmless species, and in the Gulf country many of the inhabitants think nothing of swimming amongst them. They frequent the fresh-water heads of the Gulf rivers and the lagoons, spending most of their time basking on fallen tree trunks on the banks. At the slightest noise they drop into the water, but later come to the surface and rest with their long snouts just projecting. The flesh and eggs are eaten by the natives, who find the nests in the sides of the river. The gins before bathing cup their hands, and by beating the water produce a dull booming sound to frighten the crocodiles and, incidentally, any evil spirits lurking in the water.

THE GULF COUNTRY.

Rain delayed our start from Lawn Hill to Burketown, but during a lull we started off on slippery and greasy roads, although only less than half an inch had fallen. Many detours had to be made



Preparing to camp at a water-hole in the Gulf country. Usually these are covered with the bright blue and white tints of magnificent water-lilies.

[Photo.—H. O. Fletcher.]

around black-soil patches, in which we were continually bogged, but fortunately after travelling a few miles we left the rain behind and had good smooth roads towards the Gulf. We were now passing over the Plains of Promise, named by Lieutenant Stokes of the *Beagle* when he surveyed the Albert River for fifty miles inland ninety years ago.

Burketown in its heyday was one of the romantic towns of Australia, but now its population numbers thirty-seven inhabitants. The town was first established in 1865, when the *Jacmel Packet* steamed up the Albert River with supplies for the early settlers who had driven their stock from

the south. Thirty-five miles inland, Burketown is situated on the bank of the river where the tidal rise and fall is five feet. Leaving the town we were surprised to find a bridge over the Albert, and from here to Normanton flat country was crossed for mile after mile. Black soil plains, made rough by the feet of many cattle in wet weather, caused the car to vibrate and our teeth to chatter,

and we looked forward to the ant-hill country, where, although the large ant-hills had to be dodged, the road was smooth. This practically treeless country looked destitute of life or animation of any description, except for the brolgas



Narrow concrete strips assist the motorist in negotiating the wide sandy crossing of the Gilbert River. This river is a well-known haunt of the Estuarine Crocodile.

[Photo.—H. O. Fletcher.]

that danced in fright before flying at our approach.

The main feature approaching Norman- ton is the large railway sheds, which mark the terminus of the Normanton- Croydon line. These two Gulf towns were connected by rail during the gold rush days of 1891 at a cost of £211,000. The sleepers are made of mild steel instead of wood, on account of the ravages of the white ants.

The Norman, on which Normanton is situated, is a fine deep river, and is particularly wide at the mouth. It can be navigated for forty-five miles by steamers drawing twenty feet, but from this point only vessels drawing not more than six feet can ascend to the township, a further distance of ten miles.

Normanton is ideally situated on high iron-stone ridges close to the river bank, naturally drained and free from floods, and with easy access to the back country. Normanton had many advantages over Burketown, and finally all the trade drifted there while the sister settlement declined in consequence. Then in 1866 the *Margaret and Mary*, one of the first ships to enter the Albert River, infected Burketown with a fatal disease, which ended in fever and delirium. The population was almost wiped out, and the little cemetery soon looked like that of an old established town. When Norman- ton was opened in 1867 the residents of Burketown moved there from the ill-fated town, leaving it completely deserted. Its short and merry life, free in the early days from all the restrictions of discip- line, was over, and it was many years before Burketown rose again.

The Norman River, a few miles out of the town, has to be forded, and as it is tidal, it can be crossed only at low water. A chain extending across the river marks the crossing, and if the top of the chain is showing above the water it is con- sidered safe. We had no difficulty in crossing, much to our surprise, but by this time we had come to the conclusion that things were never as bad as they are made out to be. From the Norman

to Croydon the road follows the railway line through a perfectly level and very uninteresting country. Long spear grass, taller than the car in many places, covered the road, and through this we had to travel, trusting that we would not hit ant-hills or any other obstructions. The knowledge that the Vice-regal car had travelled this road several days earlier encouraged us as we speeded over this melancholy sandy waste of scrub. Innumerable pinnacles and mounds made by the white ants at first broke the monotony, until they themselves became monotonous on this area, where the pasturage is as poor as the country looks.

NORTH QUEENSLAND.

Near Croydon the track winds amongst disused gold-mine shafts for miles before reaching this Eldorado of the north. The field was discovered in 1886 by two pros- pectors, who obtained a reward of £1,000 from the Government. Reefing has been the only way of obtaining the gold, and it is quite possible that Croydon may again be the city it was in the rush days.

At Croydon the hilly country com- mences and extends away to the east to Forsaythe, where again the railway is met, and from here one may connect with Cairns. The crossing at the Gilbert River consists of over a quarter of a mile of sand, through which it would be impossible to travel without the aid of cement wheel tracks, which have been laid down at the crossing. Woe betide the driver who lets the car slip off the strait and narrow path. We did, and the car was bogged to the axles immediately. After several hours' hard work, and with the assistance of the constable from the Gilbert River police-station and some local inhabitants, we made the crossing and arrived at Forsaythe at dark. From this town one has to negotiate the "jump-up", as it is termed, to reach the top of the hills, and the road from here is a nightmare.

Georgetown, on the left bank of the Etheridge River, is one of the first gold

reefing districts in north Queensland. The whole of the surrounding country is gold-bearing and is known as the Etheridge goldfield.

The hilly country was left behind at Einaslie, and, passing Carpentaria Downs Station and the Lynd, we made for the Atherton Tableland by way of Greenvale and the Valley of Lagoons Station.

After we crossed the Burdekin River at Greenvale heavy rain set in, and it took

several days to do the comparatively small distance from here to the Atherton Tableland. A temporary bridge had to be built over the Burdekin near the Valley of Lagoons Station, and over this our heavily laden Ford lumbered with only inches to spare on either side. Once on the good road of the tableland we were soon in Cairns, and the return journey to Sydney was made down the coast.

Book Reviews.

BIRD WONDERS OF AUSTRALIA. By Alec. H. Chisholm, F.R.Z.S., C.F.O.U., 8vo., pp. xiii + 299, with 58 illustrations. (Angus & Robertson Ltd., Sydney, 1934. Price: 6/-.)

There is no better known or more justly celebrated writer on Australia's birds than A. H. Chisholm, who is a competent ornithologist, a keen observer, and a master of English, besides being an accomplished photographer. He has, too, the faculty of seeing and appreciating the unusual and whimsical features of bird life, and in this work he has assembled a mass of interesting facts. Some sceptical person, with less extensive knowledge and experience than the author, may perhaps be inclined to doubt the probability of some of the incidents related in the work, but the author is careful to give the evidence for his statements, which are based on his own observations or on those of reliable witnesses.

The bower-building habits of the Bowerbirds are sufficiently remarkable even if the architect were not also an artist; for it is well attested that the Satin Bowerbird is in the habit of bringing charcoal to its bower, munching it into a paste and, holding a piece of bark in its beak, *painting* each stick of the inside wall—

well may our author call these the world's most cultured birds.

