

*The*  
AUSTRALIAN  
MUSEUM  
MAGAZINE

VOLUME X, NUMBER 2.

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An Albino Snail.

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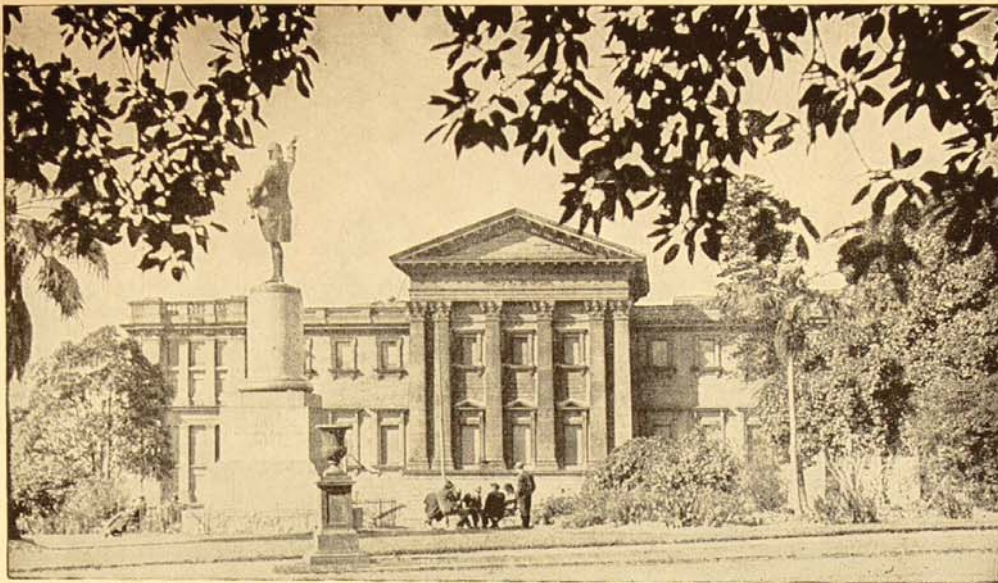
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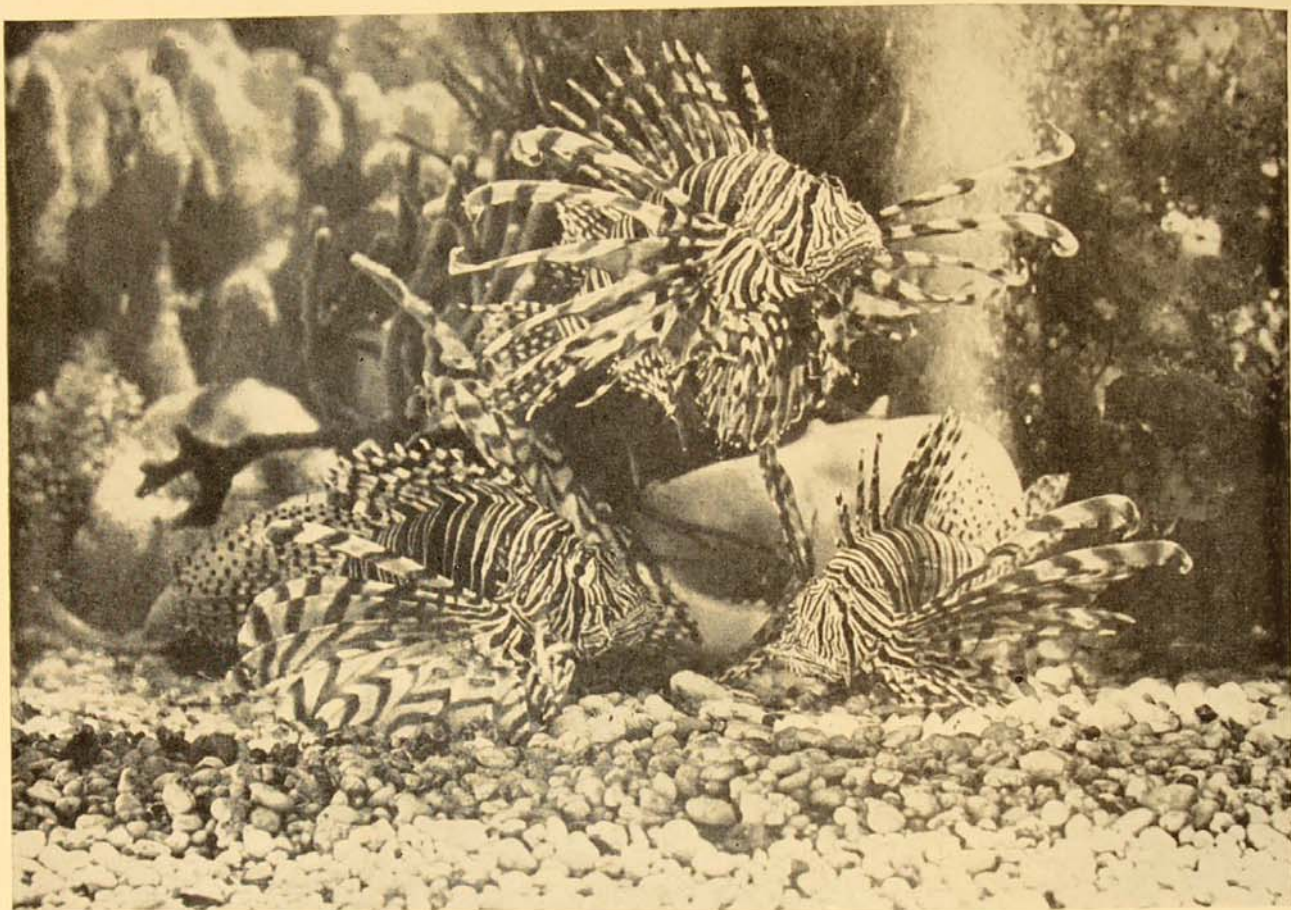


# THE AUSTRALIAN MUSEUM MAGAZINE

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(Photography, unless otherwise stated, is by Howard Hughes.)

● OUR FRONT COVER. This study of a rearing albino specimen of the common garden snail (*Helix aspersa*), which contrasts strongly with its normal dark shell, shows the extent of its albinism perfectly. Absence of pigment in the animal makes it possible to trace the course of the white nerve ganglia along the centre of the beautifully displayed eye-bearing tentacles and the lower smaller pair. Though many instances are known of albino shells of the garden snail having been found, their animals have been quite normal in colouring. An albino snail animal is rare, only one or two cases having been recorded. This example, found in the garden of a Sydney suburb recently, aroused considerable interest (see page 59).



A group of three Butterfly Cods (*Pterois volitans*) in Taronga Park Aquarium, Sydney, showing how their "disruptive coloration" renders them difficult to distinguish from a variegated background. Though of extraordinary beauty, these are fishes of evil reputation. The dorsal spines are endowed with venom-glands, capable of stinging severely, so the Butterfly Cod, a slow swimmer, confident in its disguise and armament, makes no attempt to evade capture. (See article, page 41.)

Photo by courtesy of Taronga Park Aquarium.

# THE AUSTRALIAN MUSEUM MAGAZINE

*Published by the Australian Museum*

*College Street, Sydney*

Editor: A. B. WALKOM, D.Sc.

Annual Subscription, Post Free, 8/6

VOL. X, No. 2.

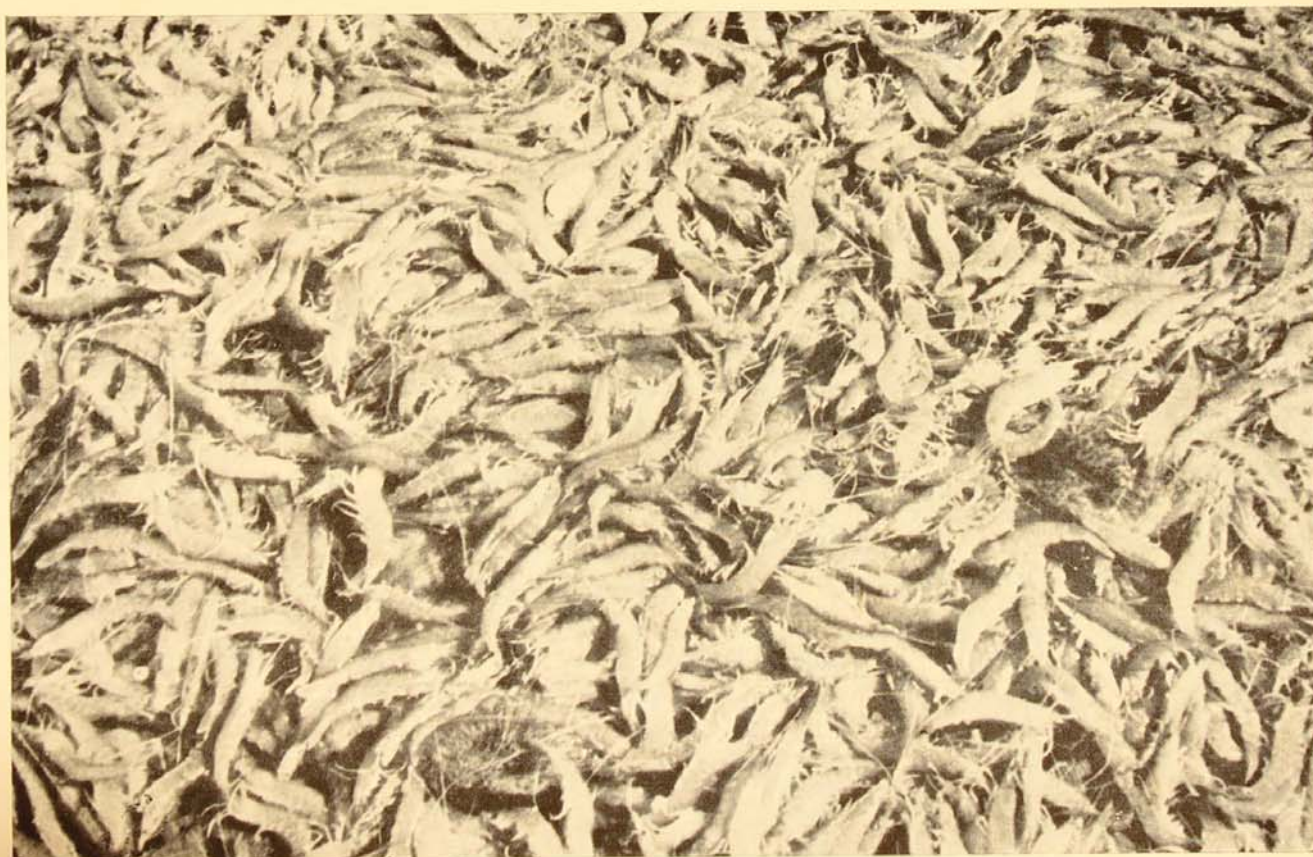
MARCH 31, 1950.

## The New Ocean Prawn Fishery

By F. A. McNEILL

FOR the past couple of years increasing interest has been centred on the development of a new marine industry. This is an ocean fishery of those prawns which have for so long been netted in the inlets and lakes of coastal New South Wales. Just before the year 1940 something of the same sort was hap-

pening in the wide waters of the Gulf of Mexico, away on the other side of the world. Though not generally known among fishermen, there is a close connection between these two happenings and the details are well worth recording. In the United States of America the deceptive name "Shrimp" is used for the



A "lift" of ocean King Prawns spilled on deck from the cod end of a trawl net.

Photo.—J. Hazzard.



**Converted seine-net fishing trawlers operating off coast at Evans Head, New South Wales. Crew of craft at right are pulling inboard the cod end of an otter trawl filled with prawns.**

Photo.—J. Hazzard.

marketable marine crustacean known here as "Prawn". The great fishery of that country embraces generally the coasts of Florida and Louisiana. While that of our waters is no match in point of volume, it can be claimed to be the world's second largest prawn fishery—one capable of great expansion and continued economic worth if properly controlled.

The significant fact is that the two great prawn fisheries in question are based on catches of crustaceans belonging to the same family group (Penaeidae). This being so, it can quite naturally be expected that they would all conform to the same rules in their breeding and life histories. Research in recent years both here and overseas has proved that they do, and the result of this study has pointed the way to a vastly increased more economic production.

In New South Wales it is only fifteen years or so since all prawn fishermen were quite unaware of the habits of their quarry. None of them realized the full significance of the swarming schools which they found so commonly heading seawards on dark nights from coastal inlets and lakes. The fact that these were nuptial journeys did not occur to the fishermen; there was a conspicuous absence of females carrying the familiar tell-tale bunches of eggs behind the legs on the underside of the body. Conjecture on breeding habits was rife. Many who believed they had solved a mystery brought specimens of egg-bearing prawns to the Museum, hoping to convince the

specialists. These enthusiasts always received the disappointing news that their finds were females of totally different families from that of the commercial prawns. The truth is that the eggs of the last-named are laid singly and allowed to float away to hatch in the open water.

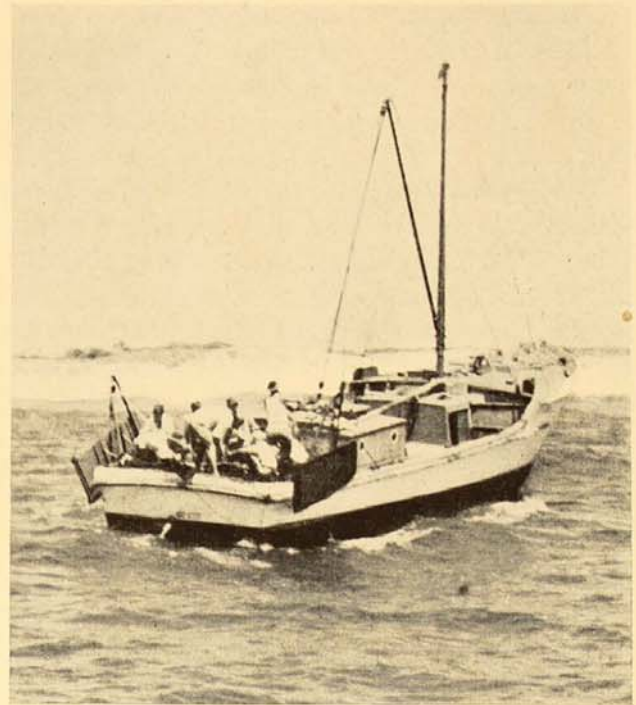
Of the three well-known kinds of prawns fished so abundantly in the lakes and inlets of the east Australian coast, the School and the King have to migrate to the open sea for breeding purposes; only the offspring return to the nurturing grounds. The third kind, popularly called Greasy Back, commonly breeds in enclosed waters but may migrate like the others to the open sea. The United States Government, working on similar evidence established for the prawns fished along the coast of the Gulf of Mexico, embarked on a large scale quest.

An American authority has written: "All through 1938—with time out for the hurricane season—a sturdy vessel, the 'Pelican', zigzagged the coastal waters of the Gulf of Mexico from Mobile, Alabama, almost to Brownsville, Texas. Every so often her crew lowered a net; its contents were spilled on the deck and examined. Instruments tested the salinity, acidity and temperature of the water and brought up samples of the bottom. Bureau of Fisheries observers kept detailed record of it all. Monotonously the dull grind went on and on—402 net hauls, 1,200 miles of bottom dragged."