Two chapters are devoted to the Lyre Bird, one of the most intriguing of Australia's feathered inhabitants, celebrated for its powers of mimicry and the dancing antics and posturing of the male. It is interesting to note that in Sherbrooke Forest, Victoria, both a sound film and a gramophone record of the Lyre Bird's glorious voice have been obtained by Mr. R. T. Littlejohns, and its song has even been broadcasted.

The Mound-building Birds of Australia and the islands to the north have the curious habit of burying their eggs in a mass of earth, stones, and decaying vegetable matter, the mounds sometimes reaching a height of fifteen and a circumference of sixty feet or more. It is believed that the young are hatched by the heat developed by the rotting vegetation.

Chapter XV, describing some queer relations of birds and insects, contains some interesting observations and suggestions. Perhaps the most surprising is that starlings are in the habit of picking up ants and placing them under their wings. The author suggests that the ants are used as an insecticide, starlings being notorious as hosts of parasites.

C.A.

AUSTRALIA'S VANISHING RACE. By Frederic Wood Jones, F.R.S., 8vo., pp. 42, with seventeen illustrations. (Angus & Robertson Ltd., Sydney, 1934. Price: 2/6.)

This little work, which contains the subject matter of three broadcast talks on the Australian Aborigines, is authoritative, compact, and brightly written, as we should expect from the accomplished Professor of Anatomy in the University of Melbourne.

Professor Wood Jones is one of those who believe that Australia received its primitive mammals from Asia by way of a land bridge, and that subsequently it became separated as an island continent before any of the higher mammals arrived in southern Asia. Thus its human inhabitants, accompanied by the dingo, came by water.

As regards the affinities of the Australian aborigine the author emphasizes the fact that he has no kinship with any negro race, but was the advance guard of the Dravidian migrants who spread from the Mediterranean area across India and beyond, and that there is no evidence of human habitation of Australia prior to the advent of the aborigines. The Tasmanians, true Pacific negroids, he says, never set foot on the Australian mainland, but came to Tasmania by sea from the islands to the north and east, just as the Maori came to New Zealand, and the aborigines to Australia.

Professor Wood Jones defends the aborigine from the charge that since his advent he has never risen above the level of a stone-age hunter, and explains that opportunity was lacking, as there are no animals in Australia that can be domesticated and no native plants that can be grown and conserved for food. But the aborigine has evolved a complicated system of kinship and affinity, and a perfect marriage code, which ensures morality and eugenic welfare, and has also formulated tribal laws and a social code which is perfectly adapted to his peculiar environment.

The author gives a succinct account of the physical and cultural characteristics of the aborigine, and also of his psychological status and mental aptitudes, and comes to the conclusion that, while he does not lack intelligence, he is not capable of being successfully adapted to a white environment, for "the detribalized native bereft of his tribal ceremonies, is an apathetic and moribund derelict, lacking all knowledge of his people's moral code and unfitted to embrace a new one that is beyond his comprehension."

C.A.

* * * * *
AN AVIARY ON THE PLAINS. By Henry G. Lamond, 8vo., pp. viii + 228. (Angus & Robertson Ltd., Sydney, 1934. Price: 6/-.)

Mr. Lamond has established himself as an entertaining writer on Australian nature subjects, and his latest work will enhance his reputation as a close observer and recorder of bird life. The "Aviary" is in the Barkly Tableland and North-west Queensland, a large area which gives plenty of scope to the author.

Mr. Lamond does not concern himself greatly with the scientific side of his subject, although the book bears evidence that his knowledge of ornithology is extensive and intimate; he devotes himself rather to the study of the habits and daily life of birds, their love-making, their struggles for existence, and the never-ending battle between the hunter and the hunted. To the soft-hearted reader it may seem that he dwells overmuch on the slaughter of the innocents, for the book contains several vivid accounts of aerial pursuits which mostly end in tragedy for the pursued; this is "nature red in tooth and claw." The author is certainly a keen observer; it is not everyone who is aware that there is "a subtle and indefinable difference between a bird rising from a nest and one rising from a clutch of young. That can only be noted by much practice and, perhaps, a form of bird affinity." The reviewer would add that in some birds the behaviour changes once the eggs are incubated.

C.A.

The Largest Gliders or "Flying Possums"

By E. LE G. TROUGHTON.

IT was originally intended to cover all the living forms of "flying" marsupials in the preceding issue, but restriction of space made it necessary to deal with the two largest species in a second contribution. The evolution of flight was briefly dealt with in the introduction to the first article, in which it was pointed out that air ranked next to water as a moulding force in the resourceful hands of Mother Nature. A watery environment moulded the likeness between whales and fish, and converted the fingers of seals into flippers, and so we find that as a result of gradually extended aerial jaunts three groups of vertebrates in different ages have quite independently evolved wings from their fore-limbs, resulting in complete control of the power of flight. First came the pterosaurs, lizard-like animals of the age of reptiles, then the birds, and finally the furry bats, which are able to fly as well as most birds.

The so-called flying possums have been termed gliders in these articles, as their spurious kind of flight cannot be compared to that of bats and birds, for it actually consists of volplaning leaps aided by the kite-like membranes stretched out between the limbs. The comparative ease with which the gliding membranes were acquired is shown by their presence in the two large species described below, in which the gliding ability has been independently evolved, as they belong to genera which are not closely inter-related. For example, the first species belongs to the genus *Petaurus* and, like the two members dealt with previously, retains the semi-insectivorous dentition of the primitive ancestry. The Greater Glider however, sole member of the genus *Schoinobates*, according to the purely herbivorous dentition and the skull features, is merely a gliding Ring-tail Possum which has substituted a fluffy tail for the prehensile one, as a steering

attachment in harmony with the parachute development.

YELLOW-BELLIED GLIDER (*Petaurus australis*.)

This largest member of the genus was also an early discovery of the colonists, and under the name "Hepoona Roo" was described and illustrated in colour in 1790 in his "Journal of a Voyage to New South Wales" by John White, the first Surgeon-General of the Colony. It inhabits the coastal forests of eastern Australia from southern Victoria to south Queensland; a sub-species (*reginæ*) has been described from Gin Gin, south of Bundaberg, based on a female which was said to be generally of paler colour.

Apart from its larger size, in which it is second only to the Greater Gliding Possum, this species is readily distinguished from its two smaller relatives by its dusky brown and blackish general coloration, which lacks their quaker-grey tones, and by the usually orange-yellow under-surface. The colour varies, however, especially that of the belly, which ranges to a creamy-white, a phase which may be characteristic of the females and young males, but which unfortunately makes the popular name less applicable as a guide to its identity.

Except for Gould's original observations on the blossom- and insect-feeding habits, little had been published on the natural history of these animals, which are by no means common or easy to observe, until the recent account by David Fleay, in the *Victorian Naturalist*, from which much of these habit notes are drawn. The observations were made in March-April, 1933, at about 5,000 feet, in the woollybutt belt on the upper slopes of Mt. Wills in East Gippsland, Victoria. In the half-moonlight in an old clearing amongst the lofty trees, a faint sound of

claws on bark attracted attention, and the watchers glimpsed a shadowy form with streaming tail shooting down through space and heard the distinct "clop" of the landing, when two of the beautiful animals were seen perched about twenty feet up on the white trunk of a Manna Gum. They appeared much greyer in the torch-light than by day, and the dark back-stripe was very prominent as in the smaller species, but the larger naked ears and long bushy tail made the identification quite simple.

The animals' "flights" appeared to take a definite route to some favoured feeding place, and one appeared to eat the tips of some tender eucalypt suckers growing out from a trunk about eight feet above the observer. The tree to tree flights averaged from thirty-five to forty yards, the take-off being accompanied by a low but unmistakable whirring moan, while occasionally before volplaning it uttered a fairly loud shriek, which is not as piercing as that of the Greater Glider, though closely resembling it. Strangely enough, it proved to be a remarkably poor climber when ascending the straight tree-trunks, and after struggling up a few feet at a time in a rather helpless spread-eagled fashion, in contrast to the rapid galloping action of *volans*, it seized the long bark dangling from the branches, upon which it then showed great agility.

About midnight, after the eighteenth flight, one of the Gliders reached a slender Manna Gum, where it began methodically licking the sap which had exuded and dried in small sugary lumps, while in a characteristic head-down position. Steadily and greedily for nearly three-quarters of an hour the pink tongue licked at the hardened gum until the watchers felt it must surely be worn away. The animal then glided off to some of the larger Manna Gums laden with blossoms, which were thickest on the outermost twigs. Upside down, like a sloth, it clambered amongst the branch tips, bobbing about with its long tail waving as the branches bent beneath its weight. The entire blossoms were eaten,

no petals falling or being observed on the ground next day, although in one large tree the animal was busily feeding for nearly three hours.

About 4.30 a.m. appeared to be bedtime, as it then landed high up on a big



The Yellow-bellied Glider is not only considerably larger, but also lacks the quaker-grey tones of its two smaller and more squirrel-like relatives. The species was also an early discovery of the colonists, being described and illustrated in colour in 1790 by John White, first Surgeon-General to the Colony.

[Photo.—David Fleay, B.Sc.]

eucalypt, crawled a few feet higher, and after neatly rolling its bushy tail disappeared into a hole about twenty-four feet from the ground; soon a bubbling shriek rang out, and its elusive mate followed it home. The nest was found to be a well made globe of gum leaves about twelve inches in diameter, which, though larger and more tightly woven, was exactly similar to that of the little Sugar Glider (*breviceps*). An adult male and half-grown female were caught uninjured, and are thriving in captivity. The general disposition is placid, and even immediately after capture they were not greatly upset by handling, and, although the bite of the long piercing incisors is deep and painful, they made little attempt to bite unless deliberately annoyed. In both the wild and captive state, when the animals are not unduly disturbed, they exchange what appear to be conversational snuffing calls which are reminiscent of the soft "talking" notes of the male Brush-tailed Possum of the genus *Trichosurus*.

The principal diet in captivity is bread and milk, with honey or jam, large quantities being consumed. They will not eat fruit, lettuce, or other green vegetables, and gum tips or leaves are not touched, though the species apparently chews the tender bark of branches for the sap, as does the Sugar Glider. Actually the feeding and nest-building habits, and scolding sound, which has aptly been likened to the whirring of a child's toy, are similar to those of the Sugar Glider, but the long tail and looser build, screech, and rapid emergence when the nesting tree is tapped in daytime, are all as in the Greater Glider.

The south Queensland sub-species was described from an adult female, said to be of a lighter, more olive-grey tone above, and also of a paler, more buffy colour below. The adult male and young female captured in Victoria were also paler, with creamy-white underparts, so that the general coloration appears to be paler at the extremities of the distribution than in New South Wales, though the warmer

yellow phase of belly colour will fade to a yellowish-white if the skins are exposed to strong light.

THE GREATER GLIDER (*Schoinobates volans*).

This largest species of gliding possum is the only one of its genus, the scientific name of which very aptly means "rope-dancer" in allusion to its climbing feats, while the specific name of course, refers to its gliding abilities. The large and more loosely built body, and extremely long evenly fluffy tail, which attains to about twenty inches, readily distinguish this animal from the largest member of the genus *Petaurus*, the Yellow-bellied Glider, which is the only member of the possum family with which it can be confused. A further difference which serves to distinguish them during flight is found in the attachment of the parachute-membrane, which only reaches to the elbow in the Greater Glider, instead of to the outer digit of the forepaw, as in the genus *Petaurus*, with the result that the larger species has a triangular appearance when stretched in flight, owing to the restriction of the membranes in front. A notable feature which assists in locating the animal at night is the manner in which the eyes are reflected as glowing jewel-like orbs in strong torch light, whereas the reflection caught from the eyes of species of *Petaurus* is much dimmer.

The range extends along the coastal highlands of eastern Australia from Gippsland in Victoria to as far north as the Bellenden Ker Range, near Cairns, Queensland, for which State three sub-species have been described, at least one of which may merely represent one of the colour phases of the extremely variable species. The species was included in the fauna of South Australia by F. G. Waterhouse in Marcus's "South Australia" of 1876, but in his handbook of 1924, Wood Jones had not been able to make any record of their extension into that State. Fleay states that he has never observed it in Victoria further west than the Ballan-Daylesford

forest, though more western localities may have been established, while it has apparently never reached the suitable country of the Otway region, where both the Pygmy and Sugar Gliders are found. The inland range in New South Wales is indicated by specimens in the Australian Museum from Tumbarumba and Tumut in the south, and the Barraba district in the north.

This large animal is naturally the record glider of the possum world, and one animal in six successive glides has been observed to cover a distance of 590 yards, when a resident of Milton, N.S.W., saw a Glider in the twilight near his home leave the top of a eucalypt 100 feet high and glide to the foot of another 70 yards away; this it immediately climbed and from its summit glided to the next at 80 yards, and lost no time in ascending three more trees at distances of 110, 120, and 90 yards, finally gliding to another 120 yards away, in which it remained. While climbing the trees it uttered its peculiar squealing call notes, as if to give friendly warning of approach to any of its kindred, and, although it is possible that the traveller landed a few yards short of some of the trees, the total journey of a third of a mile shows that these nocturnal gliding marsupials may wander considerable distances before returning home in the early morning. Another instance of this is recorded from Traralgon, Victoria, where a pair journeyed fairly frequently to an orchard quite half a mile away from the



The Greater Glider, largest of "flying" marsupials, the scientific name of which, aptly enough, means a flying rope-dancer in reference to its climbing abilities and aerobatics. The single species is closely related to the Ring-tail Possums.