As a result, a big new industry with millions of dollars turnover has been

created; a specially built fleet of trawlers has been commissioned and many workers have found prosperous employment. On the output side many millions of additional pounds of unrationed food have been won for the people of the United States. The great catches are made in shoal water, up to twenty miles off the shores of Louisiana, and the authorities are convinced that the new source of supply will never be exhausted. The open sea prawns are, generally speaking, of larger proportions than those of enclosed coastal waters; the giants among them are eight and ten inches long—named "Jumbos" in the United States. After migrating to sea it is believed that the prawns may spawn twice in the one year as they reach maturity and maximum size.

Many years before final proof of sea spawning was established for commercial prawns generally, local information was being gathered which was a pointer to the ultimate research. Observant line fishermen were at odd intervals telling of having seen prawns swarming on the surface of the sea, mostly at night, and sometimes in patches of an acre or more. Again, in the early days of steam trawling off the New South Wales coast (year 1921), the writer saw a catch of large King Prawns taken with fish from 35-40 fathoms off the sandy sea floor east of Terrigal. Despite the 2½-inch mesh of the otter trawl net, the prawns were in sufficient numbers to provide a meal for all on board. Similar incidents to this were experienced elsewhere on the trawling grounds. Then, with the gradual appearance of the smaller diesel-engined seine fishing trawlers along the coast, scattered reports came in of sporadic batches of prawns among the netted fish, always from places where the sea floor was sandy. The smaller vessels were more handy for prawn netting than large steam trawlers and a quest in earnest was gradually commenced. This, of course, was encouraged by both scientific and fisheries authorities, and full realization of success has come in the past couple of years. Development quickly advanced from the



Sorting a catch on Trawler "Voyager". Otter boards or "wings" of trawl are clearly seen drawn free of water.

Photo.—J. Hazzard.

stage when experimental hauls were made during the netting of fish. Encouraging catches came from points fifteen miles and more from the coast. Several patterns of small mesh nets were tried, until finally the most suitable was found to be an otter trawl type which is a miniature of that used by steam fishing trawlers. It features two "D"-shaped boards, to which the hauling gear is attached. The angle of the boards and the pressure of water against them during trawling keeps wide the opening of a partially flattened cone-shaped net and bears its heavy ground line close down on to the sea floor.

The first great concentration or "pool" of ocean prawns was discovered off Palm Beach, near the southern headland of Broken Bay. Close on this came the news of a bigger fishery in Stockton Bight, at the mouth of the Hunter River. Then in quick succession pools further north were located in turn off Evan's Head, the Richmond River and the Clarence River. The three latest grounds to be worked are off the Macleay River, Camden Haven and the Hastings River, again all on the coast north of Newcastle. Men on the smaller fishing trawlers have noted the presence of

prawns in spots along the south coast, off Ulladulla and elsewhere. At the present time some serious exploratory work is being carried out there by the prawn fishermen.

The great volume of catches is far in excess of those from the now secondary fishery of the inlets and coastal lakes. Outstanding is a single haul of half a ton of prawns made recently off the Macleay River. Today it is a common sight along the north coast to see fleets of prawn trawlers numbering from six to a total of twenty, all working methodically backwards and forwards over a rich ground. Late in November an aggregate catch from a fleet of eighteen to twenty vessels fishing off Evan's Head weighed approximately eleven tons. Early season prawns caught around October-November are smaller and apparently younger than those netted later in the warmer months. At first the average number to the pound weight is about 35 to 36, but the overall average to date in the new fishery is about 25 to 26 prawns to the pound. The average length of large individuals is six and seven inches.

Whether or not prawns of larger size still will be netted in quantity remains to be proved. Great credit is already due to the fishermen whose initiative and hard prospecting work with converted fishing vessels has brought them a success unaided by subsidized government field research as in the United States of America. In the main the fishery is carried out in daylight, but exploratory hauls are being conducted at night in order to test the possibility of greater supplies. Again, means are being

developed for drawing nets through the water at levels between bottom and surface. This will prove or disprove whether the most mature of the prawn hordes are disposed to rise well above the sea floor. Prompting the experiment is the established fact of great swarms milling about on the surface of the sea.

As in the Gulf of Mexico waters, there seems to be no reason to expect an early diminution of the new ocean fishery. The only thing that could possibly affect it is lack of strict control of the older type of prawn fishing in enclosed waters. Actually this amounts mainly to an exploitation of young and immature prawns, caught before they can migrate seawards to spawn. At the moment the permissible practice is the use of "set pocket nets" in the narrow channels connecting many of our shallow coastal lakes with the sea, but this is disastrous to the fishery.

For many years now we have seen the old fishery wax and wane with changing conditions which have apparently not been fully understood. Co-operation between fishermen and authority is essential to preserve an industry which at present is being fished at both ends.

The main question of the moment appears to be a scaling down of the weight of hauls to a limit where portion of the catch is not crushed and rendered useless. Another factor is supervision of proper and efficient cooking and handling of catches ashore. This department of the prawn industry is still sadly lacking in knowledge, as proved by the too regular condemning of consignments at the various marketing centres.

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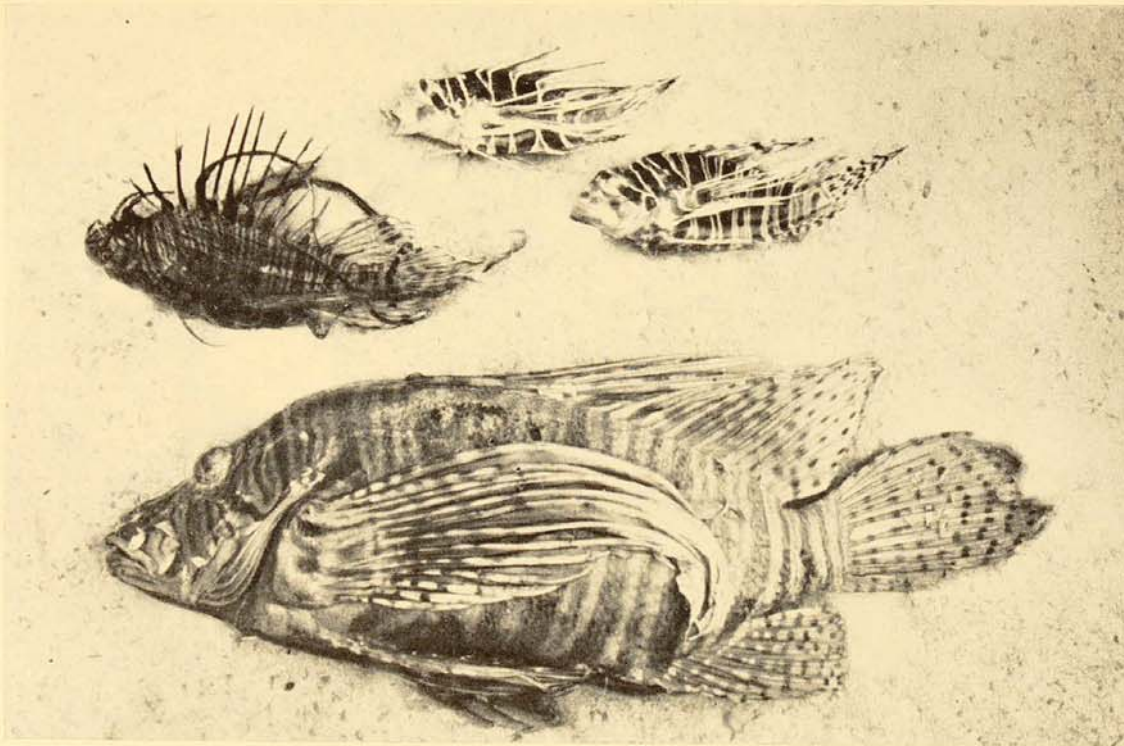


# Butterfly Cod

By G. P. WHITLEY\*

**S**YDNEY people are fortunate in being able to see the living Butterfly Cod by visiting Taronga Park Aquarium where at least one example (and frequently more than one species of these dazzling fishes) may be observed flaunting feathery fins and striped coloration in the tanks of tropical fishes. No words can

for the best-known species, *Pterois volitans*. This and its relatives are variously called Red Fire Fish, Zebrafish, Featherfins, Lionfish, Turkeyfish, Stingfish, Fireworksfish and Chickenfish. Perhaps this article will show that such dramatic terms as Sorcerer Fish, Wizard, Magician, Hypnotist, or even Fan Dancer, might not



Variation in tone and pattern in Butterfly Cods. Top and top right, *Pterois radiatus* found under stones at Rarotonga, Cook Islands. Left, a small, dark-coloured Butterfly Cod, *Pterois volitans*, with very long pectoral fins, from Lord Howe Island. Below, a larger, lighter-toned variety with shorter side fins, from near Mackay, Queensland.

convey any idea of the weird appearance of this slow-moving creature, unique among fishes in having greatly lengthened fin-spines and rays, a somewhat spiny head often adorned with tentacles and tassels, and stripes of cream, yellow, brown or scarlet. It has, moreover, a disdainful, aristocratic attitude that forbids it to flee from human or other likely enemies and renders its capture, in a scoopnet, for example, a very easy matter. It is not a true cod but the name Butterfly Cod, originating some thirty years ago at Lord Howe Island, is in general use

be inappropriate to these remarkable fishes; to the Japanese they are known as Mountain Witches or Raincoat Rockfish. The Arabic name, according to Rüppell, simply means Hell, surely a graphic designation.

In most fishes the membranes of the fins extend to near the tips of the spines and rays, but in the Butterfly Cod the membranes of the pectoral and front dorsal fins are incised, the tips of the spines and rays often extending beyond them to a fantastic extent. The elongate pectoral rays at first deceived naturalists into thinking that the fins were used for flight and old-time engravings show

\* See Frontispiece.

*Pterois volitans* leaving the sea with the gliding action of a flying fish; however, the deeply scalloped fin membranes of the Butterfly Cod are for display purposes only and not for sail. The fish's display includes also a disguise: the Butterfly Cod does not show its eyes, the pupils of which, though large, are difficult to make out because of what camouflage experts call "disruptive coloration". The head as well as the body is conspicuously striped and one stripe passes vertically through the eye, or several stripes converge towards the pupil, masking the eye in *Pterois* in a manner repeated in some other fishes and certain snakes (notably *Lachesis*).

H. B. Cott, in his magnificent book, "Adaptive Coloration in Animals", remarks: "This stripe altogether conceals the pupil, which in well-marked specimens is quite invisible from a distance of a few inches. In the second place, the strong, black, clearly defined mark flattens by contrast the fainter tell-tale half-tones—for instance, where the eye-ball joins the head—and so not only conceals the pupil, but tends to hide the eye as a whole. The aggressive significance of this admirable arrangement can be readily appreciated in view of the fishes' predaceous habits. . . . Not only is

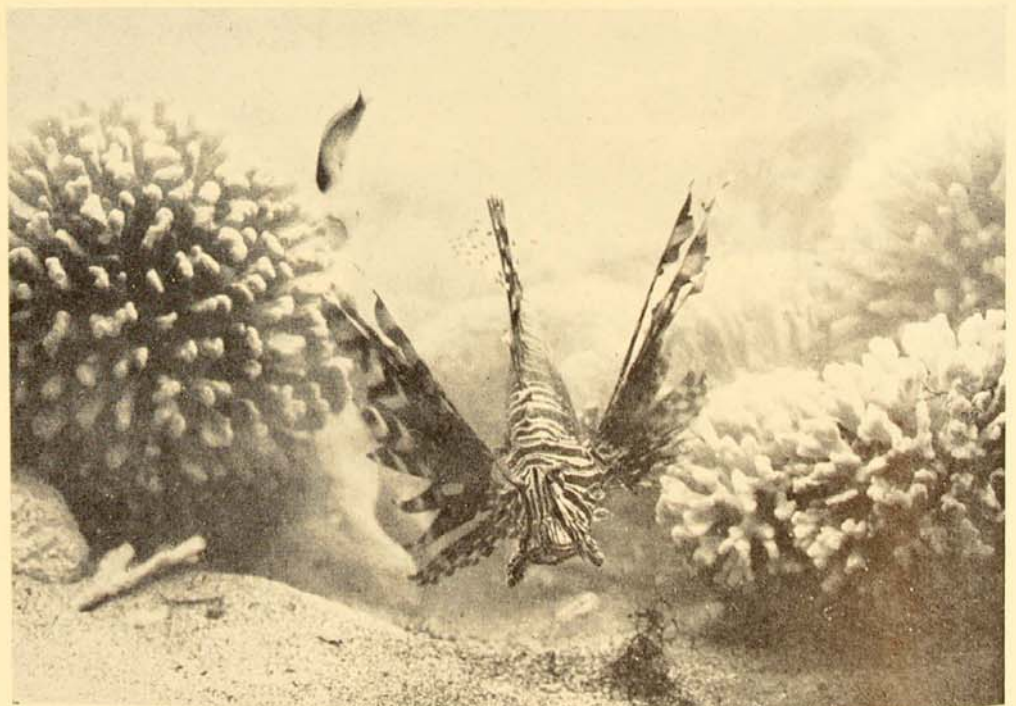
the eye concealed, but also its movements within the orbit are hidden."

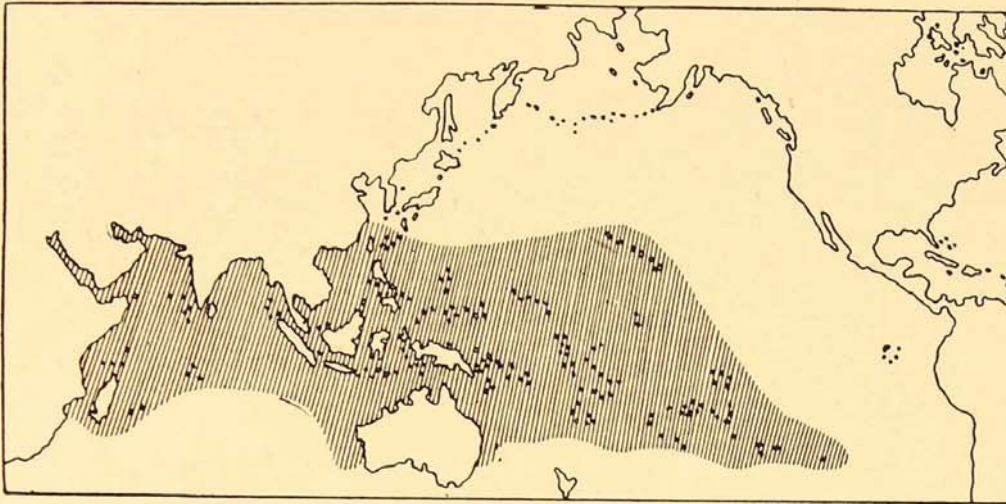
The head, like that of a scorpion fish, is bony and ridged, but the colour pattern is of zebra-like stripes, whilst red tassels of skinny appendages further disguise this grotesque creature until its head resembles a weird mask. There is often a long filament over each eye accentuating the diabolical apparition of this fish. Altogether the flaunting Butterfly Cod, swimming very slowly with finger-like fins extended and waving like a fan-dancer's fans, and with its head and body striped and fins spotted, may not only look like a very strange bundle of weeds to other finny inhabitants of the rocky reefs, but may terrify them like some marine pantomime demon. The dorsal spines are particularly tall and needle-like and are moved slowly like the spines of sea-urchins. These spines are provided with venom and can inflict a painful wound.

The late E. H. Rainford of Bowen, Queensland, experienced the sting of the spines of *Pterois*. He failed to notice it at first because the membrane did not cover the tip of the spines, and his hand came into contact with them. The pain was almost immediate, and developed in the space of about thirty seconds from slight to severe pain, which lasted about

In this "still" from a movie taken at Lord Howe Island, a small damsel fish in distress is swimming in an eccentric fashion as if terrified by the butterfly cod nearby.