[Photo.—David Fleay, B.Sc.]

bush. Three eucalypts stood at intervals on the down hill grade to the orchard, but coming back the animals naturally could not glide, and had to run awkwardly over the ground.

Remarkably at home in the air or on trees, the graceful possum aeronaut is extremely clumsy and slow on the ground, where its immediate objective is something to climb upon. According to Le Souef and Burrell, the only enemies preying on the Gliders are the Powerful Owl and the fox, a beautiful white specimen photographed by Burrell having been actually taken from a fox surprised when carrying it away to its den. In his excellent account of "The Greater Flying Phalanger" in the *Victorian Naturalist* of 1933, David Fleay, of Melbourne University, states that the fox appears to account for odd ones, even amongst tall timber, as during rambles at Upper Beaconsfield, Victoria, he discovered half eaten remains, the strong smelling and finely-masticated leaf contents of the stomach having apparently proved too highly seasoned for the killer's taste. In some localities where barbed wire is used for fencing amongst trees, the bodies of unfortunate animals are found suspended, after a miserable death, having caught their skin-folds on the sharp barbs when swooping low amongst the trunks.

The diet, as indicated by the more herbivorous dentition and Ring-tail relationship, is strictly vegetarian, consisting mainly of the tender leaf tips and blossoms of favoured eucalypts, and not sharing the liking for insects shown by gliders of the genus *Petaurus*. The narrow-leaved peppermint gums are most favoured, from which a surprising variation was observed in the Myall Lakes district north of Sydney, where the species was seen amongst the casuarinas or native oaks, and the stomach contents, though finely masticated, appeared to consist of casuarina leaves. The only complaint of economic damage brought to my notice was from Mr. S. Sinclair of Gerringong, on the south coast of New South Wales, who sought the removal of protection owing to damage done in his orchard, where he had actually seen and

shot the animals in the apple trees, of which they ate both leaves and blossoms, though never touching peaches or nectarines.

The nesting hollows are high up in the trunks of both dead and green trees, and may be lined with long strips of bark or layers of leaves, though the large gliders do not invariably add such furnishing to a really comfortable hollow. The home trees are often betrayed by the considerable shedding of bark at some distance from the ground, where the powerful sharp claws score the trunk in landing, or in travelling upwards with the characteristic rapid galloping action adopted in climbing. A loud knocking with the back of an axe will disclose whether the occupants are at home to visitors, as the nerve-racking vibrations soon result in a shaggy little Possum head peering forth, to be followed by the emergence of one or two animals. If the knocking continues they will gallop upwards to perch on the topmost point and, bunching themselves for the leap, glide off down some well charted airway, like an aerial frying pan, with the long tail streaming out behind. If they are only tapped gently forth, they may wait till quiet reigns and then slowly return to the dark haven, rolling the long tail into a furry ring as they re-enter, in a way which suggests that the nesting material may be carried curled up in the tail, as is the custom with the smaller gliders and the Ring-tail Possums, though the tail is not truly prehensile. The startling call of the animals frequently heard in forests by night resembles a gurgling shriek, sharply ascending and ending in a series of bubbling sounds, the call appearing to be uttered when they are moving in the trees or actually in flight. Occasionally slow repeated hissing calls are heard, similiar to those made by many marsupials.

As early as 1853 Gould expressed surprise that so interesting and attractive an animal had not been sent alive to England, like the smaller members of its family. Strangely enough, the larger species appears to need more careful nursing in captivity than the smaller but

hardier gliders, which may be due to its greater dependence on a fresh supply of suitable leaves, as is the case with the Koala, with which it shares an inability to thrive solely on unnatural foods. According to Mr. Fleay, who has five in captivity, they may be persuaded to acquire a taste for bread and milk spread with sweet jam or honey, melon and lemon being favoured, as in the case of other marsupials, but such variants are possible only in addition to the leaf diet. Neither will they thrive unless supplied with a log or box providing a retreat similar to their natural home, which must be situated aloft in a roomy enclosure. The captives have built a nest of leaf sprays in their hollow red-gum log, but only did so after three months, when the sprays were placed at their doorway. Stringy-bark boughs and long sapling poles are greatly appreciated, in elevated positions, because unless sick the animals seldom descend to the floor during captivity, and confined quarters which prevent the active creatures from wandering about at night with their long tails hanging free soon cause them to pine away. The prevalence of small mites found on the animals, especially about the face, is a source of annoyance, crawling about the eyelid rims, and immediately an animal becomes sickly the parasites rapidly increase and set up an irritation which hastens its end.

Although the pouch is equipped with two teats, it seems that only one infant is reared at a time. In Victoria the naked babe usually appears in July or August, and it is difficult to realize that the tiny creature, no larger than the top

of a small drawing pin, will later engage in the graceful glides of its fluffy parents. As the youngster grows, the loose parachute-fold soon becomes visible, and, although pouch inspections are difficult owing to the parent's natural resentment, and fear of hurting the young, some interesting notes have been obtained by Mr. Fleay. The little fellow appears to lose its early close attachment to the teat when about six weeks old, and is then able to suckle at will. Later the eyes open and a covering of short fur appears, and four months from birth it has outgrown the pocket-nursery, though still being nourished from within it. For a while it clings to the mother's back during nocturnal excursions, though her gliding leaps are probably not undertaken unless it is left at home in the sleeping hollow.

This quaint marsupial was first made known in 1789 by the description and illustration of the "Black Flying Opossum" in Governor Phillip's account of his voyage to Botany Bay, which stated that it was an inhabitant of New South Wales, and that the fur was of so beautiful and rare a texture that "it might probably be thought a very valuable article of commerce" if found in plenty. Although it is probably the most plentiful of glider-possums, fortunately for its existence the fur has a softness comparable to that of the feathering of most night-birds, and lacks a lasting rigidity, so that it is of no commercial value. In view of this and the harmless and almost exclusively leaf-eating habits, it is one of the very few marsupials the survival of which seems reasonably assured.

THE AUSTRALIAN AQUATIC LIFE. Vol. I,
No. 1, February 1, 1935. (Gordon
and Gotch (Australasia) Limited.)
Price 6d.

This excellent little magazine is the official organ of the Aquarium Society of New South Wales. The coloured cover, showing Siamese Fighting Fishes, is striking, whilst there are several accurate

drawings of other fishes by the same artist, Mr. A. K. Carter, an experienced aquarist. In more than fifty well-printed pages we read of such diverse topics as Taronga Park Aquarium, sharks, game fishes, trout, microscopy, photography, gardens, coral reefs, *et cetera*, all very well illustrated. The modest price should ensure its popularity and the success it deserves.

Australian Shells

EAR-SHELLS AND WIDE-MOUTHED SHELLS.

By JOYCE ALLAN.

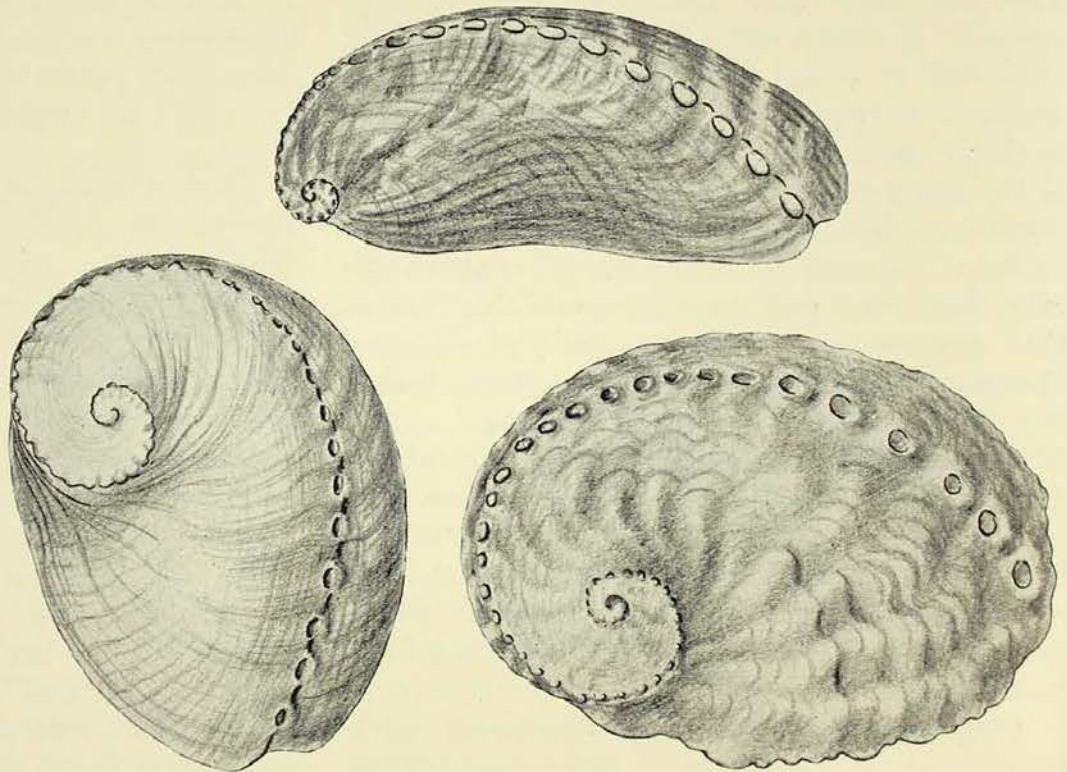
EAR-SHELLS, also called Sea-ears, Abalones, Mutton-fish, and Paua, belong to the family Haliotidæ, and include some of the most striking shells found on the Australian coast.

The shells are ear-shaped and flattened, with small spires and very wide, extremely nacreous, apertures. On the outside near the left edge is a row of perforations decreasing in size towards the apex. A very solid large animal is attached to the shell by a strong muscle, the scar of which can be seen easily in the empty shell. The foot of the animal has a fleshy fringe, and tentacular gill filaments pass out through the perforations in the shell, the anal siphon occupying the last. In young shells these holes are scarcely open, but as the shells grow open ones are added. As new ones form the oldest ones become closed by deposits, but a certain number are always open.

Ear-shells attach themselves firmly to the under surface of stones and rocks between tide marks and are hard to dislodge. Their food is chiefly plant life, scraped from rocks by means of a rasping tongue, but on examination other food

has been found in the stomachs of the animals.

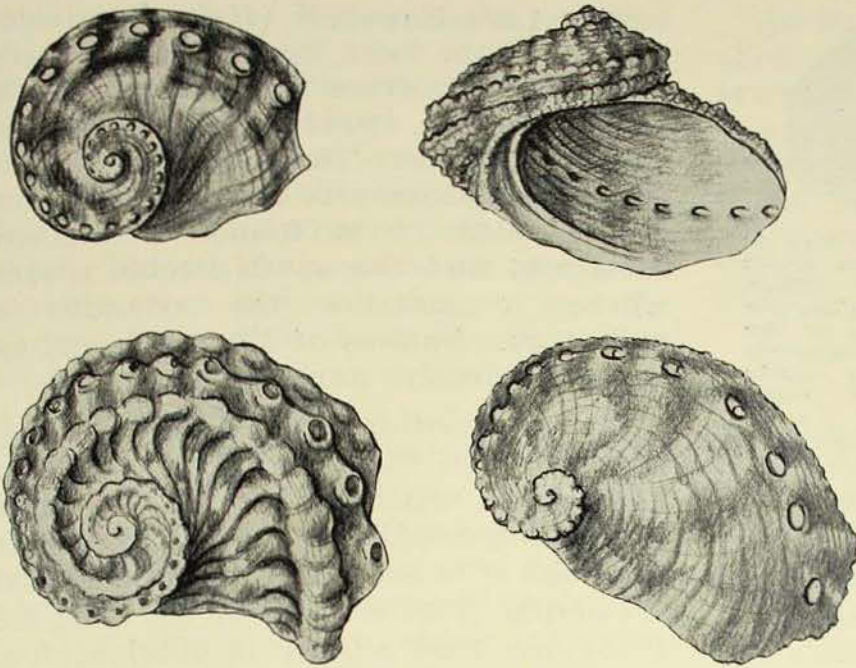
Both the animal itself and the shell are most useful. Throughout the world, wherever it occurs, the animal is eaten by



The top figure is the Ass's Ear-shell (*Haliotis asinina*), on the left is the White Ear-shell (*Haliotis albicans*), and on the right the best known ear-shell of all, the Warty or Sydney Ear-shell (*Haliotis naevosa*). These three are the largest of the Australian ear-shells.

[Joyce Allan, *del.*

many people, who consider the muscular foot extremely appetizing. In California particularly, there are large fisheries for this shellfish, great numbers of which are collected annually for making soups and chowders. The greater number there, however, are collected by Japanese and Chinese, who remove the shellfish from their retreats in rocks at low tide, dry them, and ship them away to their own countries.



Brazier's Ear-shell, on the upper left, is a pretty little shell found between tides or washed up on beaches on the New South Wales coast. A more elevated form is seen in the Round-back Ear-shell (*Haliotis cyclobates*) on the upper right. A ridge on each side of the row of holes and scaly lamellæ characterize *Haliotis scalaris*, the bottom left figure, and the Variegated Ear-shell (*Haliotis varia*), as its name implies, is not marked by any strong characters.