Photo.—A. R. McCulloch.





Map showing the approximate distribution, not only of the Butterfly Cods, but of many Indo-Pacific tropical reef fishes.  
After Delsman and Hardenberg.

half an hour. He did not touch the head, and considered he was stung by the dorsal spines only.

There are several records of stings by Butterfly Cod in medical and zoological literature, but the effect is not nearly so bad as in the much-feared Stonefish.

Butterfly Cods are absent from the Atlantic oceans and off the west coasts of the Americas; like numerous tropical reef fishes they are found from eastern Africa across to Polynesia. They like to hide under stones or rocks or deep in grottos and submerged caves, from near the shore down to at least 75 fathoms. Each fish probably stays a long time in one place; no migration has been observed though one may postulate that they may breed in deep water. Some authors state that they frequent reefs near the mouths of rivers, and even ascend rivers, but I have not known them to be found near freshwater in Australia so far.

In spite of everything that has been published about the colours and strange appearance of Butterfly Cods, there is surprisingly little on record concerning the vital facts of their natural history. In the eighteenth century Bloch dissected some but could not find eggs or milt in them and we still do not know what the egg looks like or, indeed, whether *Pterois* lays eggs or is viviparous like some of its ancestral relatives, the scorpion fishes. A juvenile Butterfly Cod, less than three-quarters of an inch long, from the Riu-Kiu Islands, was illustrated by Fowler.<sup>1</sup> The

pectoral rays of this tiny fish were already free and finger-like, the body striped, and the dorsal spines long.

The flesh is said to be good to eat but there is not a great deal of it, most of the fish being devoted to its extraordinary ornamentation. The Japanese eat it raw with saké.

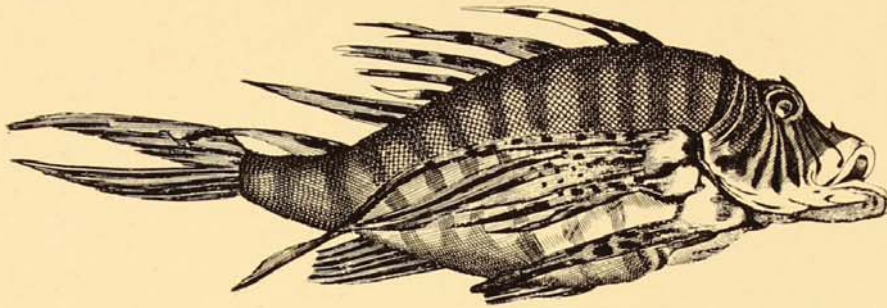
The larger kinds of Butterfly Cod reach 15 inches in length and a weight of about two pounds, but several kinds do not exceed six or seven inches; *P. volitans* reaches twelve inches.

Galls are sometimes caused on the bodies of young Japanese Butterfly Cod by a curious parasitic copepod crustacean, *Ichthyotaces pteroisicola*.

Does the Butterfly Cod or Zebrafish hypnotise its prey? Probably not, yet the suggestion that it might was put forward by Americans<sup>2</sup> observing an Indian Ocean Zebrafish (*Pterois volitans*) in the New York Aquarium. The fish might lie resting for hours, but the introduction of live food into its tank would cause it to wig-wag the fin-rays back and forth in a slow and stately manner, the dorsal spines being moved progressively, like the legs of a centipede, but with extreme deliberation. This would continue until the small fish, introduced as food, approached close enough and then, as C. M. Breder has related: "A single motion and all was over. This act was always done with almost unbelievable rapidity and never with a miss, so far as our observations

<sup>1</sup> Fowler, *Proc. Acad. Nat. Sci. Philad.*, 98, 1946, p. 209, Fig. 29.

<sup>2</sup> C. M. Breder, *Bull. New York Zool. Soc.*, xxxv, 1932, p. 31.



A seventeenth century engraving of a Butterfly Cod, the earliest figure known. From Willughby after Nieuhof.

were concerned at least. The meal would be gulped down and the process repeated until hunger was appeased. Then the beckoning rays would cease to weave to and fro, and quiet in the tank was resumed." After some months in captivity, "It no longer was content to rest on the bottom and wait for dinner to arrive under its own power. Instead it would drift imperceptibly toward a small fish, with the long rays waving . . ." and an extraordinary reversal of behaviour was observed between the Zebrafish and the little freshwater "killie" fish introduced as food. "Instead of moving off as these small killies always do on the approach of a large and strange fish, there seemed to be some mutual attraction between the two . . . the food fish would begin to wave from side to side in a rapid, almost palsied, manner. This would continue until the two were not more than an inch apart, when with a sudden gulp the smaller would start on its journey to become part of the larger. Our men were somewhat disposed to argue that a form of hypnotism was involved, which, of course, is reminiscent of the ever-current snake stories with a similar ending. Be that as it may, it is nevertheless true that the smaller and more agile fish could have eluded the Zebrafish with little effort. . . . The movement toward the approaching Zebrafish, and this curious shaking, can be explained on no reasonable basis that we are aware of at the present time."

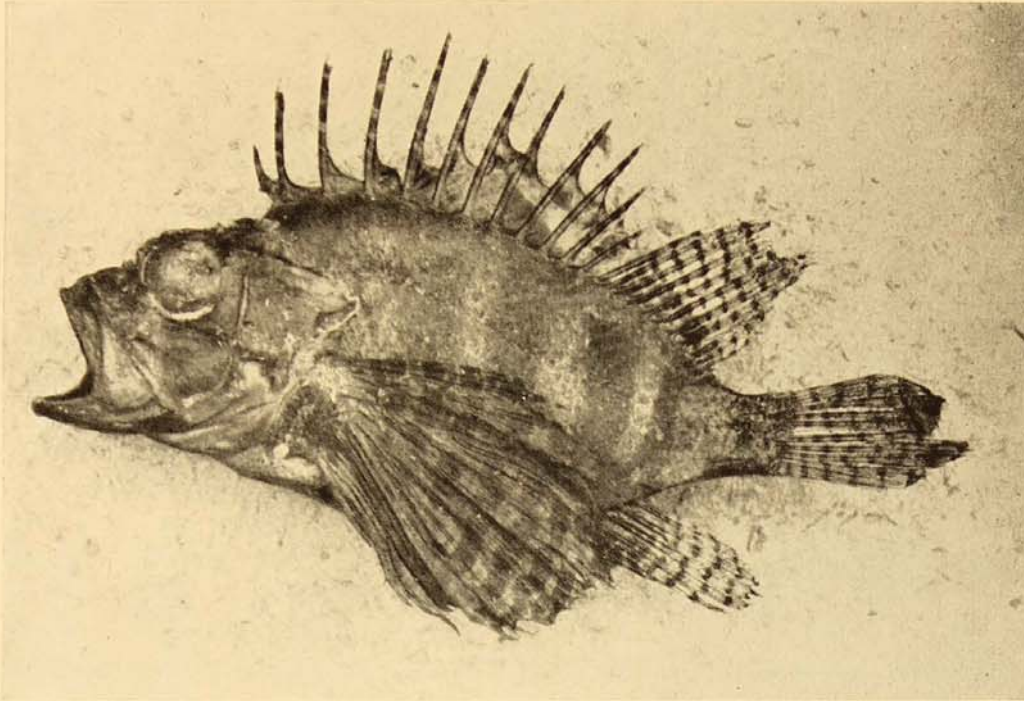
In the early 1920's the late A. R. McCulloch made a cinema film of the live Butterfly Cod in a tank at Lord Howe Island with a few small fishes included for effect. The dignified motions of the Butterfly Cod are the centre of attraction in this film which has been shown to both

adult and schoolchild audiences at The Australian Museum. Yet the frenzied swimming of one of the little "extras" often "stole the show" from the star as the children, in particular, laughed uproariously at its antics. In the light of Breder's observations, it seems McCulloch unwittingly was the first to film this frightening or "hypnotic" effect of the Butterfly Cod upon a small fish. A "still" from his film is reproduced in THE AUSTRALIAN MUSEUM MAGAZINE, Volume II, Number 3, 1924, page 104, the blob towards the top right-hand corner being the excited little fish, which is anything but paralysed by fright. McCulloch's film had a happy ending as all the actors were returned to the coral lagoon, the villain of the piece being appropriately foiled.

Independently, in the Red Sea, Al-Hussaini in 1947 recorded that *Pterois volitans* terrifies its prey and may even swallow prey until it dies of indigestion!

Various types of food were offered to some African *Pterois* which were in transit to the New York Aquarium "and refused until strips of the white of hard-boiled eggs were dropped into the tank. These slowly sank through the water with a wavy motion and effectively deceived the fish. They arrived [in New York] in good condition and are now so tame that they will take any food offered from the attendant's fingers. Incidentally, they have grown, in less than one year, to about four times the size they were when received" (Coates, *Bull. New York Zool. Soc.*, XXXVII, page 147).

The Butterfly Cod is such an exotic fish that it has no long and complicated history as some more homely fishes have. Nieuhof (c. 1610-1672), a Dutch voyager



A Turkey Fish, *Brachirus koenigii*, from Honolulu. In many respects this species is half-way between an ordinary scorpion fish and a butterfly cod, having long dorsal spines and banded body, but the pectoral membranes extend to the fin-tips.

who wrote a curious account of his embassy from the Dutch East India Company to the Emperor of China, seems to have been the first person to have published (in 1682) an account of a Butterfly Cod which was called *Perca amboinensis*, or the Amboina Perch; his engraving was reproduced in Willughby's *Historia Piscium*, 1686, a copy of which is in the library of The Australian Museum.

Butterfly Cods of all kinds belong to the same family as the scorpion fishes or "red rock cods" (*Scorpaenidae*) but are segregated into a sub-family, *Pteroinae*. Genera like *Ranipterois*<sup>3</sup> and *Nemapterois* appear intermediate between the *Scorpaena*-types and the more complicated *Brachirus* and *Pterois*. William Swainson in 1839 made a brave attempt to classify the group by sorting the fishes into sub-genera to fit into a pre-evolutionary quinary system in which he believed; this system in which animals were compared in circles of fives is now outmoded, but his names may yet be revived by ichthyologists. A key to Australian species was supplied by Ogilby in 1918, but some of the characters he used for separating the different kinds do not appear to hold good when tested with a

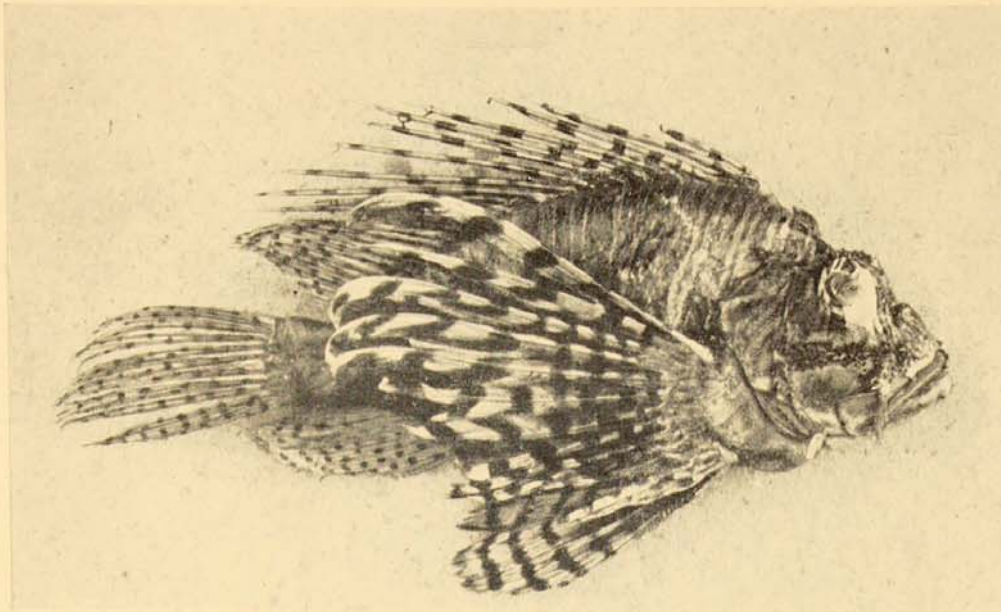
long series of specimens. The *Pteroinae* have been surprisingly neglected by fish students and here is a field for some novel observations.

About 30 nominal species have been named, but some of these are synonyms of others and there are several new varieties to be christened. Altogether there are probably at least a dozen "good" species in the genera *Pterois*, *Brachirus*, *Parapterois* and *Ebosia*, but only six are known from Australia.

The knotty problems raised here are beyond the scope of a popular article, however, and we can only suggest to our readers to send in more specimens so that the species may ultimately be clearly distinguished as the first step to elucidating their life-histories, which may prove as fascinating as any in the realm of fishes.

The best-known species is *Pterois volitans*, usually dark-coloured with very long pectoral fins. Another, the Saw-cheeked Lionfish, *P. (Macrochirus) miles*, has a band of prickles along the cheeks below the eyes and has shorter pectoral fins. The Fan Dancer or Dwarf Lionfish, *Brachirus zebra*, and the little Turkey Fish, *B. koenigii*, have the pectoral membranes not incised and are the most unspecialized members of the group, yet the motions of their rounded pectoral fins are

<sup>3</sup> *Brachypterois* Fowler, 1938, not of Jordan and Seale, 1906; Fowler, 1928.



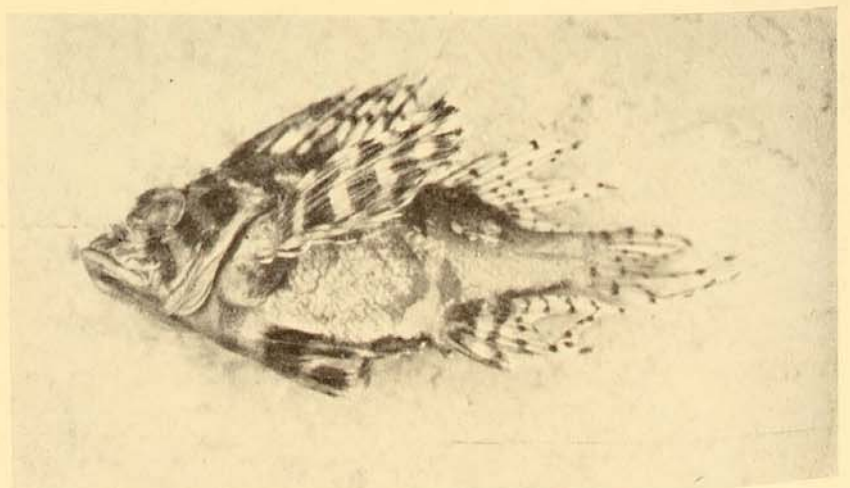
Saw-checked Lionfish, *Pterois miles*, from Lord Howe Island. A stubble of spines running along each cheek gives an "unshaven" appearance and the side fins are shorter than in *P. volitans*.

similar to those of a Butterfly Cod and make us wonder whether the inheritance of traits may be of more importance in evolution than the transmitting of outward physical characteristics. *B. koenigii* is not yet known from Australia. A common South Seas species is *Pterois* (*Pteropterus*) *radiatus*, discovered by Cook's men in Tahiti; I have seen Parkinson's original drawing of it in the British Museum and have collected it under stones in shallow water at Rarotonga in the Cook Islands. Whether there are any colour-differences in the sexes of Butterfly Cod has not yet been determined, but Baron Cuvier suspected that at least in one case "*l'éclat est occasioné par la saison de l'amour*".