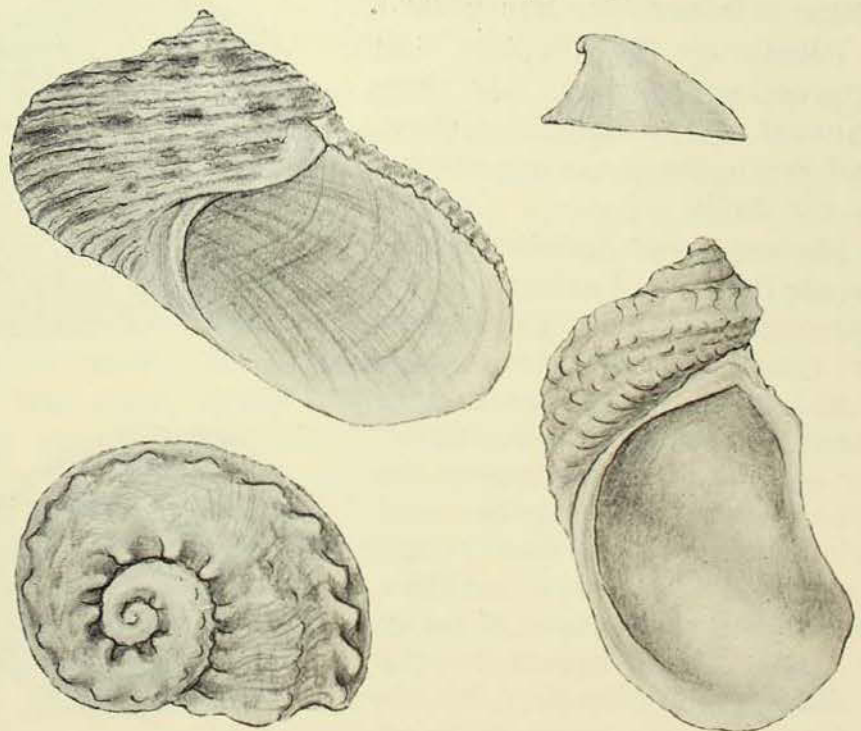
[Joyce Allan, del.]

Even in certain parts of Australasia we find this animal relished as food. Not only the aborigine, but the Maori of New Zealand used it as a staple sea-food, and today many white people consider it superior to other shell-fish. This is particularly so in Tasmania and New Zealand, where species, large enough to make an appetizing meal, exist plentifully. Although it is appreciated as food by Australians and New Zealanders, there is, as yet, no commercial fishery for them. It is anticipated by those interested in shellfish industries that in the near future, particularly in the case of the New Zealand species *Haliotis iris*, which has an extremely beautiful shell, this will possibly come about.

Ear-shell animals may be served fried, scalloped, or in many other ways, but if frying is intended the meat should be well beaten beforehand to make it tender. Before scalloping, it is wise to allow the animal to simmer for some hours. The animal of the New Zealand species has been found¹ to contain substances rarely found in ordinary foodstuffs, or met with in smaller concentration, and by reason of this it has considerable value as a food. An adult specimen, they consider, is probably as much as one could manage to eat at once.

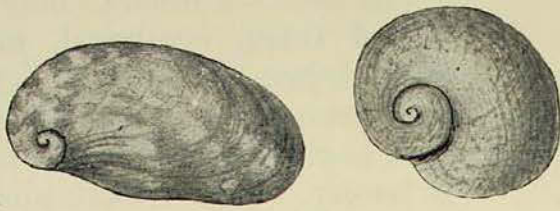
On account of its iridescent interior, the shell is used for ornamental purposes as much as the animal is for food.

¹ Malcolm and Hamilton, *Trans. Proc. N.Z. Instit.*, lv, 1924, p. 375.



From Queensland comes the small reddish brown Wide-mouthed Shell (*Stomatella rufescens*) figured on the upper left. Next to it is a very tiny cap-shaped shell (*Roya nutata*), which is placed near these in classification because of anatomical structure. On the lower left is figured a small shell (*Microtis tuberculata*), very like Wide-mouthed shells, but with the keel tuberculated, and the remaining quaintly shaped shell is the Keeled Shell (*Stomatia phymotis*), solid, irregular-shaped and lustreless.

[Joyce Allan, del.]



The small False-ear Shell on the left is *Gena strigosa*, very common in rock pools on the New South Wales coast. When danger threatens, the animal discards its tail, which extends beyond the edge of the shell. The Wide-mouthed Shell (*Stomatella imbricata*) is one of the commonest shells in pools and on beaches in New South Wales and Victoria.

[Joyce Allan, del.]

Everyone has seen ear-shells which have had their rough outer surface removed by acid or other means used as ornaments, or as electric light shades in jewellers' shops. Numbers of shells are exported from California and other places to Paris and Europe, where they are used in inlay work, and in manufacturing small articles of jewellery, buttons, and similar things. Some years ago shells of *Haliotis iris* were exported from New Zealand, but in recent years this practice has ceased.

Pearls of little value, but interesting because of their unusual colouring, blue, yellow, and green, are sometimes found in ear-shells.

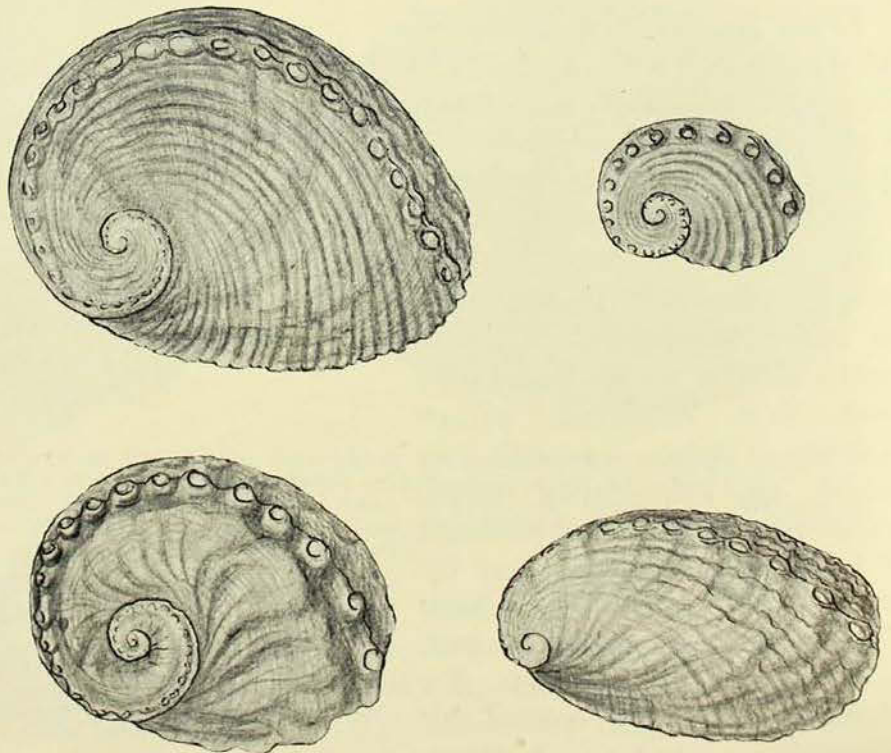
The centre of distribution of ear-shells is Australia and adjacent seas, though species are found in other parts of the world. There is only one main genus, *Haliotis*, in the family, the species of which live in the littoral zone in tropical and sub-tropical seas. The rough corrugations and coralline growths on the surface of many of the shells protect the mollusc from discovery by its natural enemies, such as large sea birds.