In 1932 I noticed in Taronga Park Aquarium a novel species from Hawaii

swimming alongside the more familiar *P. volitans* from Lord Howe Island. The Hawaiian fish had the colour pattern of the face more broken up, whilst the flame-like orange and pink on the otherwise smoky or brown-striped fins glowed and waned like a coal fire. The cheeks were extremely spiny, the tentacles over the eye were small, there were leaf-like tassels below the head, the dorsal spines had broad, orange and brown-banded flag-like membranes quite unlike the spiky spines of *P. volitans*, and the pectoral membranes extended further outward. The general colour was pale pinkish-yellow with broad reddish-brown bands; the posterior dorsal, anal and tail fins were spotted with blackish-brown. Unfortunately the specimen was not preserved. I should have liked to name it after William Swainson.

This young Dwarf Lionfish, *Brachirus zebra*, two inches long, was dredged in Port Jackson in December, 1895. Since then the species has not been noticed from New South Wales.



# Giant Sea Scorpions of the Past

By H. O. FLETCHER

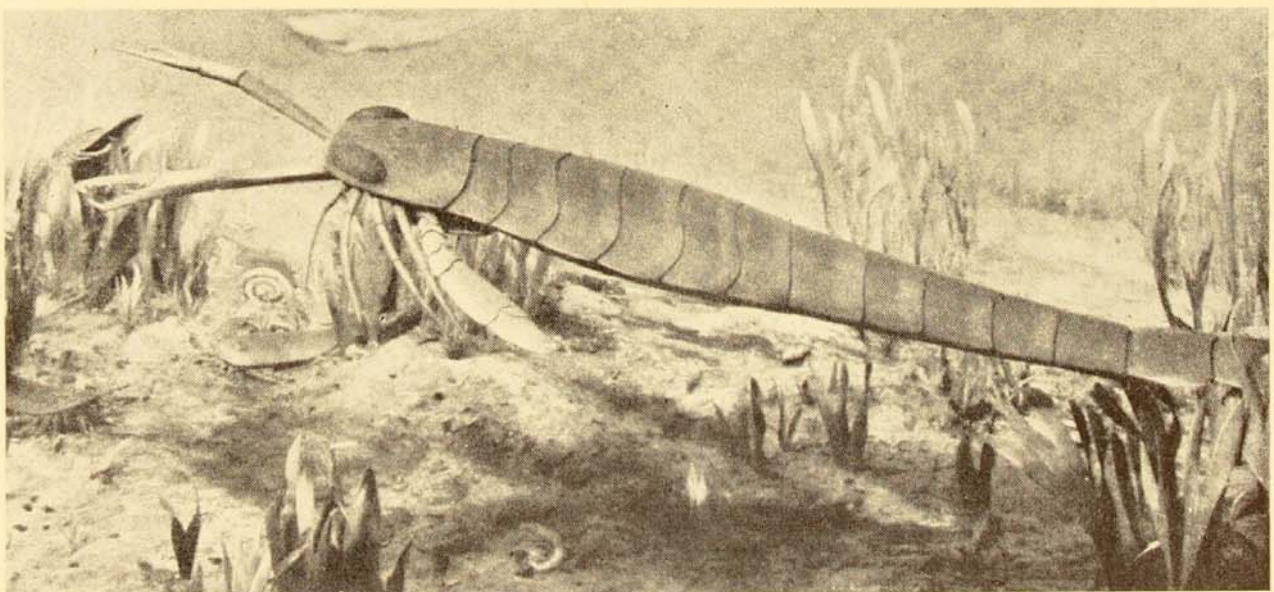
**I**N looking back through the pages of geological history it is found that recognizable life first came into existence during the Cambrian geological period, about 700 million years ago.

The Cambrian fauna is known by a multitude of fossil remains preserved in rocks of that age in all parts of the world. It embraces a great variety of invertebrate animal groups and an abundance of individuals. Many of these animal groups were so well established and possessed such complex structures that it is obvious their starting point was well before Cambrian times and must have been during the preceding Proterozoic Era. Proterozoic rocks were, however, altered to such an extent by world-wide and catastrophic volcanic outbursts that most of the contained primitive fossil life was destroyed.

As geological time rolled slowly on through the Ordovician and Silurian days there was a marked change in the marine invertebrate life which swarmed in the

seas. Certain groups became extinct while others came into existence and flourished. The important but delicate graptolites first appear in the Ordovician and being especially adapted for quick dispersal very soon had a world-wide distribution. Certain species had a short life-range and as the Ordovician rocks are crowded with their fossil remains it is possible to zone the Ordovician sequence of rocks by means of the many genera and species. This has been done in many parts of the world, including New South Wales and particularly Victoria. The greater number of graptolites became extinct at the close of Ordovician times, but a few stragglers persisted until Middle Silurian times.

In studying the early Palaeozoic fossil life it is clearly seen that a definite plan was unfolding and that slowly but surely changes were taking place; changes which as a rule were always an improvement and a bid for expansion of most animals



A restoration of a large eurypterid known as *Pterygotus*, which reached a length of about ten feet during Silurian times.

Photo.—Buffalo Museum of Science.

in effort and function. This was caused mainly by environmental changes necessitating alterations in structure and more important still the ever-increasing complexity and efficiency of the organs necessary for their very existence.

At different times, however, throughout geological history, certain animal groups ran riot in their evolutionary plan and for seemingly no reason attained bizarre characters which nearly always were coincidental with great size. One explanation could be a favourable environment with a plentiful food supply and no natural enemies.

In the Silurian seas we find our first example of this strange feature in an extinct group of sea-scorpions named the Eurypterida. This group in their classification is included in the Class Arachnida of the Arthropoda and its members are closely related to the scorpions, spiders, mites and ticks, and the king-crabs. The sea-scorpions also resemble to a great extent the lobsters and crayfish of the Class Crustacea.

Amongst the extinct Sea-Scorpions of the Silurian is *Pterygotus*, a form which attained a length of at least ten feet and is the largest size of any known arthropod, either living or extinct. These early and primitive sea-scorpions, although different from any living creature, are related to the King Crabs which today inhabit the China Seas and the east coast of North America. They also possess characters which relate them to the scorpions, while certain structures, such as a coat of armour, jointed bodies, and limbs used for crawling, swimming and seizing their prey, are comparable with the lobsters.

It is not known for certain whether the giant *Pterygotus* was a marine creature or one which inhabited fresh-water streams from where they could have been washed out to sea and buried in marine sediments in association with true marine animals. Possibly they were originally marine but later became adapted to brackish or fresh-water conditions.

The front part of *Pterygotus* was entirely covered by a type of shield or

armour, called a carapace, bearing near the centre minute eyes made up of numerous little lenses such as we find in the eyes of many insects. This has been proved by well preserved fossils in which the eye is distinctly visible with even minute characters revealed. There are five pairs of appendages or limbs all attached under or near the head and



Another eurypterid, *Eurypterus*, was characterized by the tail ending in a spine.

After R. Buchsbaum.

surrounding the mouth. With the exception of the first they are toothed at the bases in order to perform the functions of jaws. The last pair are stouter than the others and are expanded to assume the character of swimming paddles. This ancient giant arthropod propelled itself through the water in much the same way as a "Water-beetle" rows itself through the water of a pond.

*Pterygotus*, even though of great bulk and weight, must have been an active creature and in possessing a stream-lined and segmented tapering body was suitably fitted for rapid motion through the





This arthropod named *Prestwichia* is found in late Palaeozoic rocks in Europe and America. It is an ancestor of the arachnid-like group to which the living King-Crab, *Limulus*, belongs.

After R. Buchsbaum.

being placed on the margin of the head-shield, would have suffered damage in the process.

Being related to the King Crabs it is only logical to conclude that *Pterygotus* possessed the same amazing habit of using its limbs for walking on the sea floor, for swimming and also for holding their prey and eating. Broad plates at the base of the limbs are armed with tooth-like edges and by a backward and forward movement could easily act as jaws and teeth. Two of the larger appendages or limbs were fitted with nippers of a strength and size to hold victims of considerable size in a relentless grip.

The members of the Order Eurypterida are first found in the Ordovician of Europe and North America and continue through geological history until the last survivors are known from the Permian. They reached their maximum development in the Silurian when *Pterygotus* attained great size. In Australian rocks the group is known by the fossil remains of *Pterygotus* in the brown mud-stone of the Silurian at South Yarra, near Melbourne. A closely allied but smaller type of Eurypterid identified as the genus *Slimonia* was found in beds of similar age near Melbourne. Formerly *Slimonia* was known only by one species from the Old Red Sandstone of Scotland.

water. The well-developed tail flap served no doubt as a powerful propeller as well as a rudder directing the creature's course. In a closely allied sea-scorpion known as *Eurypterus* the tail is long and sword-like and assisted them to burrow into the sand in much the same way as the present-day King Crabs. It is hardly likely, however, that *Pterygotus*, with its giant body, had the same habit of burrowing in the sand. Excavating a sufficiently large hole for it would have been a great task, most likely impossible, for the eyes,

## Popular Science Lectures

The following popular science lectures will be delivered at the Australian Museum during 1950, at 8 p.m. on the following dates. Admission is free.

|       |    |      |  |  |
|-------|----|------|--|--|
| May   | 11 | .... | "Corals and Birds" .. .. .                                       | J. A. Keast  |
| May   | 25 | .... | "Who are the Australian Aborigines?" .. .. .                     | N. W. G. McIntosh, M.B., B.S.                      |
| June  | 8  | .... | "The Wild West of Tasmania" .. .. .                              | R. O. Chalmers, A.S.T.C.                           |
| June  | 22 | .... | "Australia and the Great Plagues" .. .. .                        | Prof. E. Ford, M.D., D.P.H.,<br>F.R.A.C.P., F.Z.S. |
| July  | 6  | .... | "Insect Musicians" .. .. .                                       | K. C. McKeown, F.R.Z.S.                            |
| July  | 27 | .... | "The Peaceful Uses of Atomic Science" .. .. .                    | D. P. Mellor, D.Sc.                                |
| Aug.  | 10 | .... | "Resources and their Possible Development in New Guinea" .. .. . | J. Andrews, B.A., Ph.D.                            |
| Aug.  | 24 | .... | "Exploring the Whitsunday Islands" .. .. .                       | F. A. McNeill                                      |
| Sept. | 7  | .... | "The Science of the Sea" .. .. .                                 | D. J. Rochford, M.Sc.                              |
| Sept. | 21 | .... | "With a Science Congress in New Zealand" .. .. .                 | Joyce Allan, F.R.Z.S.                              |
| Oct.  | 5  | .... | "The Story of Australia's Coinage" .. .. .                       | G. C. Heyde, A.S.T.C., F.R.N.S.                    |
| Oct.  | 26 | .... | "The World of Serpents" .. .. .                                  | J. R. Kinghorn, C.M.Z.S.                           |

# Land Shells of Australia

By JOYCE ALLAN

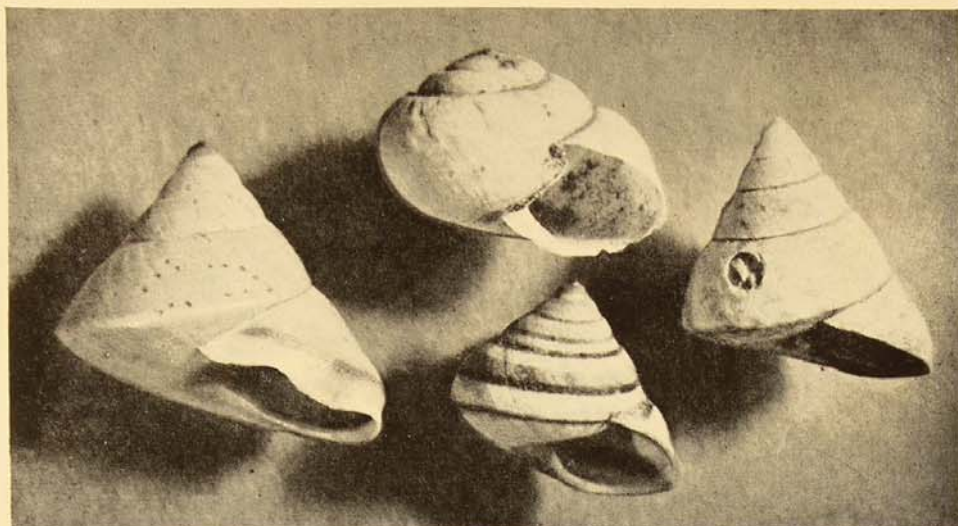
## PART I

AUSTRALIA has in its coastal waters so many different kinds of beautiful shells that many people are quite unfamiliar with the attractive land shells which are not confined, as many think, to the common garden snail introduced from Europe and other similar types found in cultivated gardens. Certainly our land shells have not the brilliant yellow, green or red colouring and striking patterns of those from the Cuban and Philippine Islands. They are generally of a somewhat dark brown tint relieved with lighter banding and do not reach the large size, five to eight inches, of some of the African and American species. Nevertheless, they are attractively shaped, unique in their distribution and specific rank, and, northern Australian ones in particular, of quite appreciable size.

Although many land shells have been recorded from Australia, research upon the group has not been very extensive; there still remains a quantity of material awaiting critical examination before work on their physiological, ecological or other aspect can be undertaken. Even more than with sea-living shells, long series of specimens are necessary for systematic research, but collecting land shells is not so simple a task as gathering sea shells along a beach or rocky reef where frequently a retreating tide is all one needs to obtain an adequate number of a particular type. Periodically, Australia is subject to hot dry spells, and at such times land snails are prone to seek protection in most obscure places, whether they inhabit desert, plain, scrub or forest country. Their appearance in the open is usually coincident with excessive moisture, such as showers of rain or dew, which may bring them out in numbers as we frequently notice with garden

snails. Under adverse conditions they seek the protection of their shells, burying themselves in locations where the little moisture they possess will be retained, seal the entrance securely, generally by a mucus film, the epiphragm, for land snails must have moisture in order to survive.

The environments in which they live in Australia vary considerably and are productive of very diverse shell structures. The shells range from very minute forms to a maximum of some inches in length. These molluscs inhabit forest, scrub, plain, bush or desert country; from low-lying lands to high mountain ranges. The majority live on and about the ground; minute forms such as Endodonts, Zonitids and Pupoids, ranging in size from a pin's head to less than one inch, inhabit damp places amongst soil and bush debris, or crevices of dead wood, and may be found by sieving damp soil from round the base of trees. There is quite a unique, though small, section which lives on trees; these are chiefly confined to northern and southern Queensland, their tree-climbing habits, delicate elevated shape, which allies them to some Solomon Island shells, and pattern of red and black spiral lines, distinguish them from other land snails. These tree-living shells are less than one inch high, and the following are a few of the conspicuous species: Macgillivray's Tree Snail (*Rhynchotrochus macgillivrayi*), which has a shiny, smooth, flesh-coloured, minutely black-spotted shell with a bluish-black apex, it inhabits trees on the mainland of north Queensland and adjacent islands; Bidwill's Tree Snail (*Rhynchotrochus bidwilli*) has a pinkish-white shell with small brownish-red mottlings spirally arranged, a reddish-purple aperture with



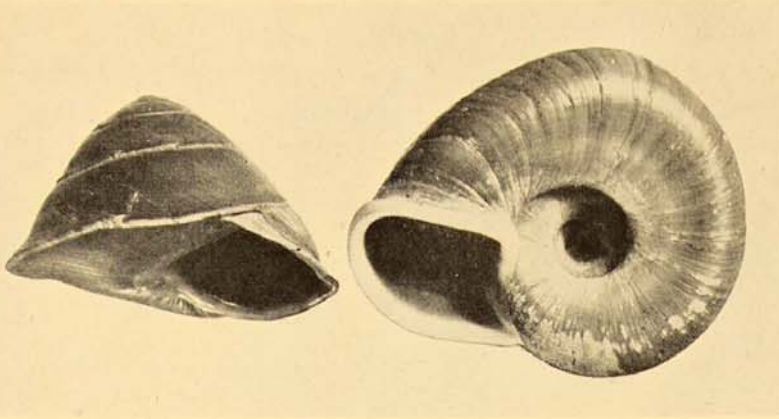
Land shells with strongly contrasting habitats. The three bottom ones are small Queensland tree-climbing snails, MacGillivray's Tree Snail, Black Banded Tree Snail and on the extreme right Bidwill's Tree Snail. The single globular shell on top, the Nullabor Melon Shell, is a typical little desert-living snail from the Nullabor Plain.

black margin, it climbs smooth stemmed trees in brush country of southern Queensland and northern New South Wales, to a height of more than thirty feet; and the Black Banded Tree Snail (*Posorites fucata*), which is a southern Queensland coastal species, with a rather solid, glossy shell having a few spiral black bands and a faint reddish one above each of the central bands. These little snails, although so small in contrast to the giant tree snails of Africa, are quite capable of climbing to the tops of extremely high trees.

An ecological study of Australian land shells, as individual species or a complete group, soon shows that they are very limited in their distribution, far more so than marine species round our coasts. Land shells, generally, are easily checked by natural land barriers, e.g., mountains, valleys, river systems, and so on; marine shells, necessarily, are not so restricted and may be transported long distances by currents or other agencies. On even a small island there may be several species of snails restricted to very limited areas. We do not find individual species common to a number of islands to the same extent or as frequently, as we do some species of marine shells, especially those of coral reefs which may range right through the Indo-Pacific reaching in some cases as far south as New South Wales and as far north as Japan (e.g., Money and Serpent's Head cowries, Red-mouthed Stromb

shells). Native snails are often limited in their range to a small section of an island or continent—in Australia this might be an area such as the south-west corner, the northern New South Wales—southern Queensland coastal belt, the northern part of Tasmania, and so on—and these would not occur, as a general rule, elsewhere in, and certainly not beyond, Australia. This does not apply to species introduced by human agency, such as the common garden snail and other similar snails, which have acclimatized themselves in most places where they have been introduced. Few Australian land snails have a range extending over even one-third of the continent; practically all are much more restricted, yet amongst the marine shell (molluscan) fauna a number of species range along half, or even more, of the coastline.

From northern Australia to about the middle of the New South Wales coastal regions we find the largest land shells, the greatest being the Giant Panda (*Hedleyella falconeri*), reaching three to four inches in length. It is like a large garden snail, and lives in southern Queensland and New South Wales as far south as the Hunter River. Bush creatures eat it and empty shells are often found along river banks. This is also known as the Australian Native Snail and Hedley's Snail; it lays chalky white eggs about one-quarter of an inch long. Three smaller Panda snails are the Pygmy Panda



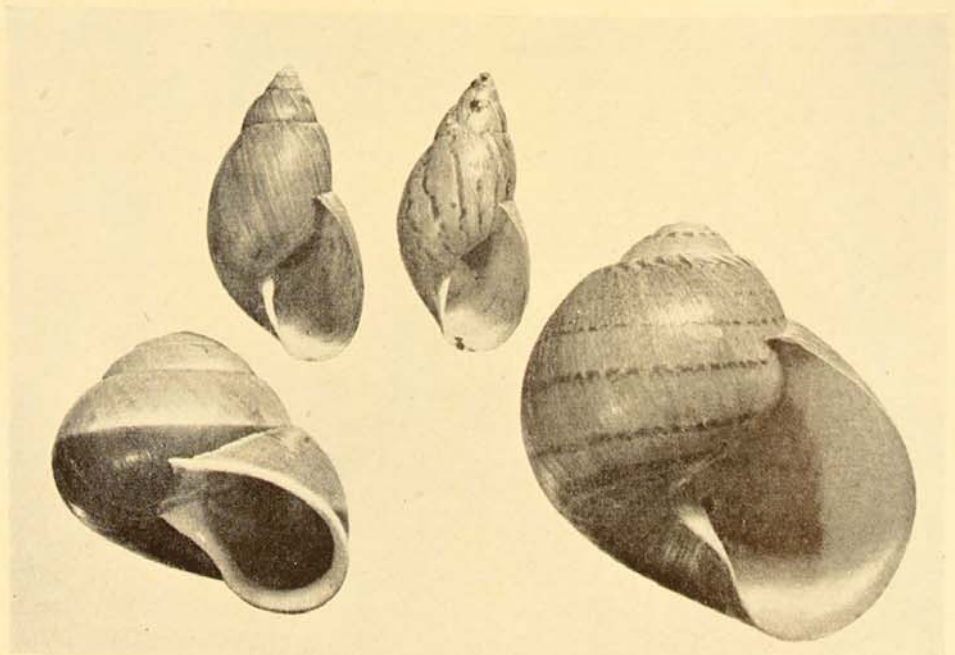
Two large and unique Australian coastal land shells. The almost triangular-shaped chocolate-coloured Richmond Snail, inhabiting river regions of northern New South Wales, and Hay's Flat-coiled Snail. The latter attains two inches in diameter, is solid, very flat, and lives in southern Queensland, but various forms occur further north and south.

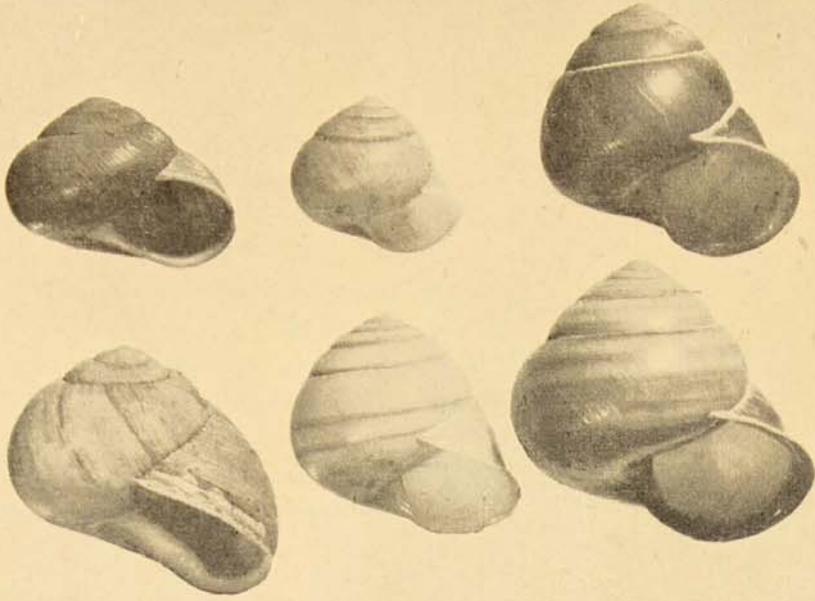
(*Pygmipanda atomata*), having a pale yellow shell with interrupted streaks, spots and zigzag markings, and a lime-yellow animal which inhabits the coastal regions of New South Wales, more particularly the open forests such as those around the Hunter and Manning Rivers; Kershaw's Panda (*Pygmipanda kershawi*), a Victorian and southern New South Wales species; and Larrey's Panda (*Pygmipanda larreyi*), a thin northern New South Wales shell about one and a half inches long, cream with red-brown marks and blotches. Panda shells form the family Hedleyellidae and are amongst our most unique land shells. Other unique shells with a northern range are the almost triangular shaped, chocolate-brown Richmond Snail (*Annakelea richmondiana*), and Hay's Flat-coiled Snail

(*Pedinogyra hayii*), with a solid circular, flattened and greenish-brown shell, banded with dark brown and yellow. The latter reaches about two inches in diameter and lives in southern Queensland coastal regions; various forms of it, such as *allani* in the Port Curtis area, and *nanna* in the Rockhampton region, appear further north. The New South Wales species, *Pedinogyra notabilis*, is fairly common round the Richmond and Clarence Rivers and also ranges into southern Queensland; it is slightly smaller than Hay's Flat-coiled snail. These Flat-coiled snails belong to the family Pedinogyridae.

In Queensland a series of very handsome snails, resembling the typical snail-like type *Helix*, to which genus the garden snail, *Helix aspersa* belongs, form the

The bottom figures illustrate the two largest Australian land snails, the Two-part Shell, nearly three inches in diameter, the upper part decidedly lighter than the lower chocolate-coloured part, and (right) the Giant Panda, a well known New South Wales and Southern Queensland coastal shell. Above are two smaller Panda Shells, (left) Kershaw's Panda from southern Australia, and (right) the Pygmy Panda which inhabits New South Wales.

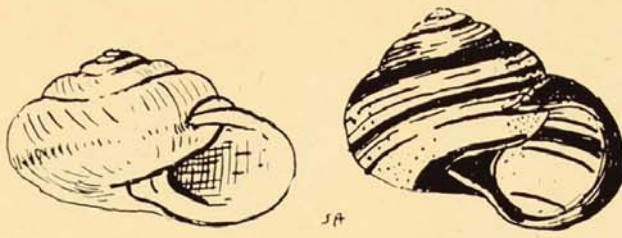




Some familiar land shells of eastern Australia. In the top row are (left to right) the *Gulosa* Snail from the Illawarra district, a somewhat similar but smaller honey-coloured shell (the *Jervis* Snail) characterized by a pink tinge between the whorls and on the base, *Bloomfield's* Snail, a solid almost purplish-brown shell, but lighter coloured above. Bottom figures illustrate the large northern Australian *Melon* Snail, *Cox's* Snail, a mid-Queensland solid whitish shell with red lines and the very handsome *Fraser's* Snail, large and globular reddish-yellow with dark bands and which inhabits Queensland and New South Wales.

family Hadridae. The Two-part shell, *Hadra bipartita*, a snail occurring from Cape York to Cooktown, has a shell nearly three inches in diameter, the upper part of which is light coloured and the lower part very dark. This is the largest of the family, the others ranging between one and a half to two inches. Most of these are coloured brownish with light or dark transverse bands encircling the shells. A few of these are *Fraser's* Snail (*Sphaerospira fraseri*), a reddish-yellow, globular shell with numerous spiral lines and bands of dark chestnut, inhabiting northern New South Wales and southern Queensland; *Cox's* Snail (*Benthosites coxi*) from the mid-Queensland area has a solid white shell with fine red spiral lines, often hidden under a pale waxy yellow epidermis; *Bloomfield's* Snail (*Benthosites bloomfieldi*), a shell with body whorl deep purplish-brown and upper whorls much lighter; and *Yule's* Snail (*Varohadra yulei*), another mid-Queensland coastal snail, whose yellowish shell is ornamented with brownish-black bands of variable width. *Ince's* Snail (*Varohadra incei*) of southern Queensland is somewhat similar but lacks the dark band round the umbilical region of the shell and on the outer edge.

A very common, pale honey-coloured shell which ranges along the New South Wales coastal regions, at times appearing quite close to the rocky shore and tidal flat swamps, belongs to the genus *Meridolum*, the common species of which is *jervisensis*, but it varies in size and colouring in different areas; a subspecies *corneovirens*, which is generally reddish-brown or pale olive-green, occurs commonly around Mulgoa. Two forms, *morosum* and *gilberti*, occur in southern Queensland. These snails bury themselves quite deeply about the roots of bushes where they will remain for extensive periods. Shells are faintly tipped with reddish colours between the whorls, around the umbilical area, and towards the edge of the aperture. The *Gulosa* Snail (*Meridolum gulosa*) is larger and chestnut-coloured; it favours the Illawarra district of New South Wales as a habitat. The handsome *Melon* Snails are represented in Queensland by a globular red-yellow shell with a thin greenish-brown epidermis (*Xanthomelon pachystylum*), and in Northern Territory by a slightly smaller form, *durvillii*, which also ranges into Queensland. In the family of *Melon* Snails (*Xanthomelonidae*) are also other species including a number of small



On the left is a Western Australian snail, Woodward's Rhagada, a representative of a very restricted group, the Rhagoid snails. This is sometimes found on trees in limestone country. The right figure illustrates Yule's Snail, a mid-Queensland coastal shell with blackish bands on the yellow shell.

desert-living ones, of which the Nullabor Melon Snail (*Sinumelon nullaborensis*) from the Nullabor Plains is an example.

Queensland land shells approach most

closely to those of New Guinea in their appearance. In Western Australia, the family Hadridae is replaced by a very restricted group, the family Rhagadidae, known as Rhagoid snails, which seem more closely related to East Indian snails than to those from other parts of Australia. They frequent lime country, and are mostly of a somewhat chalky nature, generally with light-coloured bands; some live on trees, others on the ground, under logs, stones or in rocks. Woodward's Rhagada Snail (*Parrhagada woodwardi*) has been found frequently on trees near the Limestone Caves, north end of Napier Range. The Rhagadas only reach about one inch in size.

## William John Dakin, D.Sc., F.Z.S.

By the death on 2 April, 1950, of Professor W. J. Dakin, Australian science suffered a severe loss and the Australian Museum was deprived of a valued Trustee. During his twenty years as Professor of Zoology in Sydney University he materially increased not only the prestige of his department, but also of the University as a whole. Unfortunately the years in which he hoped to produce his best work, unhampered by administrative and teaching worries, brought little but the most acute physical distress. In spite of this he laboured tirelessly, only ceasing at times when his painful illness forced him to take to his bed. He had an unusually distinguished career, his principal interest being marine biology, and of the sixty or so papers he published the greater number were based on this field. They covered a wide range of topics—taxonomic, anatomical, hydrographical, and physiological. Whilst occupying the Sydney Chair he was interested mainly in the plankton of the New South Wales coast—indeed he commenced original researches into this within a fortnight of his arrival in Sydney.

Apart from his association with the Australian Museum he was a member of the Taronga Park Zoological Trust, past President

of the Royal Zoological Society of New South Wales, also of the Linnean Society of New South Wales, was an indefatigable campaigner for the wider teaching of biology in the schools, and enjoyed unrivalled popularity as a broadcaster on scientific subjects with a topical appeal. During the latter part of the last war he was Technical Director of Camouflage for the Commonwealth of Australia, controlling an organization which trained and provided camoufleurs and advised service chiefs on their particular problems relating to the concealment of military objectives.