Only the best known species of ear-shells are figured and described in this article, as these are the ones concerning which information is generally sought.

The Ass's Ear-shell (*Haliotis asinina*) is one of the best known and is easily distinguished from the others by its peculiar, long, narrow ear-shape, and smooth surface. The average length of an adult specimen is from three to four inches, and it is found in northern Australia and the south Pacific islands, where it attracts the attention of collectors. Natives of Murray Island use them as effective dance rattles.

An extraordinary little crab lives in the branchial chamber of the animal of this shell, settling there in its larval stage, and remaining there until it dies. Although it is not parasitic on the animal, protection is afforded it by the shell, and a copious food supply is obtained from the current of water going constantly into the gills of the mollusc.

The White Ear-shell (*Haliotis albicans*) is devoid of any sculpture, although growth lines showing plainly on the shell may be mistaken for it. This species is



On the upper left is *Haliotis roei*, an ear-shell ranging from Western Australia, where it is common, to South Australia. Its surface is covered with conspicuous ridges, with grooves between them. Next to it is Hargrave's Ear-shell (*Haliotis hargravesi*), pretty, but rarely found in New South Wales. The sculpture on Emma's Ear-shell (*Haliotis emmæ*) is somewhat like that on *H. scalaris*, but is not so pronounced, and on *Haliotis squamata* it is fairly fine and scale-like. The last two species are figured on the bottom left and right.

[Joyce Allan, del.]

usually considered a deep-water one, and is generally cast up after storms, often attached to weed. The inside of the shell is silvery, and, although specimens are often found which are cream or pale buff coloured on the outside, as a general rule they are alternately rayed orange-red and white. The shell is large, adult specimens reaching seven inches in length, and the species is found in Bass Strait, rather commonly in South Australia (where it is the largest species of ear-shell), Tasmania, Victoria, and in Western Australia.

Brazier's Ear-shell (*Haliotis brazieri*) is a pretty species, with tube-like perforations on the surface, and bright red rayed markings. The shape is more circular than in most species of ear-shells, and it is between one and two inches in diameter. It occurs between tides on the New South Wales coast, and empty shells are often washed up on the beaches, particularly in the vicinity of Sydney.

In South Australia and Victoria is found the Elevated or Round-back Ear-shell, *Haliotis cyclobates*. This species, with its well rounded body whorl and elevated spire, is very unlike other ear-shells in shape. The colour varies in shades of brown, green, and flesh, and the inside is particularly silvery, with red and green reflections. The shell is found rather commonly in low water attached to rocks and sometimes to other shells in South Australia. It has also been recorded from Victoria. An average specimen is between three and four inches high and about the same in width.

The best known of the Australian ear-shells is the Sydney or Warty Ear-shell, *Haliotis navosa*. This is not only the largest species, but is so common on the rocks and in crevices at low tide along the southern Australian coast, particularly that of New South Wales, that a description of it is hardly necessary. Its brick red colouring and strong wavy sculpture enable it to be recognized easily. The animal is eaten by many people, and the shell, in a polished condition, is used ornamentally.

As its name implies, the Varied Ear-shell varies considerably in colouring, brown, green, and yellow predominating, but is not marked by any strong characteristics. It is a rather small species found in north Australia, where several other small species occur, and is also widely dispersed in the islands of the south Pacific.

A strong ridge running round the shell inside the row of elevated holes, as well as thin longitudinal, scale-like ridges, easily distinguishes the Ridged Ear-shell from all the others. Specimens reach over four inches, and in Western Australia, where it is not uncommon, the sculpture and ridges are more pronounced and the holes more tubular than in specimens from South Australia, where it also occurs. The South Australian form, however, should not be confused with *Haliotis emmæ*, a smaller but somewhat similar species found there, and also in Tasmania, Victoria, and Western Australia. This species has a low ridge, and is free from the scale-like longitudinal ridges of the Ridged Ear-shell.

Several other ear-shells, which are very briefly mentioned here, occur on the Australian coast. Two species, *Haliotis roei* and *Haliotis squamata*, have somewhat similar sculpture. This consists of closely spaced, regular, rounded ridges which cover the surface of the shells, but in the former species, which occurs in south-west Australia, the shells are more rounded than in the latter, which comes from north Australia, and looks like an elongated form of *roei*. Hargrave's Ear-shell, *Haliotis hargravesi*, is found in New South Wales, where it is very rare. This species is rounded, between one and one and a half inches broad, and its reddish brown surface is characterized by revolving sharp-edged ridges and tube-like perforations. It is about the same size as Brazier's Ear-shell.

THE WIDE-MOUTHED SHELLS.

These small shells, sometimes known as Miniature Ear-shells, belong to the family Stomatiidae, and resemble ear-

shells but have no row of perforations. They are usually found in rock-pools between tide marks, although empty shells are frequently found washed up on beaches, where their brilliantly nacreous interiors attract attention. Some species have an operculum attached to the animal.

There are three main genera in the family: *Stomatella*, which consists of regular ear-shaped shells with large, oblique, thin-lipped apertures, found in warm seas; *Stomatia*, in which the shells have their surface tuberculated or keeled, the aperture oblong or transverse, and the animal is minus an operculum; and *Gena*, known as False Ear-shells, with thin, smooth, ear-shaped shells. The animal of this genus has a large foot incapable of complete retraction within the shell. False Ear-shells grow to a little over an inch in length, possess no opercula, and are very common in rock-pools in warm seas. There is also a genus *Roya*, to which a small cap-shaped shell, *Roya nutata*, from eastern Australia, belongs, included at present in this family, but the shells are more like small limpets than wide-mouthed shells in shape. The genus, however, has been associated with others of this family because of the similarity of the radula. Small flattened *Stomatella*-shaped shells, form the genus *Microtis*, also belonging to the family Stomatiidæ. These are found in north Australia and the south Pacific islands.

The largest shell of the family is *Stomatia phymotis*, the keeled Wide-mouth Shell. This is strongly tubercled and varies in colour and form, but is generally reddish, marked with olive or

brown. It is found in the south Pacific and in north Australia, where also a smaller variety, *Stomatia australis*, occurs. A very pretty wide-mouth shell, *Stomatella rufescens*, which occurs in north Australia, is greenish brown, with a very silver sheen within and a faint red margin.

The true wide-mouth Ear-shell, *Stomatella imbricata*, is one of the commonest shells found under stones, in rock-pools, or on beaches along the New South Wales coast and Australia generally. The shells vary from sand to buff colour, with minute red dots, and the surface is finely sculptured with thread-like concentric lines. The shells are usually about an inch in diameter.