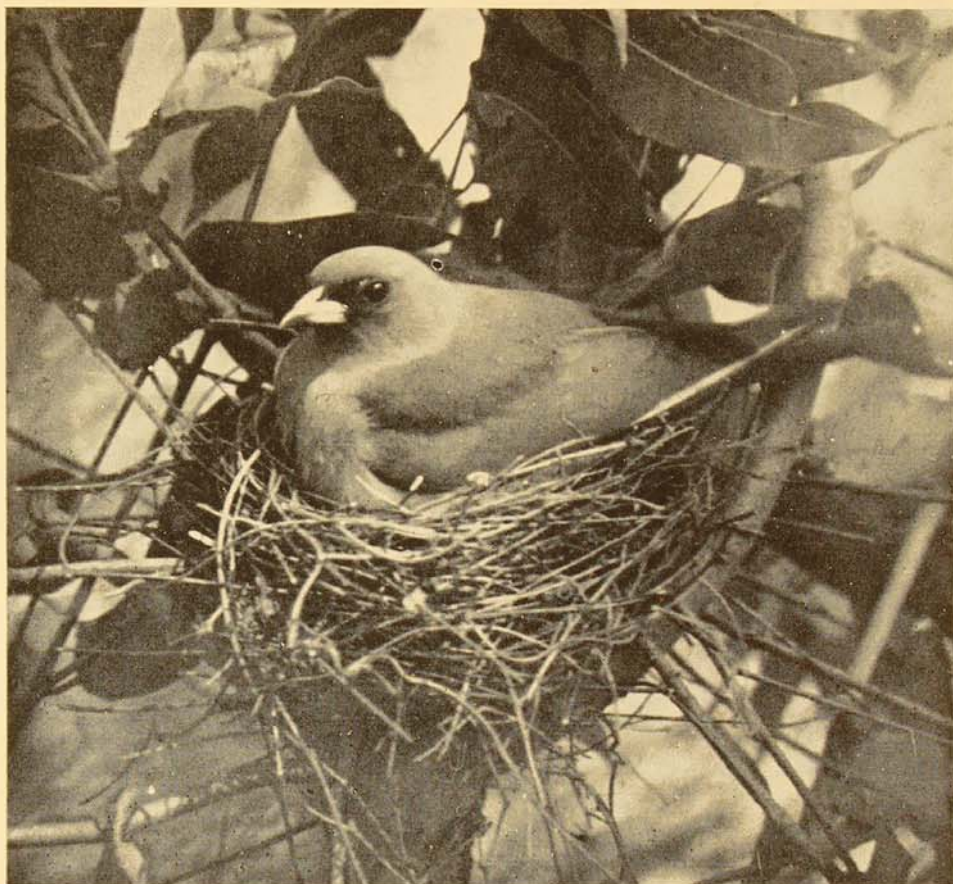
Apart from research papers, he also published two textbooks on zoology, a small work on the principles of camouflage, a popular book on whaling, and numerous articles on natural history subjects. He did not live to see his two final works appear in print. One of these is an important book on the coastal fauna of eastern Australia, and the other a small book on the Barrier Reef, both of which are in press. It is gratifying that he knew that his work had not gone unrecognized—indeed he had ample evidence of this last year when he was awarded the Mueller Medal for distinguished service to Australian science.

A. N. COLEFAX.

# The Wood-Swallows

By J. A. KEAST

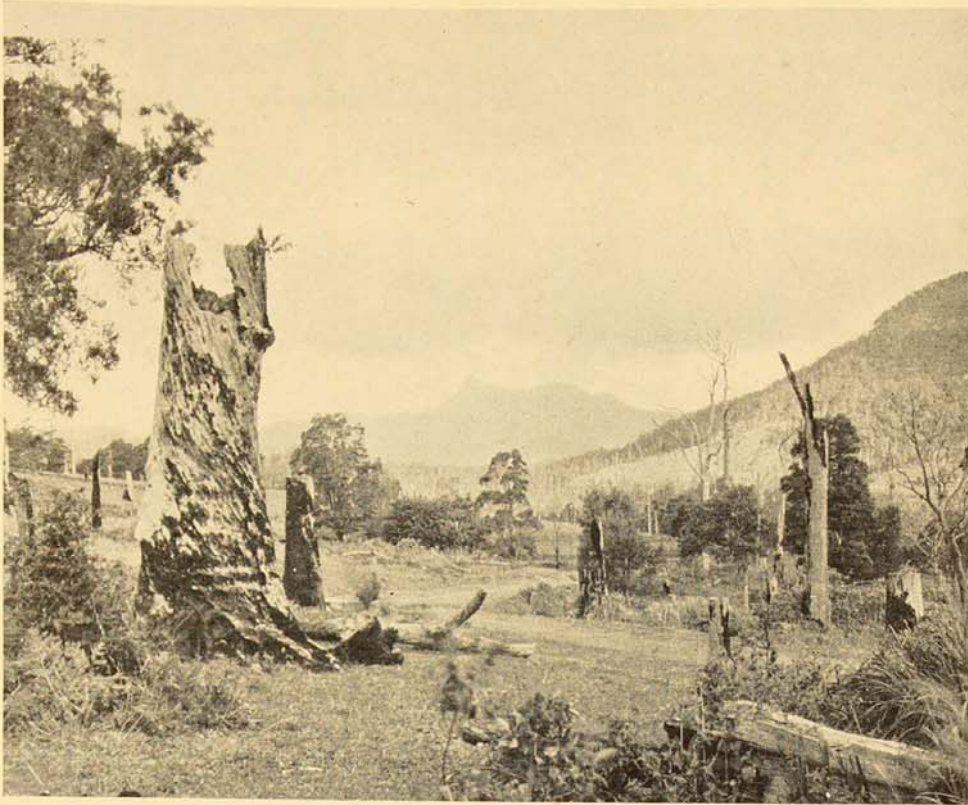
**Dusky Wood-swallow  
nesting. Wahroonga,  
New South Wales.**  
Photo.—J. A. Keast.



**W**OOD-SWALLOWS are one of our most useful groups of birds. Extremely insectivorous they are a considerable help to the agriculturist. The resemblance suggested by the name is superficial for the relations of the family Artamidae, as it is known scientifically, are unknown. Wood-swallows are plump-bodied, have tapering wings, and their flight is a graceful fluttering and gliding. They are company loving, friendly and most are nomadic. Of a dozen or so species six occur in Australia, another is confined to the mountains of New Guinea and there is an exceedingly handsome species in the Bismarcks. It is thought that the group originated in Australia, certainly it is a stronghold of the wood-swallows as evidenced by the millions which follow the grasshopper plagues in the interior.

Names such as Skimmers, Bluies, Summerbirds, applied particularly to the common White-browed and Masked Wood-swallows, evidence the popularity of these alert and sprightly birds. Naturalist and farmer alike look forward to the return of the flocks in the spring, for in the ensuing weeks the air will resound with their chattering and the countryside be alive with their dainty wheeling forms.

Probably the best-known of the group is the Dusky Wood-swallow (*Artamus cyanopterus*), a handsome chocolate-brown species with a white edge to the wing and tail and a pale bill. It has a wide range throughout Australia, reaches southern New Guinea, and is a familiar inhabitant of the bushlands about the capital cities. It may be seen near Sydney at almost any time of the year although much reduced in numbers during the autumn and winter.



The dairying country of the Upper Tweed River, New South Wales, between Chillingham and Numinbah is a favourite haunt of the Dusky Wood-swallow. Mount Warning is in the distance.

Photo.—J. A. Keast.

My acquaintance with the Duskie was made in an area of lightly timbered forest at Wahroonga some years ago, a place, alas, fast being cleared for building. Every September the birds would appear and with Yellow-tufted Honeyeaters, Red-browed Finches and Painted Quail for company, commence to breed.

The nest, a cup shaped of fine sticks and rootlets, they would wedge into the flaking bark of a tree trunk or into a sapling fork. A commanding position was always chosen and though the sitting bird could consequently see us boys some distance away, she would cling to the nest until the climber advanced to within a few feet, then a flick of the wings would take her into a long sweeping glide and an adjoining tree. Here her scolding note would bring the male hurrying to the scene and together they would flutter about the intruders, harrying us with all the vigour they could muster. The attack was, of course, token only, neither size nor strength of bill permitting them to do more.

November would see a ceaseless hunt for insects in progress—in the air, tree trunks and foliage all being scanned in the search for food for the impatient trio of nestlings. It is at this time that the nests can

be located easily, for so occupied are the adults that scant attention is paid to a wandering naturalist. Enemies were few, rarely did a hawk or goanna appear, but occasionally the rascally Kookaburra capitalized on the state of affairs to steal youngsters. Once the young left the nest the parents led them down to where the sapling trunks and stumps were fire-charred and into which the colour of the dark-plumaged young merged. From here the youngsters made their practice flights and gradually learned to emulate the parents in hunting and in the air. The wood-swallows would remain until late summer when they disappeared—but just where we never found out.

In contrast to the regular behaviour of the Dusky Wood Swallow the White-browed and Masked species (*A. superciliosus* and *A. personatus*) seem decidedly capricious. These birds undertake great nomadic movements—flocks of hundreds of individuals suddenly appearing in areas from which they have been absent for years, staying a few months, and then disappearing. Details of these movements are unknown but doubtless they extend over great areas of the State. A curious feature of these parties is that they are usually made up of members of



**Masked Wood-swallow at nest.**

Photo.—J. A. Keast.



both species with the White-brows preponderating in numbers.

To witness the arrival of the "Blue Martins" is a spectacular sight. Some years ago I was at Tahmoor, near Picton, New South Wales, early in October. The day was dull, wet, and there was the sting of a cold winter in it. Even the birds seemed depressed and only an occasional call-note could be heard from amongst the dripping foliage. But bird-students never like being "confined to barracks", and with the cessation of rain in the mid afternoon, we tramped out again. Results were disappointing until, at about 4.30 p.m., we suddenly became aware of an excited twittering high in the air above. We glanced up, just visible through the treetops were a dozen wheeling forms, mere silhouettes as yet but there was no mistaking that flight and the characteristic call-notes. The wood-swallows had arrived! More and more appeared until perhaps two hundred could be seen at once, circling round and round, cutting their way through the gnats and termites that had emerged after the rain. It was not until it was almost dark that the wood-swallows descended into the trees

and we were unable to view them closely that night. But we returned to our hut elated, for it was the first time, and I have not seen it since, that we saw the actual arrival of these birds.

The forest had taken on a new appearance next morning. It was a fine day and the wood-swallows were everywhere, chattering and arguing as they fluttered and glided through the trees. But they were still restless and by eight o'clock the White-browed Wood-swallows (for there were none of the Masked species in this flock) were again high in the air. The ownership of the forest had returned to the Fuscous Honeyeaters, Scissors Grinders and Leatherheads.

Unfortunately we had to leave for Sydney that night. The next week-end we returned but to our disappointment found that all the Wood-swallows had left the vicinity. Only a few Duskie (which had been there for more than a month and were egg-incubating) remained as representatives of the family. The following Wednesday we received a letter telling us that the White-brows (and a few of the Masked species) had returned again. And this time they settled down to nest.



Nest and eggs of the Masked Wood-swallow,  
Doonside, near Sydney.

Photo.—K. A. Hindwood.

We returned early in November to find the scraggly cup-shaped nests everywhere—a timbered paddock of little more than an acre in area held twenty nests. They were propped in the lower branches and forks of the trees, pushed into tree-stumps, even hollow fence posts had their quota. Most nests held well-incubated eggs and a few small downy young. A couple of pairs, apparently more lacedaisical than the rest, were still nest-building. To pry into the domestic affairs of the colony and do a little photography was a delightful experience, but our enthusiasm was not shared by the birds who were too impatient and anxious to be on with domestic duties.

By the end of December only a handful of birds remained at Tahmoor and in the ensuing weeks these, too, left the locality. A few returned the following October but they were again common the following spring. It is now some years since I was at Tahmoor, but doubtless the birds still occur there, arriving in October and remaining a few months to breed, that is if the whim takes them to that part of the world.

Favourite haunts of the White-brows and Masked Wood-swallows when they “come to town”—i.e., to Sydney—are the

forests of tea-tree and ironbark about Doonside and St. Mary’s. In recent years their occurrences near Sydney are as follows:

- 1928 (October): Doonside. Nested but no record of numbers.
- 1931 (November): Doonside. Nested but no record of numbers.
- 1935 (Doonside): Rare.
- 1937 (November): Doonside. Rare, only a few being seen.
- 1940 (September 29): Menangle Park. About 30 birds flying, calling a lot, and apparently migrants on the move. (October): Plumpton. Large numbers and nesting. (November): Common at Kellyville, North Rocks and Castle Hill.
- 1943 (October 31): Mulgrave. Flock of several dozen flying. Richmond. Nests found, birds fairly common.
- 1944 (October): Doonside. Common and nesting.
- 1945 (October–November): Doonside. Common and nesting.
- 1948 (October): Doonside. Numbers about, only recently arrived.

These records are a composite from the field observations of the ornithologists K. A. Hindwood, N. W. Chaffer, M. S. R. Sharland and others. The time of observation does not, of course, correspond with the time of arrival of the birds. The greatest visitation was in 1940 when large numbers of birds reached as far east as Wahroonga, Pymble, Hunter’s Hill and Epping. Two points are worthy of note in regard to these observations, first that they refer to the White-browed Wood Swallow, but that when that species is common there are certain to be also a number of Masked Wood-swallows present. Secondly, that, typically, October seems to be the month of arrival, although it is apparent that it may vary by weeks from year to year.

In order to ascertain whether or not these visitations had a meteorological basis, I forwarded this data to the Director of the Meteorological Bureau in Sydney. His reply contained rainfall details for various parts of the State, from the analysis of which he concluded:

It appears that some correlation exists between the rainfalls in the West, North West and Central districts, and the movements to the coast. In the southern parts of the State,

rainfall has appeared more nearly adequate on most of the above occasions.

Perhaps, then, the behaviour of these two wood-swallows is not so whimsical after all.<sup>1</sup>

Of the other Australian wood-swallows I have had little experience. The Black-faced and Little Wood-swallows (*A. melanops* and *A. minor*) are purely inland birds. The White-breasted Wood-swallow (*A. leucorhynchus*), which has a wide extra-Australian range extending from the Malay Archipelago to the Philippines, New Guinea, Fiji and the New Hebrides. In Australia it is an inland bird in the southern parts but occurs on the coast in the northern parts. I first met with the species at Townsville where their favourite habit is to perch on the telegraph wires and from there make sorties on passing insects. Its dark head and back, white rump and breast make it one of the most lovely of this very attractive group. The species is common in the dry eucalypt-covered hillsides of Port Moresby.

<sup>1</sup>These two wood-swallows appeared about Sydney in large numbers in October, 1895, 1896, 1897, corresponding with periods of drought inland (see North, A. J., "Handbook Aust. Ass. Adv. Sci.", 1898, p. 88).

Similar in colour-pattern but much larger and with more intense colours is *A. maximus*, the mountain species of New Guinea.

A third pied wood-swallow, *A. insignis*, occurs in New Britain and New Ireland. This is perhaps the most striking of all, for it has a white back, wings and tail, the latter edged with black (see illustration). It is closely related to the Celebes Wood-swallow. *A. insignis*, too, is apparently nomadic, for in 1944-45 when the Australian troops cleared a patch of jungle at Jacquinot Bay, New Britain, for an airstrip, a party of these birds appeared and took up residence, hawking the air above a patch of felled trees and overgrown plantation. No birds were seen from the time of our arrival in November, 1944, but by March each jungle clearing (and the only natural clearings are the native villages and garden sites) had its population. A steady increase in numbers occurred in the following months, but of course never became large by wood-swallow standards. The birds were still present when I left the Bay in August and doubtless would soon have bred.

## A Molluscan "Moby Dick"

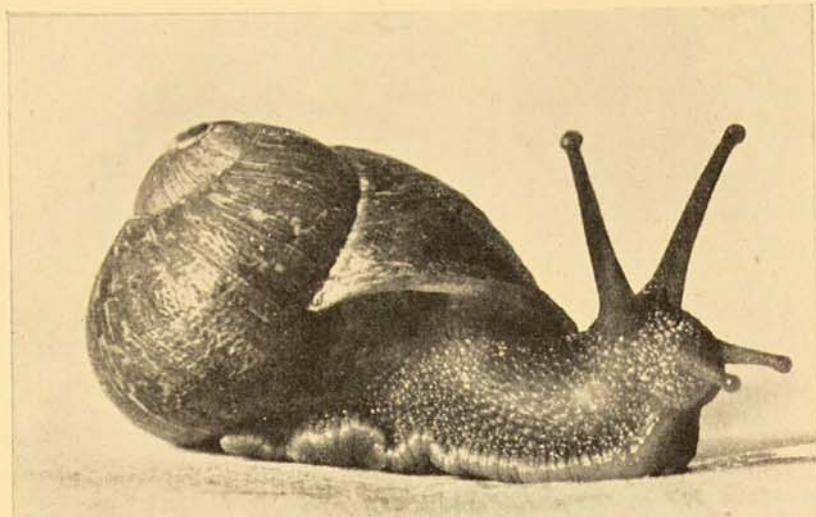
### An Albino Snail

By DONALD F. McMICHAEL

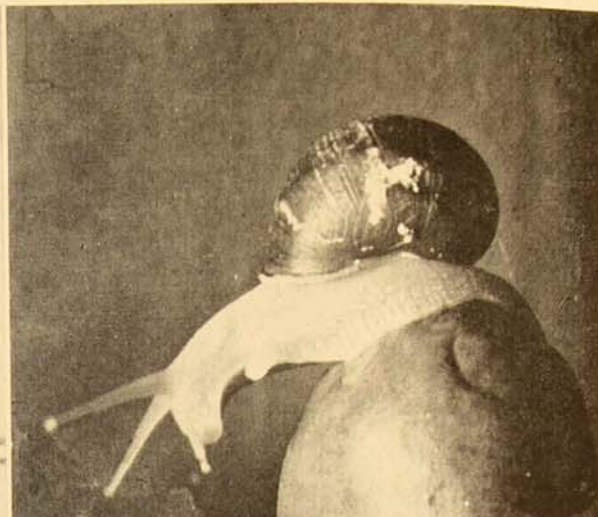
THE famous white whale of Herman Melville's novel could scarcely have aroused more interest than when the Museum recently received an unusual garden snail (*Helix aspersa*). It was a living albino specimen, presented by Mrs. J. Tait of St. Leonards, a Sydney suburb. The body of the animal appeared to be creamish-white in colour, but closer examination revealed an almost complete absence of pigment of the skin. The colouration is due to the thickness of the body and the whiteness of some of the internal structures, such as the nerve ganglia.

On being awakened from a short period of dormancy, the snail ate greedily a small piece of bread and raspberry jam. The transparent skin of the head provided an ideal opportunity to study the action of the single dark jaw and the radula. This many-toothed horny, rasp-like tongue was seen to move rapidly from its position just under the longer pair of tentacles, tear off a piece of bread and retreat with it.

Even the eyes situated at the tips of the longer or ocular tentacles appeared quite colourless, in strong contrast to the conspicuously black eyespot of the normal



A normal specimen of the garden snail, showing the coarsely granulose skin, and the way the snail walks with a rippling movement of the foot.



The albino snail. Note the translucent tentacles, and finely granulose, creamish white appearance of the body.

snail. This has resulted in a remarkable insensitivity to light, as was demonstrated when a flashlight, only a few inches away, failed to produce the sharp recoil which normally would have occurred.

The shell colouration was fairly normal and further investigation is necessary to explain why this is so. It is of a form which is slightly taller than others, and this is believed to indicate that the snail is, temporarily at least, male. Normally a snail is both male and female at once, or hermaphrodite and this one will, no doubt, develop the hermaphrodite condition when it is older.

The skin was of a more finely granulose texture than is usual, suggesting that some disease or peculiar genetical con-

dition was responsible. Albinism, or absence of pigment from the skin, eyes and appendages, occurs throughout the animal and plant kingdoms, and is often due to the presence of an uncommon gene or hereditary factor. A truly albino snail would also have a colourless shell, and such cases, as well as these partial albinos, are very rare, only one or two having been previously recorded. Many instances are known, however, of absence of pigment from the shell of a normally coloured animal and such forms are known as *Helix aspersa*, variety *exalbida*.

Further interesting facts should come to light about our molluscan 'Moby Dick' from breeding experiments and physiological study.

# Fishing with the Hand

## “Tickling Trout” and Other Fishes in Great Britain, 1602-1943<sup>1</sup>

By E. W. GUDGER,

American Museum of Natural History, New York

IN Article I of this series, five personal accounts of hand fishing<sup>2</sup> in the United States were given. One was by a native-born Englishman and four by Americans of English descent. These first-hand accounts were introductory to the six published records of hand-fishing by native Indians in the two Americas (1699-1942) that have come to light in this search.

From the Americas, it seems logical that our quest should take us to that small island kingdom west of Europe in which hand-fishing has been practised for centuries, and possibly and probably by the progenitors of the five Americans whose personal experiences have in Article I introduced us to this most primitive fishing method. In Great Britain, if not longest, this fishing is certainly best known, since English literature abounds in citations to one particular kind of hand-fishing extending back over hundreds of years.

To start us in our study of hand-fishing in Great Britain, there will now be quoted a general statement of methods of catching British fishes, and notably of “tickling”, but referring to no particular kind of fish. This will serve as an admirable introduction to this whole article.

In 1678, John Bunyan published his “Pilgrim’s Progress”. In his “Apology

[or Foreword] for his Book”, (“The Pilgrim’s Progress”) he writes at some length:

You see the ways the fisherman doth take  
To catch the fish, what engines he doth  
make!  
Behold! how he engageth all his wits;  
Also his snares, lines, angles, hooks and  
nets;  
Yet fish there be, that neither hook nor  
line,  
Nor snare, nor net, nor engine can make  
thine;  
They must be grop’d for, and be tickled  
too,  
Or they will not be catch’d whate’er you do.

### “TICKLING TROUT” IN GREAT BRITAIN

The first account to be quoted of this catching of British trout is not by an Englishman nor is it the earliest account of British tickling, but its very isolation and its implications fit it for an introduction to this section of this article.

Niccolo Parthenio Giannettasio published a poetical work, “Halieutica”, at Naples in 1686. In William Radcliffe’s “Fishing from the Earliest Times” (1926, p. 39) are four lines in Latin extracted from this book. These have been kindly translated by Professor Henry T. Rowell of the Johns Hopkins University as follows: “The fisherman softly rubs the belly [of the fish] with his fingers, and, while caressing him, steals up to the sea-blue gills. Then suddenly he seizes him, and the fish, deceived by his caresses, becomes the catch of the British man.”

The description of the whole *modus operandi* is exact for English practice. But the enigma is: How did Giannettasio learn that a “British man” had devised

<sup>1</sup>This is the second article of this series. The first, “Catching Fishes with the Hand: I. In the Two Americas, 1699-1942”, appeared in *The American Naturalist*, Volume LXXXII, for 1948 (1949), pp. 281-288.

<sup>2</sup>By fishing with the hand, just that is meant—the use of the human hand without the aid of any auxiliary instrument unless specifically mentioned.

this procedure? Had he read some of the early English authors shortly to be quoted?

“TICKLING TROUT”—IN EARLY  
ENGLISH LITERARY WORKS

How far this “technique” had been practised in England no one—least of all the present writer—knows. It must have been known to our Anglo-Saxon ancestors, and possibly earlier—to the “first settlers”. There are many incidental allusions to the practice of “tickling trout” in comparatively early printed English books, and so we now turn to this singularly prolific source of such notices.

The earliest account has probably not come to light, but in 1602 (348 years ago) Shakespeare, in his *Twelfth Night*, Act II, Scene V, makes Maria (on seeing the approach of Malvolio) drop a letter and say “Lie thou there for here comes a trout that must be caught with tickling”. So far as found, Beaumont and Fletcher come next. In their *Scornful Lady* (played in 1609, printed 1616), Act III, Scene II, occurs this line, “Leave off your tickling of young heirs like trout”. And again in their *Humourous Lieutenant* (probably played about 1619 and printed in 1647), Act III, Scene V, we read that “This is the tamest trout I ever tickled”.

Last of these early writers to be quoted is George Farquhar, the Irish dramatist, who wrote in his *The Beaux' Stratagem* (1707), Act III, Scene II: “He keeps it at the end of his line, runs it up the stream and down the stream till at last he brings it to hand, tickles the trout, and whips it into his basket.” This presumably testifies to “tickling” in Ireland. And I am told that in the United States this method of landing trout is sometimes practised by some anglers instead of the use of a landing net.

It is significant that none of these early authors quoted gives any description of the method. Each speaks of tickling trout as a matter known to all his readers and probably practised by many. To me this widespread practice seems to indicate an origin far in the past in Great Britain.

“TICKLING TROUT”—IN LATER ENGLISH  
LITERARY WORKS

References to this fishing in later English literature are also abundant and hence indicative of the widespread knowledge of this practice down to the present day. This is evidenced by the allusions now to be quoted. The earliest is from Sir Walter Scott who says in his “Woodstock” (1826, Chapter VII) that “Every fisher loves best the trouts of his own ‘tickling’”. Two years later (1828) a detailed account was published—the first for England so far as I know. It is found in William Hone’s “Table Book” (Volume I, column 662). The account is signed “—P.” and reads as follows:

It is a liberty taken by poachers with the little brook running through Castle Coombe to catch trout by tickling. I instance the practice there because I have there witnessed it, although it prevails in other places. The person employed wades into the stream, puts his bare [hands and] arms into the hole where the trout resort, slides his fingers under the fish, feels its position, commences tickling, and the trout falls gradually into his hand and is thrown upon the grass. This is a successful snare, destructive to the abundant trout, and the angler’s patient pleasure. The lovers of the “hook and eye” system oppose these ticklish practices, and the ticklers, when caught, are punished according to law.

Next to hand is R. D. Blackmore in “Lorna Doone” (1869, I, Chapter 7), who makes one of his characters say of a fishing excursion, “I had very comely sport of loaches, trout and minnows, forking some and tickling some”.

And last of these literary citations, and to me quite interesting, is a present-day account of tickling trout in the River Wye in Wales. This is found in “Coming Down the Wye”, by Robert Gibbings (1943, Chapter 3). Two actors are involved—an experienced tickler and a novice who is being “broken in”. The account is too long to be quoted, but it vividly recalls John Norwood’s objurgations when he was instructing me in the technique of “grabbling” fishes in his brook in the Southern Appalachian Mountains, U.S.A., seventy years ago. This citation adds Wales to the other parts of Great Britain in which trout have been

caught by tickling, and brings our history down to 1943—practically to date.

These abundant allusions to tickling trout found in English literary works attest that this custom is widespread in England today, and reaches back hundreds of years.

TICKLING FISHES OTHER THAN  
TROUT

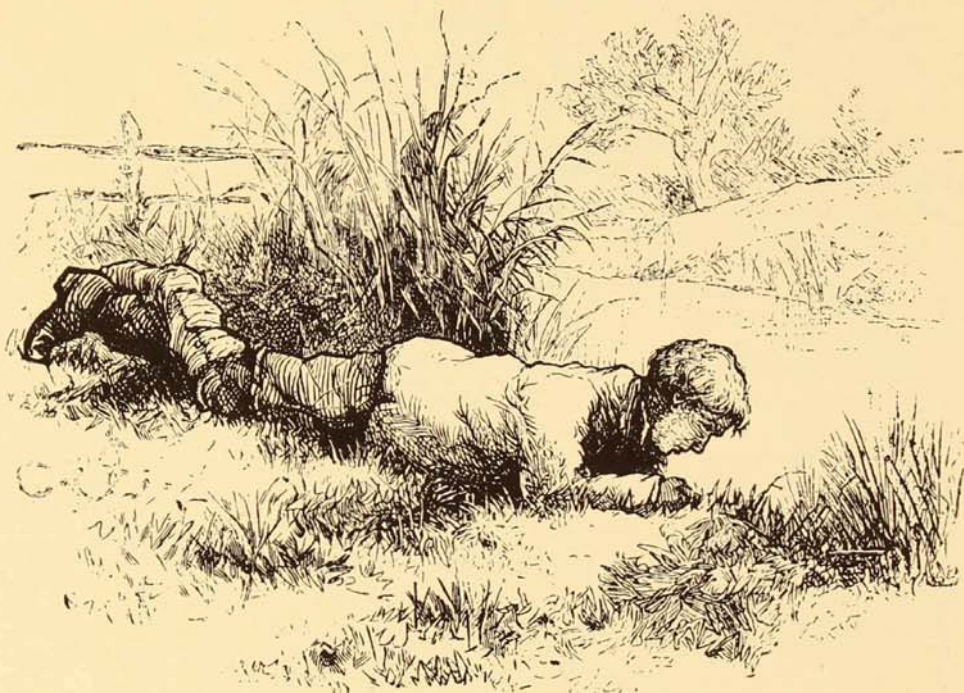
The earliest account for fishes of this group is found in the *Philosophical Transactions of the Royal Society*, 1673, Volume VII, page 6006. As was the

Next is Lionel Wafer, who, in his "New Voyage and Description of the Isthmus of Panama" (1699, p. 129), in speaking of this fishing by the Indians of Panama, says that they "... feel them [the fishes] out with their hands and take them thence, as we do chubs . . . in our [English] rivers".

The last of these later accounts that has come to hand is found in *The New Monthly Magazine*, 1820, Part II, p. 123, and is signed "Amateur". He states that:

Darcey, who kept a music shop at Oxford . . . was an excellent swimmer. He used to

**Tickling tench.**  
After Richard Jefferies.



habit in those early days, it has a "long-handled" title, thus: "An Extract of a Letter Written by Mr. John Templer, June 16, 1673, containing some Observations upon a pleasant way of Catching Carps". In the "Extract", the "pleasant way" was described as follows:

On Thursday last, Sir Justinian Isham invited me to walk with him to his fish ponds, and to see a boy throw out Carps with his hands . . . I saw four very large ones that the boy took. His way was thus: He waded into the pond, and then returning to the sides, he would grope them out in the sedg or weeds, and, tickling them with his fingers under the belly, quickly remove his fingers to their gills, and throw them out upon the land. And this he did not in a narrow but large pond, of half an Acre of ground, or rather an Acre.

dive after barbel into a deep hole . . . and having remained under water a minute, he returned with a brace of barbel, one in each hand . . . They were not disturbed at his approach, but allowed him to come close to them and select the finest.

HOW A POACHER TICKLES A TENCH

English natural history books must abound in accounts of hand-fishing, but search through these has, in view of the wealth of allusions quoted, seemed unnecessary. However, Richard Jefferies, in his "Game-Keeper at Home" (1890, pp. 193-195) gives a full description with a figure showing in part the *modus operandi* of a professional poacher in "tickling" tench. Since this portrays the standard

practice of poachers, it may be well to quote it at some length:

Everyone has heard of tickling trout: the tench is almost equally amenable to titillation. Lying at full length on the sward . . . the poacher peers down into the hole where he has reason to think tench may be found . . . Presently, having made out the position of the tench, he slips his bared [hand and] arm in slowly, and without splash, and finds little or no trouble as a rule in getting his hand close to the fish without alarming it: tench, indeed, seem rather sluggish. He then passes his finger under the belly and gently rubs it. Now it would appear that he has the fish in his power, and has only to grasp it. But grasping is not so easy. . . . The gentle rubbing in the first place seems to soothe the fish so that it becomes perfectly quiescent, except that it slowly rises up in the water, and thus enables the hand to get into proper position for the final seizure. When it has risen up towards the surface sufficiently far . . . the poacher suddenly snaps, as it were, his thumb and finger, if he possibly can manage it, closing on the gills. The body is so slimy and slippery that there alone a firm hold can be got, though the poacher will often flick the fish out of the water in an instant so soon as it is near the surface. Poachers evidently feel as much pleasure in practising these tricks as the most enthusiastic angler in using the implements of legitimate sport.