The small False Ear-shell, *Gena strigosa*, found in rock-pools in New South Wales and Victoria, is very active, and when disturbed will often throw off the posterior end of its foot, which, however, grows again later. The shell is about an inch long, shiny, and varies in colour between white, red, brown, and green. It is also very common on beaches. A shiny black smaller species, *Gena nigra*, occurs on the Queensland coast, and a somewhat larger species, *Gena auricula*, is found in Western Australia, but both these are sufficiently different to enable them to be distinguished from *strigosa*.

In the genus *Microtis* the two south Pacific representatives are *Microtis tuberculata* and *Microtis heckeliana*, the latter distinguished from the former, which is found in Queensland as well as islands of the south Pacific, by a flatter shape and the colour pattern on the last whorl.

Recent visitors to the Museum include Mr. Percy W. Clemens, Torquay Natural History Society, England; Professor H. C. Richards, University of Queensland; Professor W. R. McGregor, University College, Auckland, New Zealand; Sir Henry Fowler, Spondon Hall, Derby,

England; Professor W. B. Benham, Dunedin, New Zealand; Mr. N. B. Tindale, Ethnologist, South Australian Museum, Adelaide; Mr. Gilbert Archey, Director of the Auckland War Memorial Museum, New Zealand; the Dowager Lady Swaythling, Kensington Court, London.



THE SPEAR-THROWER.

The aborigine fits his spear with remarkable speed and skill against the notch of his spear-thrower. This device acts as an extra joint to his arm, and adds length and force to his throw. Various types of spear-throwers are used in Australia; the one above is lath-shaped. Many tribes do not use them.

[Photo.—Capt. F. Hurley.]

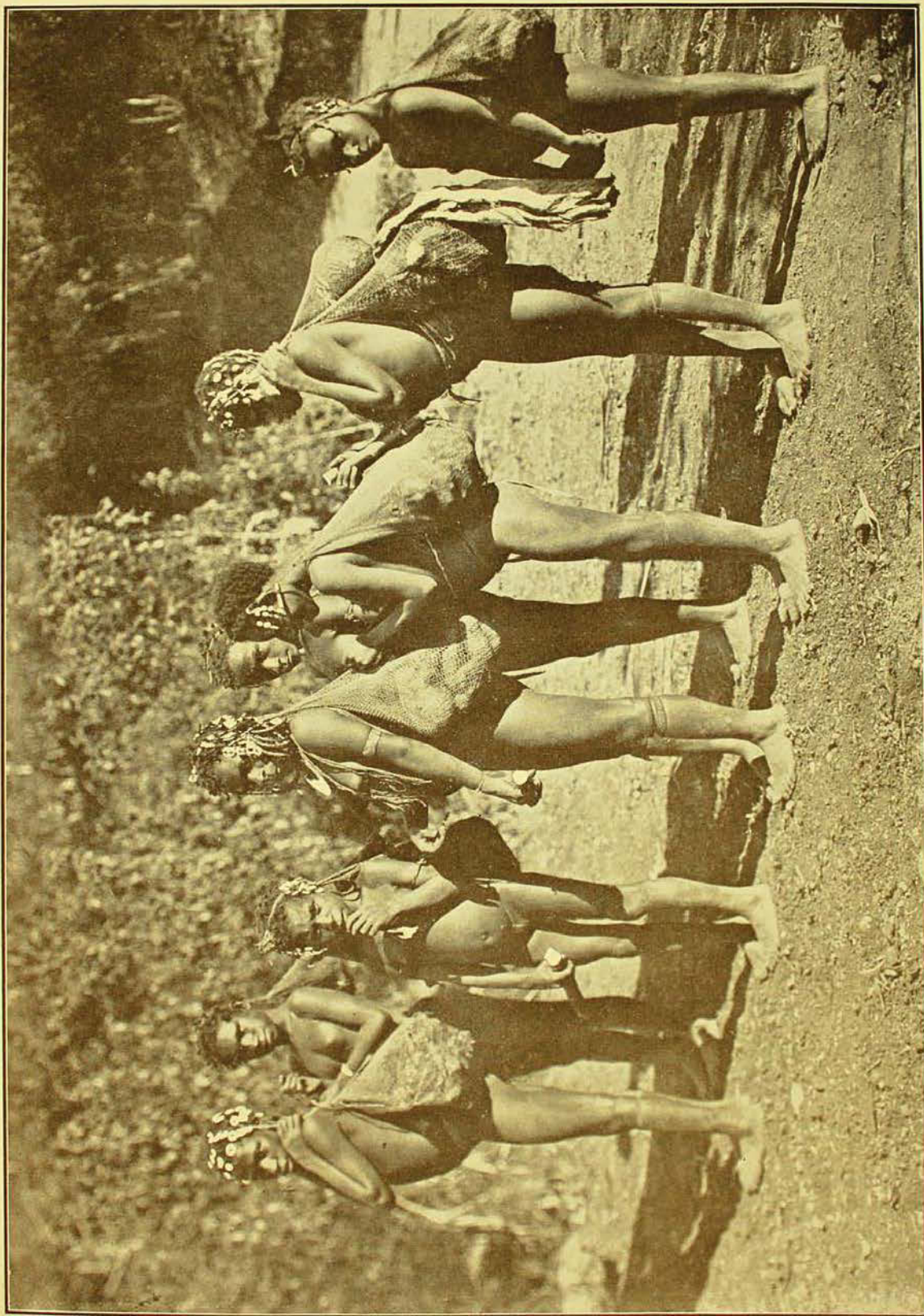
(This and accompanying photographs have been selected from a collection of more than two hundred recently placed on exhibition in the Upper Ethnological Hall of the Australian Museum.)



A MANUS HOUSE, ADMIRALTY ISLANDS.

The house is built upon piles over the quiet waters of the lagoon. It accommodates several related families. On the left stands a pig-pen, an outrigger canoe runs under the entrance platform. The child clings tightly to its mother as she steps upward; should it fall into the water it is not frightened, for it is taught to swim at a very early age.

[Photo.—R. Fortune. By courtesy of Australian National Research Council.



NATIVE GIRLS OF A MOUNTAIN VILLAGE, NEW GUINEA.

Girls and women are seldom seen without their netted bags, woven and coloured in a variety of ways, in which are carried garden produce, babies, young pigs and dogs. Their dress consists merely of a narrow waist belt and a mid-leg strap of fibre. Necklaces of dogs' teeth are worn, and small shells and shell-discs are strung on to their tiny plaits of hair.

[Photo.—Capt. F. Hurley.



BASKET-MAKING.

Aboriginal women are adept at making baskets out of strips of cane and netted bags of plant fibre skillfully twisted into cord. This woman is sitting in front of a hut made by placing a thatching of grass and rushes over a framework of boughs. Kendall River, Cape York, Queensland.

[Photo.—Miss U. McConnel. By courtesy of Australian National Research Council.