#### FINALE

And now, in ending this article, there will be introduced a personal communication from Mr. George Goodwin, a member of the staff of the American Museum. In this he recounts one of his experiences in this practice in his native England about 1912.

Just when I started tickling trout is difficult to remember. No one showed me how and I doubt if I was told about it. It was probably a natural instinct that comes to a boy who spends his leisure hours off the beaten track. I remember one particular incident that happened when I was about fourteen. I was trespassing on a private game preserve and saw a trout streak for shelter under the bank. The temptation was too much. Just as I was about to grasp the fish a faint sound attracted my attention and glancing over my shoulder I was stunned to see a burly game-keeper standing over me. From the puzzled expression on his face I figured he had no idea what I was up to and I presented him with the rather lame story that I was after a water rat and got off with a lecture on the stupidity of catching a rat with my hands.

The fifteen accounts set out above clearly indicate how long known (1602-1943) and how prevalent has been the practice of hand-fishing in Great Britain. No other country, and indeed no other continent, has such a published record.

## Review

COLLECTING BUTTERFLIES AND MOTHS. By Ian Harman. (Williams and Norgate Ltd., London). 8vo. Pp. 128, 1950, illustrated. English price, 7s. 6d.

This little book provides an extremely useful guide to the collecting of Lepidoptera and their preservation and care. Though primarily intended for the British collector, for the species cited are those of Great Britain, nevertheless the methods advocated are those in use by collectors and by museums all over the world.

Chapters are thus devoted to equipment, setting, care of the collection, preserving larvae, rearing, collecting by day, collecting by night, varieties, collecting Microlepidoptera, and entomological calendar.

To a museum worker in Australia, of especial interest are those chapters on setting, care of the collection and collecting Microlepidoptera, and which may be read with profit.

A praiseworthy feature is Chapter XI, "Entomological Calendar", which sets out for Britain the Lepidoptera likely to be encountered during the various months of the year. With the lively interest now manifest in supplying phenological data for meteorologists, such a calendar along Australian entomological lines is highly desirable, but remains still to be written.

For those who are considering forming a collection of butterflies and moths, this book should provide the means of training them along the correct lines.

A. MUSGRAVE.



# Australian Insects. XXXIX

## Coleoptera 16 — Ladybirds

By KEITH C. McKEOWN.

WITH the exception of the cicadas, and possibly the butterflies, there are few groups of insects which excite so much popular interest as the ladybird beetles. This, on account of their small size, is rather remarkable—yet every child knows a ladybird when it sees one. It may be the result of early training, for what child in the nursery has not learned the tragic story of the disaster that overwhelmed one happy family of them:

“Ladybird, ladybird, fly away home,  
Your house is on fire; your children are  
gone;  
All but one, and her name is Ann,  
And she hid under the frying-pan.”

The rhyme is certainly of considerable antiquity, and it has been said that it had its origin in the immense swarms of ladybirds which assemble in the Kentish hopfields to prey upon the sap-feeding aphids. When picking is completed, the vines are destroyed by burning, thus bringing about the doom of many of the useful little insects. Variants of the rhyme exist in many European countries as well as in Great Britain. In Shropshire, the jingle runs:

“Lady-cow, lady-cow, fly thy ways home,  
Thy house is on fire, thy children are  
gone;  
All but one, and he is Tum [Tom],  
And he lies under the grindelstun  
[grindstone].”

Folklore has grown up around the beetles in almost every land. In France they are treated with a certain degree of reverence by the peasants who call them God's Cows (*Vaches à Dieu*) and Virgin's Beetles (*Bêtes de la Vierge*). It is probably from the latter name that our name of “ladybird” is derived.

In Shropshire they are called God Almighty's Beetles, but Germany has been most prolific of such names, among them Little Bird of God, Horse of God, Little Cock of Mary, Little Cock of God, Little Animal of Heaven, Little Bird of the Sun, Little Cow of Women (and on this account the insect is invoked for milk), and Little Cock of Women. The maidens of Germany used to send ladybirds to their lovers, looking on them as messengers of Cupid.

In Russia the insect is known as the Little Cow of God, and in the early spring the child finding one sings:

“Little Cow of God,  
Fly to the sky,  
God will give you bread.”

In Italy, ladybirds are known by various names, which vary in different localities. In the Piedmont it is called the Chicken of St. Michael, and the children sing:

“Chicken of St. Michael,  
Put on your wings and fly to Heaven.”

Lucia is its name in Tuscany—possibly in honour of St. Lucia—and the song goes this way:

“Lucia, Lucia,  
Put on your wings and fly away.”

In the Tyrol the little beetle is associated with St. Nicholas, the children believing that when they lose a tooth they must bury it in the garden, at the same time reciting:

“St. Nicholas, St. Nicholas,  
Let me find bone and coin”

in the belief that a search on the site of burial will reveal some small coin left there in compensation by St. Nicholas.

The ladybird was also credited with powers of divination and prophesy. Swiss

children question the insect to find out how long they will live, while in Shropshire it is consulted on an important question to the unmarried girl—that of when she will marry:

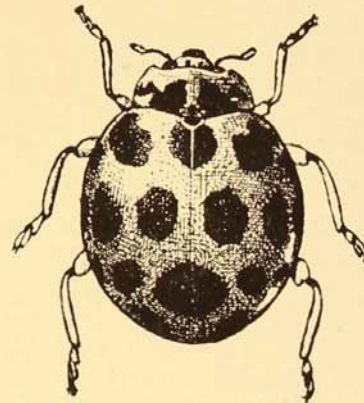
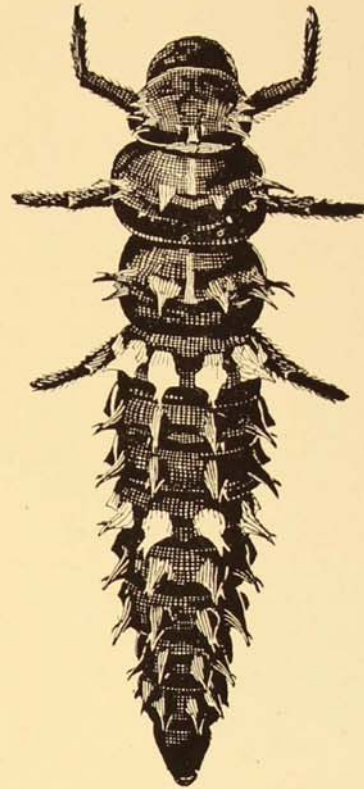
“Lady-cow, lady-cow, fly away, flee!  
Tell me which way my weddin’s to be,  
Up hill or down hill, or towards the  
Brown Clea”,

the Brown Clea being a well-known hill in Shropshire. In the same country, the number of black spots upon the insect’s wing covers is said to indicate the price that will be paid for the season’s wheat.

The tale might be continued almost indefinitely, but enough of fantasy!

Australia is rich in ladybirds, which are scientifically placed in the family Coccinellidae, and more than 250 different species have been described. The adult beetles, rounded and strongly convex in form, are so well known that they need little description. Many are orange-yellow in colour marked with varying numbers of black spots or other marks according to the species concerned; some are wholly metallic blue, with or without yellow or red markings; others again are wholly black.

Most common of all our species is the Thirteen-spotted Ladybird (*Leis conformis* Boisd.). Its life-history, generally typical of most species, may be given in detail. The bright yellow, skittle-shaped eggs are deposited in clusters on foliage in the vicinity of aphids, upon which the larvae, on hatching, will feed. Hatching occurs in about two days. The active, long-legged larvae immediately begin to prey upon the nearest of the crowded aphids. They grow rapidly, and their black, somewhat concertina-shaped bodies become blotched with yellow. In about three weeks the larva is fully fed and, crawling to the stem of the plant or some convenient fence-post or other object, suspends itself by the rear extremity of the body and transforms into the pupa, only partly divesting itself of the last larval skin, which splits down the back exposing part of the enclosed pupa. There are four moults between hatching and pupation. Within a week the perfect insect emerges; at first it is pale and without black mark-



The 13-spotted  
Ladybird (*Leis  
conformis*) and  
its larva.  
Courtesy of N.S.W.  
Department of  
Agriculture.

ings, but as the insect hardens the colour deepens and the black spots appear. The adult beetles are quite as valuable as destroyers of aphids as are their larvae, and in both stages are valuable friends of farmer, orchardist, and gardener.

The most famous of all ladybirds is, possibly, the Australian Ladybird (*Rodalia cardinalis* Muls.), a very small black and yellow species. About 1868, the Australian Cottony-cushion Scale (*Icerya purchasi* Mask.) was accidentally introduced into California. Within a few years this destructive insect, free from its natural enemies, had increased to such an extent that the existence of the orange groves was threatened. In Australia, its native home, the scale did little or no damage, so the United States

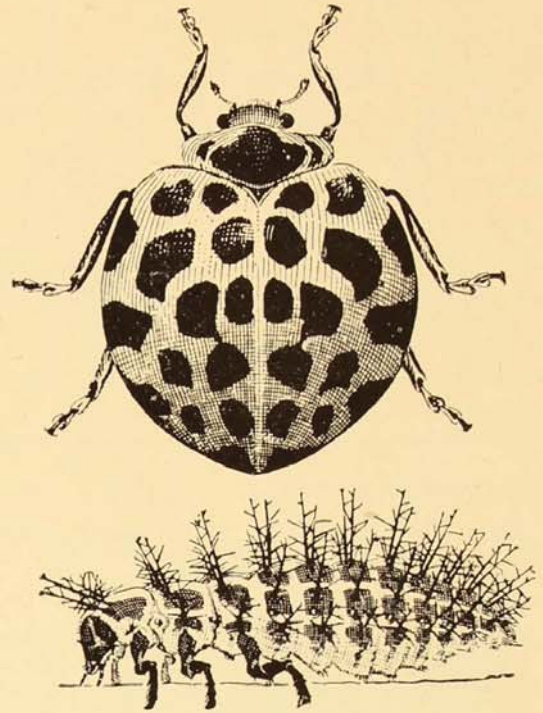
Government sent an entomologist here to search for its native foes. The control exercised by the ladybird was soon discovered, and in 1888, 150 of the beetles were despatched to California: here they increased rapidly and within eighteen months they had increased to such numbers that they had checked the scale over the whole State. It was soon practically eliminated and ceased to be of any serious importance. Its introduction to California has been among the most successful of all attempts to control an insect pest by biological means. *Rhizobius ventralis* Er. proved equally successful when introduced into New Zealand to combat the Gum-tree Scale (*Eriococcus coriaceus*) in eucalypt plantations.

The genus *Rhizobius* contains both aphid- and scale-eating species.

Two common yellow and black species which, like *Leis conformis*, often appear in great numbers are *Verania frenata* Er. and *Coccinella repanda* Thunb.; the former bears a black marking resembling the figure 7 (reversed on the left elytron) upon each of the wing-covers, while the first-named species bears two wavy black marks (rather resembling the conventional representation of a bird in flight) upon each elytron. Both are feeders upon aphids, and valuable on that account.

*Orcus* contains many striking, metallic-blue insects. *Orcus australasiae* Bois. is a particularly fine species with three or four large yellow spots upon each wing-cover. Members of the genus *Scymnus* are minute black beetles which feed upon scale-insects.

The larvae of the beetles of the genus *Cryptolaemus*, which feed upon mealybugs, differ greatly from the typical Coccinellid form. They are curious creatures, broad and flattened, and are covered with a thick coating of waxy meal, while the margin of the body is fringed with a great number of long white filaments. They so closely resemble the coccids upon which they prey that their detection is often difficult, and they are frequently destroyed in mistake for the injurious insects. Whether any advan-



The leaf-eating 28-spotted Ladybird and its spiny larva.

Courtesy of N.S.W. Department of Agriculture.

tage is obtained by this mimicry is obscure.

*Leptothea galbula* Muls. has departed from the carnivorous habits of the majority of ladybirds and feeds upon moulds. It is a pale creamy-yellow marked with a double cross upon the back, formed by a black band at the base of the elytra, a black suture, and cross bar about one-third from the apex to the elytra.

Two species of ladybirds are plant feeders, and injurious, for they are wholly vegetarian in their diet, attacking pumpkins, potatoes and tomatoes. *Epilachna 28-punctata* Fabr. is deep yellow, marked with 28 black spots; *E. guttatopustulata* Fabr. has a curious blotched appearance produced by mingled black, purple and yellow tints. The larvae are thick-set creatures covered with a dense clothing of branched spines. Both species are comparatively large insects—much larger than the majority of Coccinellid species.

Ladybird beetles have the power of secreting an acrid yellow fluid ("bleeding") from the basal joint of the leg, which appears to have a strongly deterrent effect against enemies, especially birds, to many of which they are distasteful.

## Review

PRINCIPLES OF ANIMAL ECOLOGY, by W. C. Allee, Professor of Zoology, University of Chicago; A. E. Emerson, Professor of Zoology, University of Chicago; Orlando Park, Professor of Zoology, Northwestern University; Thomas Park, Professor of Zoology, University of Chicago; Karl P. Schmidt, Chief Curator of Zoology, Chicago Natural History Museum. (W. B. Saunders Company, Philadelphia and London, 1949.) Pp. xii + 837, 263 figures. Our copy from W. Ramsay (Surgical) Pty. Ltd., Melbourne. Price £6 13s.

The appearance of this work marks a very important step in the production of text-books in zoology for senior students and therefore in the teaching of zoology itself. It is, however, of wider significance than this. After defining ecology broadly the authors proceed to indicate some of the difficulties of the subject. In five sections they summarize the history of ecology, show how an analysis of the environment may be made, discuss the subject of populations (including their growth form, fluctuations, and the organization of insect societies), treat of the nature of animal communities and finally discuss the relationship of ecology and evolution.

The section dealing with history is a brilliant effort in condensation in which a great field of research is summarized in an accurate and most interesting manner.

The chapters on population problems should fill a need in providing material almost entirely lacking at present in advanced teaching.

Since much of Australian zoology has been pure systematics (taxonomy) it may be well to emphasize the fact that the systematics of the future, if it is to be scientific, will need to go hand in hand with serious studies in ecology. Unfortunately in Australia the full significance of this has often failed to be appreciated, as well as the practical benefits to be derived from its development. This book should provide a very suitable introduction to such studies.

The authors point out that one constant effort of the modern ecological movement has been to take the study of nature again out under the sky. This is another reason for a whole-hearted approval of this text-book.

Although we may find some items missing which we might have wished embodied in such an extensive work, Australian scientists are perhaps more than usually recognized. For example, one finds a brief description of the theories of Nicholson and Bailey concerning animal populations in the chapter on the latter subject.

The selection of diagrams, many original, others from the works of a diversity of authors, is particularly valuable and they are beautifully reproduced.

It may seem niggling in view of the pleasing appearance of the work and the good points we have mentioned to drag out some aspects for criticism. One feels, however, that the balance between marine biological examples and those from terrestrial, particularly entomological, fields seems a little uneven, despite the treatment of fish populations.

It might be claimed that there has been more recent work of importance based on researches in the fields of entomology and mammalia. This, however, is no excuse, and one feels the defect especially in the bibliography, where many names associated with important and original marine ecological research are missing, whereas the authors of quite popular works are cited almost as if they were responsible for the discoveries named therein.

The index is fairly extensive, as it should be for a book of such length, but it is often a little difficult to use. It seems surprising for example that "plagues" is not listed in a work devoting so much space to population fluctuations.

These are minor matters and the reviewer has been on the whole very pleased to study a work which covers such a wide field so well, and which is not to be judged without much reading and thought.